

# M. S. SWAMINATHAN RESEARCH FOUNDATION

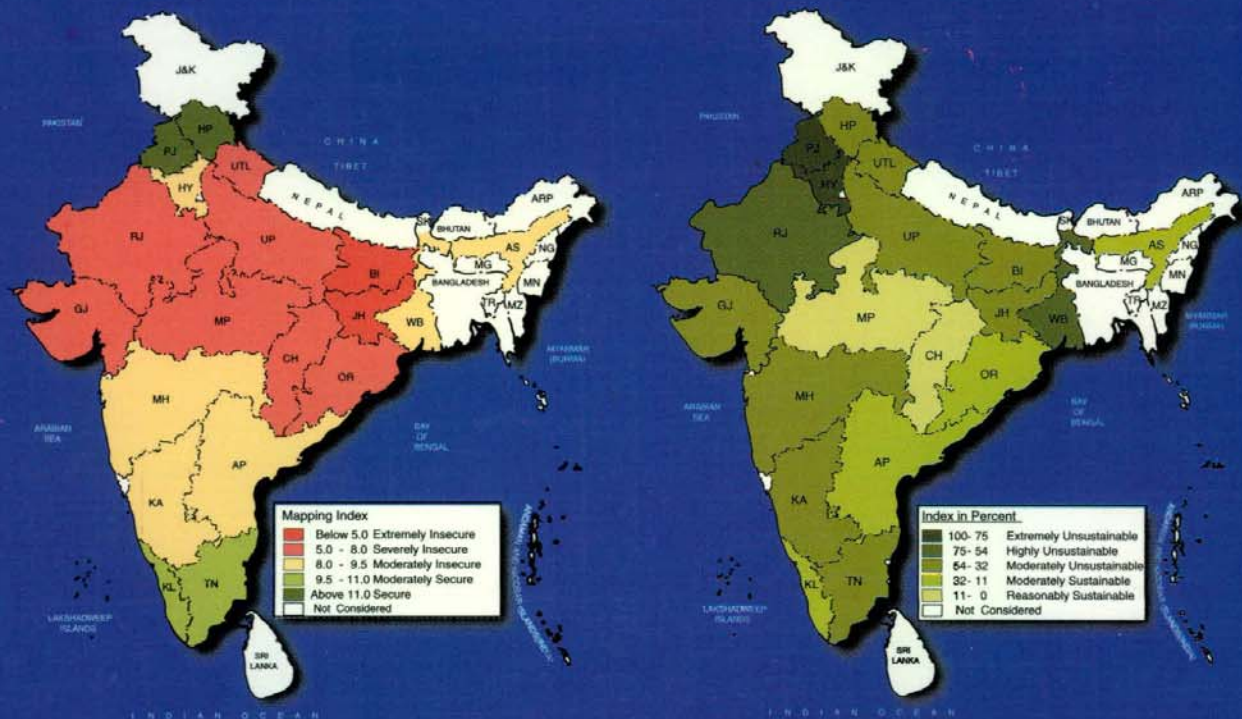
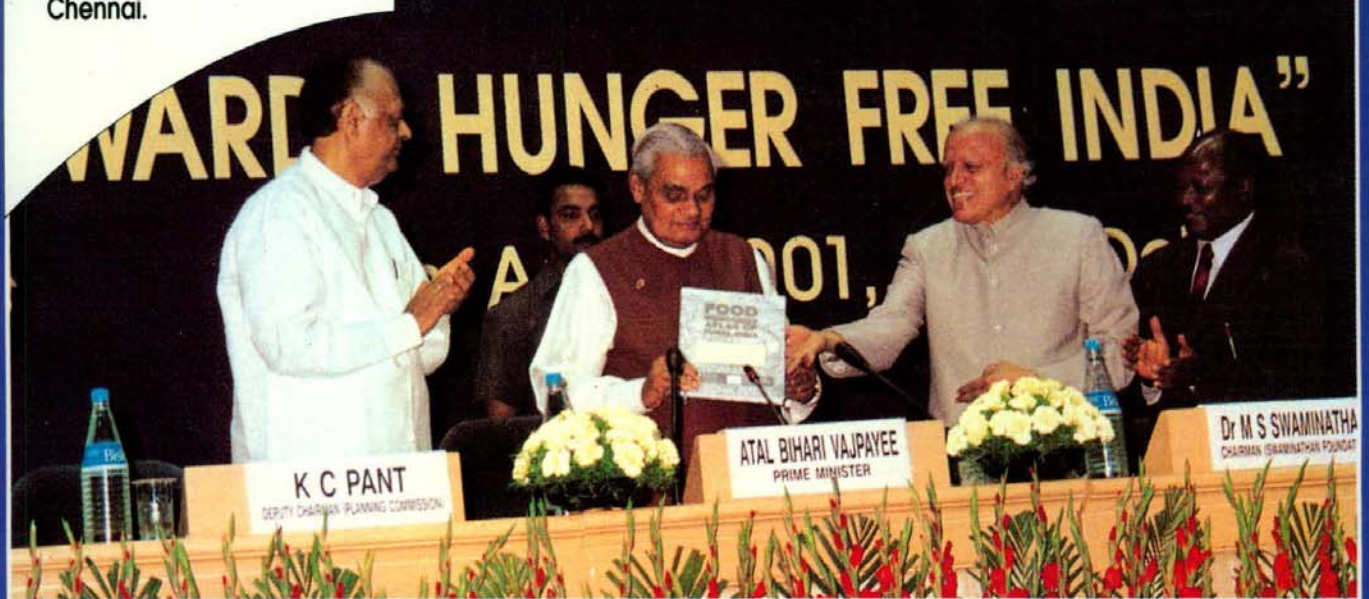
## 2000-2001 ELEVENTH ANNUAL REPORT

Centre for Research  
on Sustainable Agricultural  
and Rural Development,  
Chennai.

M S Swaminathan Research Foundation

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### Front Cover

1. Prime Minister of India Shri Atal Behari Vajpayee releasing the book "Food Insecurity Atlas of Rural India" at Vigyan Bhavan, New Delhi, on 24th April 2001
2. Food Insecurity Map of Rural India showing the three major typologies of most food insecure states in shades of red, moderately food insecure states in yellow and more food secure states in the shades of green
3. Environmental Sustainability Map of India showing the most environmentally unsustainable states in dark green and environmentally more sustainable states in yellow

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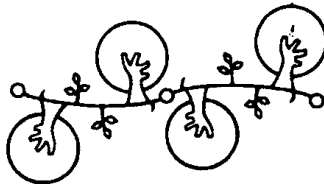
### Back Cover

1. Building of the Community Agrobiodiversity Centre, Kalpetta, Wayanad with members of different Self Help Groups
- 2,3. Map of mangrove forest cover changes and MSSRF Restoration Site in Pichavaram, Tamil Nadu
4. Learning from Environment
5. Fishermen at Veerampattinam using the Reporting Terminal donated by the Space Application Centre, Ahmedabad

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# **Eleventh Annual Report**

## **2000 - 2001**



**M. S. Swaminathan Research Foundation**  
*Centre for Research on Sustainable Agricultural  
and Rural Development*  
Chennai, India

**M. S. Swaminathan Research Foundation**

*Centre for Research on Sustainable Agricultural and Rural Development*

Third Cross Road, Institutional Area,  
Taramani, Chennai 600 113 India.

Telephone : +91 (44) 2541229  
+91 (44) 2541698

Fax : +91 (44) 2541319

E-mail : [executivedirector@mssrf.res.in](mailto:executivedirector@mssrf.res.in); [msswami@mssrf.res.in](mailto:msswami@mssrf.res.in)

Visit us on the World Wide Web at <http://www.mssrf.org>

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## Chairman's Introduction

The year covered by this Report was marked by considerable progress in the research, training, sustainable rural development, gender mainstreaming and policy advocacy programmes of the Foundation. The details of the work done are given in the later pages. This Introduction aims to capture a few significant events and accomplishments.

In the area of infrastructure development the building of the Community Agrobiodiversity Centre at Kalpetta, Wayanad, Kerala, represents a significant landmark (see back cover). This is probably the first of its kind in the country, explicitly devoted to the cause of the revitalisation of the *in situ* on-farm conservation traditions of tribal and rural families. Provision exists in the draft legislation relating to both the Biodiversity Act and the Protection of Plant Varieties and Farmers' Rights Act, now under the consideration of the Parliament of India, for according recognition and reward to holders of traditional knowledge and conservers of bioresources. The Kalpetta Centre, working under the guidance of a local Management Advisory Committee headed by Mr A Ratnam, an outstanding leader of sustainable and scientific farming, has stimulated interest in the conservation of medicinal plants with particular emphasis on medicinal rice varieties and local health traditions, by creating an economic stake in conservation among tribal and rural women and men.

Training programmes are being organised to empower local communities with knowledge relating to the new legislation which will

confer important rights on them as well as on issues relating to the preparation of biodiversity registers and bio-monitoring. With the interest from an endowment made by the Ford Foundation and a generous grant from the management of Kerala's leading Malayalam newspaper, *Malayala Manorama*, a computer-aided educational programme for tribal and rural children, titled "Every Child a Scientist", is being started with computers generously gifted by "Friends of MSSRF" in Tokyo headed by Dr (Ms) Geeta Mehta. It is proposed to start a similar programme at Chennai for children of the underprivileged sections of urban society using the funds associated with the Indira Gandhi Prize for Peace, Disarmament and Development. This will help to spread knowledge and awareness among children not only on their biological heritage and ecological endowments, but also on scientific facts related to human health and nutrition.

In the area of policy advocacy also, a significant step was taken during the year. On 24 April 2001, Shri Atal Behari Vajpayee, Hon'ble Prime Minister of India, released in New Delhi the *Food Insecurity Atlas of Rural India*, prepared jointly by MSSRF and the UN World Food Programme (see front cover). Based on 19 indicators, the Atlas contains a comprehensive analysis of the different components of food security, such as food *availability*, economic *access* to food, and biological *absorption* of food in the body. In addition, it has introduced sustainability criteria in the analysis, in order to sensitise policy makers and farmers on

the need to harmonise today's production with tomorrow's prospects. The Atlas also deals with hunger in its different forms, such as *endemic hunger* caused by poverty-induced protein-calorie under nutrition, *hidden hunger* caused by the deficiency of micronutrients in the diet and *transient hunger* resulting from drought, floods and other natural calamities.

Releasing the Food Insecurity Atlas, the Prime Minister called for a strategy which can help the country to achieve substantial progress in ending poverty-induced hunger by 15 August 2007, which marks the 60<sup>th</sup> anniversary of India's independence. A Consultation was held at Bhubaneswar, Orissa, on 18 and 19 June 2001, on utilising the unique opportunity provided by the substantial grain stocks (over 60 million tonnes at the end of June 2001) available with the Government of India, to organise a national grid of Community Grain Banks. The proposal developed at Bhubaneswar was enthusiastically welcomed by the participants at the MSSRF-FAO Expert Consultation on Science for Sustainable Food Security, Nutritional Adequacy and Poverty Alleviation in the Asia-Pacific Region held at MSSRF from 25 to 28 June 2001. Since the organisation of a *National Grid of Community Grain Banks* will help the country to leapfrog in its goal of achieving a hunger-free India, it may be useful to give a brief account of its principal features.

Every village or a cluster of villages with a population ranging from 1,000 to 5,000 could establish a Community Grain Bank under the supervision of a Community Grain Bank Society or Council or any other form of

implementable and low transaction cost management structure chosen by the Gram Sabha. The Society/Council will have the following three groups of members, each of which will be managed by one or more self help groups.

#### ➤ *Entitlement Group*

The members of this group will belong to families entitled to the benefits of government schemes like Targeted Public Distribution System, *Antyodaya Anna Yojana*, *Annapoorna*, etc.

#### ➤ *Ecology Group*

Members of this group will consist of those who wish to join the *Food for Development (Work)* programme. The work undertaken will relate to land and water care, such as wasteland and watershed development, social forestry, cleaning and desilting of ponds and canals, and construction of roads and water harvesting structures. The priorities in the work to be undertaken will be decided by the local community. The work could be carried out both on community land and in the holdings of small and marginal farmers. Thus, grains will be used for greening the area and will thereby become an instrument for sustainable development.

#### ➤ *Ethics Group*

Members enrolled in this group will be entitled to free access to food grains and other categories of available foods provided by national and international agencies (like the World Food Programme). The group will consist of individuals such as -

- Pregnant and nursing mothers
- Infants and children

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- School children
- Old and infirm persons

In other words, those who are not in a position to join the food for development category can be enrolled in the Food for Nutrition group. They should also take advantage of Integrated Child Development Services (ICDS), *Annapoorna*, School Noon Meal and other similar schemes. One of the principal aims of this Group should be to prevent maternal and foetal under-nutrition resulting in low birth weight babies. At present, nearly 30% of the babies born in the country are characterised by low birth weight (LBW). This has disastrous implications for the future of the country, since LBW children are handicapped in brain development, besides suffering from several other disabilities.

Such a system of local level food security will be *inclusive* in nature and will cover everyone, irrespective of religion, caste, age or gender. It will have low transaction costs and will be self-perpetuating; storage losses can be eliminated. *It is recommended that the Government of India may launch this programme on 15 August 2001, with an initial allocation of 5 million tonnes of food grains.* Once the Grain Banks are established, replenishment can come from the purchase of locally available grains, wherever possible. Priority in the establishment of the Grain Banks could go to villages and areas which have become "*hunger hot spots*" due to factors such as drought, floods and the higher incidence of persons without assets.

Another significant development is the establishment at MSSRF of a *National*

*Consultative Group on Land and Water Care.* This was one of the recommendations of the International Conference on *Land Resource Management for Food, Employment and Environmental Security* held at New Delhi in November 2000, under the sponsorship of the Soil Conservation Society of India and Department of Land Resources, Ministry of Rural Development, Government of India.

The establishment of the Consultative Group on Land and Water Care, which is designed as a forum for generating convergence and synergy among numerous ongoing programmes, has been made possible through a generous grant from the Sir Dorabji Tata Trust. The community land and water care movement was launched in Orissa in June, 2001 by the Chief Minister, Shri Naveen Patnaik and Shri Venkaiah Naidu, Minister for Rural Development, Government of India. The programme will be initially taken up in the districts of Nuapada (drought-prone), Kendrapara (cyclone-prone) and Keonjhar (high incidence of poverty).

Work was also initiated on the sustainable management of the principal soil categories in the country in collaboration with the Ohio State University of USA. Under this collaborative project, MSSRF is undertaking studies in the red soils (alfisols) of the Pudukottai district of Tamil Nadu. The Punjab Agricultural University, Ludhiana, is undertaking research on the sustainable management of alluvial soils, characterized by both receding and rising water tables. The Jawaharlal Nehru Krishi Viswa Vidyalaya, Jabalpur is in charge of the work on black soils (vertisols). The JRD Tata Ecotechnology Centre of MSSRF serves as the coordinating



centre of this inter-institutional collaborative project, which is generously supported by the Sir Dorabji Tata Trust. The MSSRF-PAU-JNKVV-Ohio State University project should yield practical guidelines for the management of these important soil types to obtain high yields in perpetuity. Soil health and water management hold the key to an ever-green revolution leading to a continuous improvement in productivity without associated ecological or social harm.

MSSRF was called upon by several organisations, in India and abroad, to help in converting calamities like the super-cyclone in Orissa and the severe earthquake in the Kutchh region of Gujarat, into opportunities for improving the livelihood security of the affected populations in an environmentally sustainable manner. With financial support from the Sir Dorabji Tata Trust, staff of PricewaterhouseCooper and Friends of MSSRF, Tokyo, the following activities were initiated in the cyclone affected areas of Orissa in order to strengthen the coping mechanisms and livelihood opportunities of the victims of the calamity:

- Rebuilding a school and establishment of a storm shelter in the Mallikapur village
- Developing the very poor village of Gyaspur into a biovillage with a biocentre which can also serve as a storm shelter
- Establishment of Knowledge Centres on the model of the one functioning in the coastal village of Veerampattinam in Pondicherry. A particular aim of these coastal Knowledge Centres is to enable

local fisher communities to get accurate and advance information on sea and tide conditions as well as on fish shoals

Thus, the rehabilitation programme in coastal Orissa pays concurrent attention to knowledge and skill empowerment and on-farm and off-farm employment, as well as to creating the infrastructure essential for saving lives during severe cyclonic storms.

Following the disastrous earthquake in the Bhuj-Bachao area of Kutchh on 26 January 2001, steps were taken jointly with the Gujarat Agricultural University (GAU) and the Vikram Sarabhai Centre for Development Interaction (VIKSAT) for organising a habitation cum livelihood rehabilitation programme. The twin aims are to provide shelter for the roofless through low cost greenhouses, and later use the greenhouses for horticulture, hybrid seed production and other high value but low water requiring activities. In the Bhuj region, evapo-transpiration exceeds precipitation throughout the year except during July and August. However, farmers still tend to grow uncertain crops of sorghum, cotton, etc. Greenhouse farming using fertigation and drip irrigation techniques (i.e., giving nutrients through water delivered in small droplets) will be ideal in that area. The farmers are hard working and enterprising and self-help groups are being formed for enabling them to take to environmentally sound and economically rewarding enterprises. GAU under the guidance of its distinguished Vice Chancellor, Dr M H Mehta is carrying out the construction of low cost greenhouses and providing technical guidance for the horticulture enterprises, while VIKSAT under the leadership

of Dr Srinivas Mudrakartha, is organising the self-help groups. Thus a tripartite partnership involving GAU, VIKSAT and MSSRF has been formed for implementing the "opportunity in calamity" programme in the earthquake ravaged areas of Gujarat. This work is being generously supported by the Sir Dorabji Tata Trust, Friends of MSSRF, Tokyo and interest from the Ford Foundation endowment.

### **Programme Area 100**

MSSRF's work in mangroves since 1990, under Programme Area 100, is also helping the coastal areas prone to natural calamities. There is considerable interest among the coastal communities of Orissa in the rehabilitation of degraded mangrove ecosystems, since they have found that good mangrove forests provide protection against the fury of cyclones. A publication titled, "Manual on Vegetative and Micropropagation of Mangroves" was released during an MSSRF-FAO workshop on "Rehabilitation of Degraded Mangrove Forests: Practical Approaches" held in June 2001 for officers of Forest Departments from coastal States. Also, the World Environment Day, 5th June, was commemorated this year as Mangrove Day. Steps were taken to promote the organisation of mangrove nurseries by local women and men, on the model of the practice already in vogue in the case of social forestry. Such community nurseries will also provide additional income to the rural poor, since they can be raised on the basis of a buy-back arrangement with Forest Departments.

Further, draft guidelines were developed for promoting a Joint Mangrove Management

(JMM) system in areas rich in mangrove wetlands. Such a multi-stakeholder system of management has been designed to create a "win-win" situation for all, thereby making all stakeholders equally concerned with issues relating to conservation, restoration and sustainable and equitable use. The JMM system is being tried in 42 villages in Tamil Nadu, Andhra Pradesh, Orissa and West Bengal. Based on grassroot experience, the guidelines will be finalised and submitted to the Ministry of Environment and Forests, Government of India and State Forest Departments for their consideration and adoption in a manner considered appropriate. The draft JMM guidelines are gender sensitive and give specific attention to the needs of women and men dependant on mangrove ecosystems for their livelihoods. Ultimately, conservation will be possible only through an integrated system of education, regulation, social mobilisation and sustainable and secure livelihoods.

A Mangrove Atlas of Tamil Nadu has already been prepared. Similar Mangrove Atlases of Andhra Pradesh and Orissa are under preparation. MSSRF's work on mangrove ecosystems has been supported generously during the last 5 years by the India-Canada Environment Facility (ICEF). Our sincere gratitude goes to Mr Bernard Bourdeau, Director, ICEF and Dr (Ms) Jaya Chatterjee for their encouragement and meaningful involvement.

MSSRF's expertise in mangrove propagation and rehabilitation of degraded mangrove wetlands will also be used in the coastal wastelands of Kutchh by promoting an integrated silviculture-cum-aquaculture move-

ment in collaboration with GAU and the GSFC (Gujarat State Fertilizer and Chemical Company) Science Foundation. Under such a system, mangroves and *Salicornia* as well as prawn and fish culture will be developed as an integrated farming system. The trees that can be used in similar programmes in South India are casuarina, cashewnut and coconut together with low external input sustainable aquaculture. GSFC plans to collaborate in this project with Seaphere International, a company with considerable experience in setting up agro-aqua farms.

The integrated land-ocean Coastal Research System of MSSRF was extended to the Gulf of Mannar area during the year with the generous support of the Ministry of Rural Development, Government of India and UNDP. This programme which is being implemented in partnership with the Dhan Foundation aims to create an economic stake in the conservation of the unique Gulf of Mannar Biosphere Reserve. The work will help to prevent the unsustainable exploitation of the coral reefs, sea grass beds, mangroves and other flora and fauna by providing opportunities for alternative livelihoods. The biovillage model of integrated on-farm and non-farm employment is being introduced. The Dhan Foundation has already undertaken the strengthening of Self-Help Groups, tank rehabilitation and water conservation programmes. Among the activities being undertaken by MSSRF, an important one relates to the implanting of artificial reefs in the buffer zone, so as to enhance the availability of fish and shellfish.

The Tamil Nadu Government formally constituted a Gulf of Mannar Biosphere Trust vide G.O.Ms.No.263, Environment &

Forests (FR V), on 19 December 2000 in order to promote a multi-stakeholder system of management. MSSRF has been nominated as a Member of this Trust. The aim is to hold in trust this unique biological paradise in its pristine purity for current and future generations. The proposal prepared by MSSRF for this purpose has been approved by the Global Environment Facility (GEF) and UNDP for a financial grant of USD 7.8 million. This project is to be implemented by the Gulf of Mannar Biosphere Trust through the State Forestry and Fisheries Departments.

The principles of Coastal Systems Research have been successfully introduced in the Kudankulam region of coastal Tamil Nadu, where a nuclear power plant is being set up by the Nuclear Power Corporation of India Limited (NPCIL). In addition to the work relating to the establishment of green belts and water harvesting ponds, a Genetic Garden consisting of a wide range of plants relevant to human nutrition and health security was also established during the year with active cooperation from NPCIL. This work generously supported by the Department of Atomic Energy and NPCIL is designed as a prototype for strengthening both the ecological security of the area and the livelihood security of the poor. This prototype model for green belt development illustrates how the vast coastal wastelands of India can be converted into eco-gardens.

### **Programme Area 200**

The following were some of the significant developments:

The work done under the project "Conservation, enhancement and sustainable

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and equitable use of biodiversity” at Kolli Hills (Tamil Nadu), Wayanad (Kerala) and Jeypore (Orissa) supported by the Swiss Agency for Development & Cooperation (SDC) was reviewed by an external review panel consisting of Dr R S Rana and Ms Seema Bhatt in November, 2000. The team concluded:

*“All the three site teams have worked resolutely under very trying situations and they have succeeded to a large extent in implementing the approved work plan. Their gains need to be consolidated and built further by learning from the experiences of the past two and a half years.”*

Recognising the achievements made so far and considering the desirability of continuing the ongoing work to pursue the important goals of this project, the Team recommended that this project should be provided with support for its second phase, preferably for a period of 5 years.

On the basis of the above recommendation and the extensive discussions held with Dr Werner Hunziker of SDC and the Steering Committee of this project, a new project titled, “Biodiversity Conservation, Integrated Natural Resources Management and Poverty Eradication” was sanctioned by SDC from 1 April, 2001. In this project, the conservation of biodiversity will be integrated into an overall programme of natural resources management and poverty alleviation. The programme relating to the establishment of field level gene banks (i.e., *in situ* on-farm conservation), and village level seed, grain and water banks will be strengthened. Policy Makers’ seminars will also be held

each year. The first such Policy Makers’ seminar will be held at Kalpetta, Kerala, in October, 2001 on the theme of “Farmers’ Rights : From Analysis to Action”.

The Agrobiodiversity Conservation Corps project supported by the Government of Netherlands, which commenced in April 1996 was completed in May 2001. A Convocation was held on 2 May 2001 when H E Mr P F C Koch, Ambassador of the Netherlands, delivered the Convocation address and distributed certificates. This programme has resulted in training 212 rural and tribal youth for being enrolled as members of the Community Agrobiodiversity Conservation Corps. The members of this Corps were drawn from Dharmapuri and Kolli Hills of Tamil Nadu, Kalpetta in Wayanad district of Kerala, Jagatjou in Kendrapara district of Orissa and Lakshadweep Islands.

The concept of management of Biosphere Reserves on a trusteeship mode (as in the case of Gulf of Mannar Biosphere) is being extended to the Simlipal Biosphere Reserve in Orissa, with generous financial assistance from the Summit Foundation. The concept which has been enthusiastically welcomed by the Hon’ble Chief Minister of Orissa was discussed in detail at an Expert Consultation held at Bhubaneshwar on 18 and 19 June 2001. It was decided at the Consultation that work relating to the generation of an economic stake in conservation among the families living in the buffer zone of the Reserve should be started by adopting the biovillage model of job-led economic growth in the villages of Baniabasa in the transitional Zone and Budgoan and Bhapsala in the buffer zone of the Simlipal Biosphere Reserve.

This work will be taken up with the active support and involvement of the Orissa State Forest Department.

A project funded by the National Bioresources Board was started for chronicling the state of bioresources conservation in selected coastal ecosystems rich in biodiversity. Another part of this project relates to the molecular characterisation and enhancement of coastal bioresources.

A consultation was held jointly with CAB International to develop a strategy for facing the challenge of invasive alien species. This threat is growing in importance as a result of increasing bulk imports of oil seeds, pulses and other food commodities. Invasive alien species deplete native biodiversity, and pose hazards to plant, animal and human health. The strategy developed was forwarded to the appropriate Ministries and agencies of the Government of India for follow-up action.

The Golden Jubilee Women's Biotechnology Park was established at Kelambakkam near Chennai with support from the Department of Biotechnology, Government of India and the Tamil Nadu Government (through the Tamil Nadu Industrial Development Corporation). This Park was formally inaugurated by Hon'ble Dr M Karunanidhi, then Chief Minister of Tamil Nadu on 24 November 2000. This is the first Biotechnology Park in the country designed exclusively for women entrepreneurs, who wish to take up a career of self-employment, in the fields of food, agricultural, medical and environmental biotechnology.

Further progress was made in the study of microbial diversity particularly with reference to *Anabaena sp.* in relation to their capacity to sequester salt. Efficient salt tolerant BNFs like *Azospirillum sp.*, *Acetobacter sp.* and Rhizobia have been identified. For the first time salt tolerant biocontrol species are being tested in the green house for diseases in paddy. Lichen research has reached a stage at which a comprehensive Guidebook on the use of lichens as biomonitoring tools is under preparation.

In the area of molecular mapping and genetic enhancement, outstanding progress was made in the isolation and characterisation of salt tolerant genes and in the transformation of *Brassica juncea*. Sequences of 76 ESTs from *Avicennia marina* from the Molecular Biology Group have been submitted to the Worldwide EST database. This is the first ever bulk submission of EST, from any laboratory in India. In recognition of these contributions, the Department of Biotechnology provided support for an Automated DNA Sequencer to be added to the equipment available for research in molecular genetics. Pre- and precision breeding designed to generate novel genetic combinations and participatory breeding with farming families are the major applied goals of this programme.

Thus, considerable progress was witnessed during the year in the conservation and sustainable and equitable use of biodiversity, involving the conservation of endangered spaces and species, equity and ethics in benefit sharing, the use of biotechnological tools in the conversion of bioresources into jobs and income, and in facing the potential challenge of sea level rise caused by global warming.

### **Programme Area 300**

The science of ecotechnology, which involves the blending of traditional knowledge with frontier technologies, is now gaining widespread attention. Ecotechnology provides the foundation for the evergreen revolution spear-headed by MSSRF under Programme Area 300. The following are some of the significant achievements in this field during this year:

The National Network on Community Banking and Biovillages now comprises 276 self-help groups with over 4,000 members. A large number of rural women and men have been trained in the production of the biological software essential for sustainable advances in farm productivity. Examples of the biological software include biofertilisers and green manure crops, biopesticides and biological control agents, vermiculture and biomonitoring and bioremediation agents. These activities are undertaken by self-help groups working largely in their own homes.

The eco-aquaculture project was further strengthened through steps for establishing a hatchery and training centre at Karaikal in the 9 hectares of land provided for this purpose by the Pondicherry Administration.

Precision farming techniques were refined and demonstrated at Keelamanakudi. Precision farming leading to the optimum use of water and other inputs is also an important component of the Integrated Intensive Farming System (IIFS) promoted by MSSRF. An important step in promoting the production of high value organic crops was taken during this year when farmers in Kolli Hills were encouraged to produce organically

grown pineapples. TRIFED and Ion Exchange Enviro Farms Ltd have come forward to purchase organic pineapples and other fruits and vegetables both for the home market and for export. Ecocert International based in Germany sent a team to study and certify the organic nature of the production process.

The Biovillage model of Natural Resources Conservation and poverty eradication was extended to Orissa. The Biocentre in the Pillayarkuppam village of Pondicherry functioned under the guidance of the Biovillage Council consisting of women and men drawn from the different biovillages. The Biocentre and the Biovillage Council have shown the importance of institutional mechanisms for making programmes like biovillages socially and financially sustainable and replicable.

The JRD Tata Ecotechnology Centre undertook a wide range of training and capacity building programmes. Some of the earlier projects started by the Centre such as Seed Villages are now being operated by local families. Thus, every attempt is being made to ensure that the livelihood and other programmes initiated by the Centre become self-replicating and self-sustaining. Also, steps are being taken to enable the JRD Tata Ecotechnology Centre to become an authorised agency for Certification for the Organic Market. For this purpose, standards governing organic food products and subsequent handling and processing will be developed to ensure that any food marketed as "organic" complies with strict standards. This initiative of the JRD Tata Ecotechnology Centre will help to protect the credibility of organic farmers and will at the same time enable national and international consumers

to satisfy themselves that they are buying genuine organic foods.

The B V Rao Centre for Sustainable Food Security supported by the Shri Ramkrishna Bajaj Fellowship for the Sustainable End of Hunger has taken up a long term project for the preparation of a Food Insecurity Atlas of India. This work is being generously supported both technically and financially by the United Nations World Food Programme (WFP). A Steering Committee consisting of appropriate Government experts and officers and leading academic experts, as well as representatives of FAO, UNDP and other UN organisations and leading national and international non-governmental organisations guided the work. As stated earlier, the Hon'ble Prime Minister of India released the first volume relating to Rural India on 24 April 2001. The Atlas relating to Urban India is now under preparation.

The Food Insecurity Atlas has been designed not as just a collection of maps prepared by the GIS methodology using 19 indicators, but as a tool for policy makers and development administrators to identify the "hunger hot-spots" in the country and to develop a priority action plan based on a disaggregated analysis of this complex problem. MSSRF plans to update the Atlas periodically and refine the indicators and analytical tools and policy prescriptions, so that the Food Insecurity Atlas becomes, like UNDP's Human Development Reports, a useful policy and monitoring instrument. WFP and its humanistic and visionary leader in India, Mr Pedro Medrano have extended their total support and involvement in this crusade against hunger. We are indebted to the Venkateshwara Group and its

leader Smt Anuradha Desai and to the Bajaj Group of Trusts headed by Shri Rahul Bajaj for their long-term support for our work in the area of sustainable food security.

From 1990 to 2001, MSSRF has been coordinating and implementing the programmes of the Tamil Nadu Council for Sustainable Livelihoods with support from the Hunger Project (India, Japan and Sweden). Under the auspices of the Council and with financial assistance from the Government of Tamil Nadu, a strategy for a Village Panchayat-led hunger-free area programme was developed and launched in Dindigul district. From May 2001, the responsibility for organising and managing the programmes of the Tamil Nadu Council has been transferred to the Gandhigram Rural Institute (Deemed University) with Dr K V Palanidurai as the Chair of the Council. Our heartfelt thanks go to Smt Lalita Banawali, who until recently served as Manager, Hunger-Project (India) with great dedication and vision.

### **Programme Area 400**

Activities in this area are designed to develop innovative procedures for reaching the unreached. From the beginning, children have received priority attention under this programme, with early childhood care and development serving as the focus. Project ACCESS which has had an outstanding impact on both the grassroots and policy making ends in terms of capacity building, development of resource materials and research-based advocacy is now in its tenth and concluding year. Thanks are due to the

Bernard van Leer Foundation for generous support during the last 7 years. Sustainability of the work has been ensured by the building up of strong networks and alliances which will continue to develop the different dimensions of these efforts.

The publication of "The Unborn Girl Child – A Case Study on Sex Ratio at Birth as an Indicator of Female Foeticide" is a timely one, in view of the highly adverse sex ratios reported in the 0-6 age group in Punjab and several other States in North India in the preliminary report of the 2001 Census.

A significant initiative of the Uttara Devi Resource Centre for Gender and Development is the initiation of a collaborative project with the Kerala Agricultural University on engendering the agricultural curriculum. Another interesting study relates to women and household food security with particular reference to life-saving wild foods, in the Wayanad district of Kerala. The Uttara Devi Centre has also contributed to internalising gender considerations in all the programmes.

The Project *Voicing Silence* or "women's theatre for women's development" now in its eighth year, has in the last two years successfully used theatre to empower women. Working with a group of women theatre professionals in Tamil Nadu, it has helped them to form an all-woman theatre collective, enhance their skills and produce plays on traditional themes from a feminist perspective. This year's play was performed at the annual National Theatre Festival organized by the National School of Drama in New Delhi.

### Programme Area 500

MSSRF's work in developing and introducing the *Antyodaya* model (i.e. bottom-up approach, beginning with the poorest of the poor) of bridging the digital divide won the year 2000 Motorola Gold Award. This is in recognition of the innovative use of a hybrid system of wired and wireless technologies. The principle adopted by MSSRF scientists in fostering the rural digital revolution is that for every problem there is a solution. Thus, in the area of power supply a hybrid system of thermal and solar power was introduced. The Rural Knowledge Centre programme was extended to the Kannivadi area of Dindigul District of Tamil Nadu. Since the basic philosophy is to cater to need-based and demand-driven information, the Kannivadi Centre is concentrating on market information for vegetables and fruits. MSSRF has proposed that one day each year should be commemorated as *Rural Connectivity Day*, in order to emphasise the importance of extending the power and benefits of information technology to villages.

*The Hindu Media Resource Centre* continued to enable media (printed, electronic and the new media) to serve as effective bridges between scientists and the public in areas of concern to society. In addition to Millennium Lectures by eminent persons, dialogues were organised in fields such as genetic engineering and gene revolution. Training programmes were organised for media reporters on rural issues. MSSRF assisted the Scientific Committee on the Problems of the Environment (SCOPE) to convert its books into web-accessible form.



From the inception of MSSRF eleven years ago, an annual interdisciplinary dialogue under the generic title "New Technologies : Reaching the Unreached" is being held each year during January – February. The 2001 dialogue was on "Information Technology and Poverty Alleviation". The participants concluded that in an era of jobless economic growth, information and communication technologies can play an effective role in the alleviation of poverty, only if new knowledge and information result in the creation of new jobs or livelihood opportunities. It has hence been decided to choose the theme "The New Economy and New Employment" for the January 2002 Dialogue.

MSSRF organised a Science Academies Summit in June, 1996, in collaboration with FAO and the Italian National Science Academy headed by Prof G T Scarascia Mugnozza, for articulating the role science can play in ending hunger, for presentation at the FAO World Food Summit held in Rome in November 1996. In November 2001, there will be a conference in Rome, to review the progress made during the last 5 years in achieving WFS goals. Again in collaboration with FAO, particularly its Regional Office for Asia and the Pacific, an expert consultation was held at MSSRF from 25-28 June, 2001, to review the situation in the Asia-Pacific Region and the potential impact of recent progress in science and technology in ushering in an ever-green revolution in the region. The deliberations led to the formulation of a Chennai Declaration consisting of 12 action points, which will be presented at the Rome Conference in November 2001.

Another area in which the Foundation can legitimately take pride is the impact of its policies on fostering the professional growth of its staff. This is an area which has received continuous and intensive attention from 1990 onwards, as will be evident from the Introductions to earlier Annual Reports. Three recent examples may be cited to illustrate how staff trained at MSSRF have been able to contribute internationally.

- Dr P Balakrishna joined the Foundation as Scientist in a project funded by the Department of Biotechnology in March 1992. Since at the time of his recruitment he held only a M Sc degree, he was technically and financially supported to obtain his Ph D from the Osmania University. Later, he was deputed to various international conferences and to research centres in Europe and North America in order to expose him to issues relating to the implementation of the ethics and equity provisions of the Convention on Biological Diversity (CBD), as well as to issues in the area of biosafety as related to genetically modified organisms. As a result, he secured a job in the World Conservation Union (IUCN) where he is currently Head of the Regional Biodiversity Programme-Asia, with headquarters in Colombo, Sri Lanka. MSSRF's investment in the academic and professional growth of Dr Balakrishna is now proving to be of value to IUCN and countries in this region.
- Another scientist, Dr V Balaji, who joined MSSRF in November 1990 on a short term assignment, was given a wide range

of national and international opportunities to equip himself in the areas of coastal biodiversity, ecotechnology and information and communication technologies. He was also deputed to undergo a management training course at the Asian Institute of Management, Manila. Although his Ph D work was in the area of microbial energy cycles, he was given important responsibilities in the areas of biodiversity conservation and management and in the setting up of computer-aided rural knowledge centres. He has recently joined as the Head of the Information Systems Unit of the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Hyderabad. The computer-aided and internet connected Rural Knowledge Centres programme of MSSRF initiated on the basis of an interdisciplinary dialogue on this subject held in 1992 has evoked considerable national and international interest, since it is rooted in Mahatma Gandhi's principle of *antyyodaya* (ie, attention to the poorest person). Both connectivity and content have received concurrent attention. We are proud that Dr V Balaji, who was the Head of this programme until December 2000, was chosen for the year 2001 World Technology Award for Education.

It is again a matter of pride for MSSRF that at the junior level, a young scholar, Ms Annie Jennifer, who joined as Library Assistant in February 1997, was selected for a position in Aztec Technology Partners, USA in July 2000. She was provided with opportunities for gaining

proficiency in informatics and database development.

Thus, MSSRF has become a centre for the professional growth of young scientists and scholars, from where leading international and national organisations, both in the public and private sectors, are making recruitment. MSSRF's loss is the gain of IUCN, ICRISAT and other organisations. Several other young scientists who were trained at MSSRF's expense have also been selected for higher positions in national organisations. The Foundation is happy that its personnel policies and work culture have enabled young scientists to get opportunities for wider responsibilities in national and global organisations.

A happy event was the selection of Dr (Ms) M Lakshmi for the *Young Woman Bioscientist Award*. This is a prestigious national recognition of the outstanding work carried out by her at MSSRF.

The growth and evolution of the research, training, networking and policy advocacy programmes would not have been possible but for the continued and considerable financial support and technical advice of a wide spectrum of donors – individuals, institutions, trusts and foundations, Central and State Government Departments, Friends of MSSRF, Tokyo and bilateral and multilateral agencies. In particular, the generous corpus grant made by the Ford Foundation has ensured the continuity of important programmes like asset building and community development as tools of poverty eradication and gender justice and equity. Our sincere gratitude goes to all of them. We assure our donors that we shall continue

to strive to prove worthy of their trust. The State Forest Departments of Tamil Nadu, Andhra Pradesh, Orissa and West Bengal have been particularly generous in their support to our biodiversity conservation and coastal mangrove wetlands programmes. The Governments of Tamil Nadu, Pondicherry and Kerala and different Ministries and Departments of both State and Central Governments have extended their full support and encouragement to our work.

During this year, the Executive Director in consultation with the staff introduced several management innovations. A two-tier structure comprising the Programme Advisory and Academic Committee and the Staff Council, has been set up to assist and support the Executive Director in managing the institution through collegial management, moving towards greater participation, transparency and collective decision-making. This group undertook a detailed exercise to streamline performance assessment procedures, so as to make them more impartial and transparent and strengthen a work culture where every individual staff member takes pride in performance.

The work summarised in this Report has been possible only because of the dedicated work of our staff and scholars under the dynamic leadership of Prof P C Kesavan, Executive Director and DAE-Homi Bhabha Chair in Nuclear Science and Rural Society.

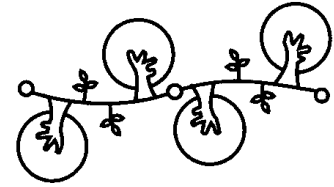
Our sincere gratitude goes to the Trustees of MSSRF and Members of the Governing Committee for the Centre for Sustainable Agricultural and Rural Development Society for their advice, support and above all the time they are so generously sparing. Our thanks also go to the eminent persons serving on various advisory committees of the Foundation. Also, we are proud of our association with NGO partners like the DHAN Foundation and VIKSAT, as well as with the Kerala and Gujarat Agricultural Universities.

A new addition to the Board of Trustees is Dr K N S Nair, an eminent agricultural economist, Member of the Kerala Planning Board, and until recently, Vice Chancellor of the Kerala Agricultural University. Dr Nair had earlier played an important role in developing the biovillage paradigm of rural development.

As in previous years, Mr N Ram, Editor, *Frontline* and the staff of *Frontline* have helped to design the cover of this Annual Report. Dr Sudha Nair compiled this Report with assistance from the different Project Leaders, and particularly from Mr Senthilkumaran and the staff of the Informatics Section. Dr Nandhini Iyengar edited it with her characteristic thoroughness.

We hope the Annual Report will be found useful by all interested in imparting a pro-nature, pro-poor and pro-women orientation to job-led economic growth in rural India.

## Programme Area 100



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# Coastal Systems Research

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**G**uidelines were developed for a participatory system of management of coastal mangrove wetlands, involving all the principal stakeholders. Mangrove Atlases were prepared for Tamil Nadu and Andhra Pradesh. The Research-cum-Demonstration Programmes initiated in Kalpakkam and Kudankulam were intensified. Methods of rehabilitation of Coastal Wastelands were standardised.

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## Sub Programme Area 101

### Coastal Wetlands : Mangrove Conservation and Management

The project aims at developing and strengthening micro level people's institutions towards conserving macro level mangrove ecosystems. The emphasis is on enhancing the capacity of fishermen and farmers, NGOs, Panchayat institutions, Forest Department (FD) and other government agencies to manage mangroves sustainably and to improve the livelihood of the community through non-mangrove resources. The Joint Mangrove Management (JMM) model with stakeholder involvement is to be implemented in 42-targeted villages. At present, the project is being implemented in 27 villages in Andhra Pradesh, Orissa, Tamil Nadu and West Bengal.

In the model villages, people's institutions, viz., Eco-Development Committee (EDC) /Vana Samrakshana Samithi (VSS) in Andhra Pradesh, Luna Jungla Samrakshana Samiti (LJSS) in Orissa and Village Development and Mangrove Conservation Committee (VDMC) in Tamil Nadu, have been organised with adequate gender representation. These institutions, along with representatives of NGOs, FD and MSSRF, meet regularly, take decisions and implement activities as per the micro plans.

#### 101.1 Tamil Nadu

In Tamil Nadu, Joint Mangrove Management (JMM) and village development activities are progressing in six demonstration villages, four in Pichavaram and two in Muthupet. Of these

six villages, Kalaingar Nagar and T S Pettai in Pichavaram and Manganargkadu in Muthupet are the villages included in the current year. In all these villages, a science-based, people-centred and process-oriented approach, explained in detail in the previous Annual Report, is being followed.

#### *Community mobilization, organisation and micro planning*

During the current year, the third micro plan was prepared for the villages already participating in the project, viz., MGR Nagar, Vadakku Pichavaram and Veerankoil and the first micro plan was prepared for Kalaingar Nagar. In the other two villages, processes such as Participatory Rural Appraisal (PRA), identification of the Mangrove Management Unit (MMU) and formation of VDMC have been completed.

#### *Mangrove conservation and management*

All the demo villages have a mangrove management unit and an effective community-based mangrove management system, involved in the restoration and maintenance of mangroves. The details of area under restoration and protection by the community management system are presented in Table 1.1

#### *Restoration*

As indicated in Table 1.1 a total area of 271 ha has been restored so far, of which 120 ha were covered during the current year. A total number of 27 lakh seedlings have been planted and the survival rate is above 75 per cent. Based on the distribution pattern of the mangrove species, *Avicennia marina* was selected as the species for plantation in the restoration area. However, about 10,000 seed-

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lings of *R. apiculata* and *R. mucronata* were also planted along the peripheral area of the restoration site of Vadakku Pichavaram. In the MMU of MGR Nagar, Vadakku Pichavaram, Kalaingar Nagar and T S Pettai, the canal technique developed by MSSRF was followed for restoration, whereas in Veerankoil of Muthupet, the traditional method was followed. In the MMU of T S Pettai, canal construction and planting were completed in January 2001. The Forest Department (FD) funded the restoration activity and constructed the canal; technical guidance was given by MSSRF. A VDMC has been formed in this village recently, which will henceforth undertake all the activities relating to JMM.

### **Protection and maintenance of canals**

The entire village of MGR Nagar has been involved in the protection of the MMU

against cattle grazing and bunding method of fishing, a system developed by the local community. They have devised a management system by which a SHG is responsible for protecting the MMU for one month and 2 members belonging to that SHG patrol the area every day on a rotation basis. The people of Kalaingar Nagar also follow a similar system to protect their plantation against grazing, bunding and fishing. However, the problem of grazing is high in this village, especially at night. Hence, the villagers stay in a small hut built in the forest with the permission of the Forest Department. In Vadakku Pichavaram, the VDMC has appointed a village watchman to look after the MMU and discourage grazing and other illegal activities. He works under the supervision of the VDMC and the Range Officer.

Table 1.1 : Area of mangroves under protection in Tamil Nadu sites

Village	Total area restored	Status of the plantation		Joint activity
		Planted	Survival %	
<b>Pichavaram</b>				
MGR Nagar	39	4,00,000	85	Monitoring, desilting and protection
Vadakku Pichavaram	32	3,00,000	80	Canal construction and planting gap filling, desilting monitoring and protection
Kalaingar Nagar	30	3,00,000	80	Canal construction and planting
T.S.Pettai	70	7,00,000	70	Canal construction and plantation
<b>Muthupet</b>				
Veerankoil	100	10,00,000	75	Canal construction and plantation
<b>Total</b>	<b>271</b>	<b>27,00,000</b>		

During the summer months, all the members of the General Body of the VDMC of both MGR Nagar and Kalaingar Nagar were involved in desilting both the main and feeder canals of their respective MMUs. The work was completed without any remuneration. The VDMC mobilised the members, MSSRF provided transport and the Forest Department supervised the work. In Veerankoil and Muthupet, 20 families involved in desilting the canals and protecting the mangroves were given one main canal for fishing.

It is apparent, therefore, that in most of the project villages, the villagers are actually involved in mangrove management, either by providing free labour for canal maintenance and patrolling the area or by providing money to pay the salary of the watchman appointed by them. In appreciation of the people's involvement, the FD has allotted 20 ha of degraded mangrove areas for restoration by the people of MGR Nagar and released the money for the restoration work directly to the VDMC. Similarly, it has allotted about 20 ha of dry land associated with mangroves to the VDMC of Kalaingar Nagar to grow casuarina with the agreement that the VDMC and the FD will share the final harvest. These are indications that the FD and the villagers have developed confidence in each other, which is a basic requirement for successful Joint Mangrove Management programme.

### ***Creating an economic stake in restoration***

*Crab fattening in Pichavaram:* In the Pichavaram mangrove wetland, two commercially important crabs, viz., *Scylla serrata* and *S. oceanica* are found in large numbers. These crabs are commonly called mud or mangrove

crabs. They fetch a price which is 3 to 4 times higher if their weight is more than 500g and if they are not in the moulted stage. It is easy to convert the moulted crabs, which have a soft-shell and watery meat into hard-shelled, solid meat crabs by confining them in a natural brackishwater environment for about 4 weeks.

Since crab fattening can be done in a small area and profit from this activity is high it was decided to introduce crab fattening in the restoration canals of MGR Nagar. Five families in MGR Nagar were trained and given financial assistance to start crab fattening as a commercial activity in the restoration canals with the permission of the FD. After one harvest, each family has made a profit of about Rs.4,000 in a period of 30 days. However, there are certain problems and constraints:

- Availability of water crabs from natural stock is diminishing due to overharvest of undersized crabs.
- A few private companies have a strong monopoly over water crabs and so supply of water crabs depends on the co-operation of these companies.
- Constant vigil is required against poaching.
- It is a strenuous operation which needs endurance and patience.

*Canal fishing in Muthupet:* In the Muthupet mangrove wetlands there are large patches of healthy mangroves where a traditional fishing method called canal fishing is followed. This method integrates fisheries development with mangrove regeneration

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and has been followed by a group of local fishers for the last 200 years.

This method was identified as suitable and followed to restore about 100 ha of degraded mangrove with the participation of the fishing community of Veerankoil. Each of the 20 canals which were constructed last year and allotted to a fishing family, with the agreement that they would maintain the canals and protect the plantation as well as practise fishing, has yielded about Rs.15,000 to 18,000 worth of fish and prawn. The plantation in the degraded area is also growing well, thus providing a model for Joint Mangrove Management.

### Poverty alleviation

*Self Help Groups:* There are 38 women SHGs and 21 men SHGs functioning in the project hamlets of Pichavaram and Muthupet. During this year, 26 SHGs, 17 for women and 9 for

men were formed. The total savings of the 59 SHGs was about Rs. 9,00,000, out of which Rs. 6,40,000 (71%) was the savings of the women SHGs. The savings were loaned to members for various purposes (Table 1.2) so that they could avoid borrowing from moneylenders at high interest rates.

*Integrated poverty alleviation programme:* An integrated poverty alleviation programme was developed with the help of the community, the block development office, the Panchayat banking institutions and the Forest Department. These programmes integrated income generation activities as an alternative to unsustainable use of mangrove resources, such as bunding and groping, which are non-traditional methods of fishing in MGR Nagar and Kalaingar Nagar. These two methods affect the mangrove wetlands by blocking free tidal flushing and affecting the establishment of seedlings in the restoration area. Secondly, income from these methods is also very

Table 1.2 : *Utility of loans disbursed by the SHGs in the demonstration villages in Tamil Nadu*

Purpose	To pay old debts		For agriculture and fishery		For new income generation activities		To meet social commitments	
	No. of Members	Amount (Rs.)	No. of Members	Amount (Rs.)	No. of Members	Amount (Rs.)	No. of Members	Amount (Rs.)
<b>MGR Nagar</b>								
Women SHGs	25	69,300	5	10,400	4	6,500	20	26,500
Men SHGs	03	10,000	8	7,500	1	6,000	1	2,000
<b>V.Pichavaram</b>								
Women SHGs	11	17,500	28	42,900	02	5,000	32	53,450
Men SHGs	07	18,000	48	77,750	07	2,700	80	1,55,100
<b>Veerankoil</b>								
Women SHGs	42	1,37,000	25	81,900	03	14,000	48	1,39,000
Men SHGs	15	17,200	03	5,000	02	7,000	12	19,000



meagre. In order to increase the income and avoid a negative impact on the mangrove wetlands, revolving funds were provided to purchase fishing boats and nets. As a result, 30 families abandoned the non-conventional method of fishing and their income increased by about Rs.1,500 - 2,000 per month. Apart from this, fishers who wanted to start other enterprises were given revolving funds and technical guidance. 24 families have stopped fishing in the mangrove wetlands and adopted various land-based income generation activities. In MGR Nagar, the project provided funds to a group of 10 persons who wanted to start agriculture on leased land, since most of the income goes to purchase food and income from fishing during the monsoon is also very limited. Micro plans were prepared jointly by the villagers, project staff and by other stakeholders such as the Forest Department and other line departments incorporating these activities.

In Vadakku Pichavaram, where grazing is a serious problem, an integrated cattle improvement programme was launched and aged cattle were replaced with new crossbred cows. As crossbred cows are stall fed, grazing pressure has been reduced. Indian Bank provided funds to start this programme on an experimental scale and seeing its success, has come forward to provide more loans. This integrated programme also involves the establishment of a fodder bank and a Visiting Veterinary Centre in the village. Apart from this, a number of activities were implemented in the farming hamlets to improve income from agriculture. Some micro enterprises like palm candy making were also implemented. Thus, the integrated poverty alleviation programme conceived, planned and

implemented in the project hamlets jointly with the villagers, has not only improved the income of individual families but also reduced unsustainable use of mangrove resources.

### **Gender issues**

*Women empowerment in social and economic domains:* In many of the VDMCs, the number of women members in the Executive Committee was increased substantially and their active participation in the decision making and planning processes was ensured. Forming SHGs for women, linking them with micro enterprises and banking institutions as well as with various programmes of the Women Development Corporation and District Rural Development Agency were the important activities of the year.

*Participatory social and gender impact assessment:* In order to understand the impact of the project activities on the gender issues of the project villages in Tamil Nadu, a Participatory Social and Gender Impact Assessment (PAGIA) was conducted during the year in both Pichavaram and Muthupet. A consultant acted as facilitator and the participants were villagers, project staff and in some cases field staff of the FD.

Six project interventions identified by the villagers were selected for assessment and the matrix-ranking method was employed. The results indicate that establishment of the VDMC in the village has helped in a number of ways, particularly in the involvement of a large number of women and men in decision-making, whereas only a few village leaders were involved earlier and no woman was included. Another indication is that the project

interventions have helped many young and old women and men to acquire new social skills as well as the courage to face social and economic challenges.

### **101.2 Andhra Pradesh**

In Andhra Pradesh, work is progressing in four villages viz., Matlapalem, Bhairavalanka and Dindu in Godavari and Dheenadayalapuram in Krishna Mangroves. The JMM model is being implemented in all the villages. Work has been initiated in three new villages in Kobbarichettupet and Pedagadimoga in Godavari and Khallipalem in Krishna on the lines of JMM.

#### ***Vegetation survey in Godavari and Krishna mangroves***

Vegetation survey has been carried out in 8 Reserved Forests (RFs) in 1,500 ha in Godavari and 34 species have been recorded, of which *Xylocarpus molluccensis* and *Sonneratia caseolaris* are rare species and *Scyphiphora hydrophyllacea* Gaertn.f (RUBIACEAE) is endemic. Measures were taken to protect this endemic plant which is found only in Kothapalem RF in Godavari. In the newly accreted areas *Porteresia coarctata* is seen, followed by *Avicennia alba* and *Sonneratia apetala*. *Rhizophora apiculata* and *R. mucronata* occur rarely between Matlapalem canal and Gaderu due to reduced saline water availability during most of the year.

Vegetation survey was conducted in both Krishna and Guntur districts in 1,000 ha. An inventory was prepared of the species composition and zonation pattern. *Avicennia*

*marina*, *A. alba*, *A. officinalis*, *Aegiceras corniculatum*, *Sonneratia apetala*, *Bruguiera cylindrica*, *Excoecaria agallocha*, *Caesalpinia crista*, *Myriostachya wightiana* and *Rhizophora apiculata* occur in both the districts. *Suaeda maritima* and *Acanthus ilicifolius* were found to occupy large areas. In some areas, the invasion of *Prosopis juliflora* was very high leaving no space for the growth of mangroves.

#### ***Mangrove nursery***

A mangrove nursery with 22,000 seedlings of *Avicennia marina*, *A. officinalis*, *Bruguiera gymnorrhiza*, *Rhizophora apiculata*, *Xylocarpus* and *Sonneratia apetala* was established for planting in the restoration sites near Bhairavalanka (25 ha). Propagules of *Ceriops tagal* and *Bruguiera parviflora* raised at Sunderbans were sourced and established in the Genetic Resource Centre in Corangi. A Mangrove Nursery was established in Sorlagondi RF where 4,500 seedlings of *Rhizophora* and *Bruguiera* were raised. Raising of *Sonneratia apetala* seedlings from seeds and *Excoecaria agallocha* from stem cuttings was demonstrated. Propagules of *Ceriops tagal* and *Bruguiera parviflora* from Sunderbans were raised in the nursery for establishing a Genetic Resource Centre at Corangi.

#### ***Institution strengthening towards sustainable management***

Sensitizing and awareness generation exercises were conducted involving local people, government officials, NGOs and elected members of the Panchayat and legislature through exposure visits, meetings and training and by using folk media, street play, video play and

including school children. The linkages among NGOs, Government officials and the community were strengthened for empowering the local community / institutions in leveraging funds from other agencies for implementing the microplans / JMM. Regular EDC/VSS meetings were conducted to impart participatory training in leadership skills, gender concerns and resource mobilization.

### ***Preparation of second micro plans***

In order to ensure better participation by all the stakeholders, two separate meetings were conducted for Krishna and Godavari areas before drawing up the micro plans. EDC/VSS Executive body members, officials from APFD, Central and State Fisheries department, NGOs and NABARD staff participated and suggested ways and means of leveraging support towards implementing the micro plans. The existing institutions were strengthened and wherever it was felt essential, new executive committees were constituted. Sub-committees were formed for different activities, viz., mangrove conservation and management, land based activities, poverty alleviation, village development and strengthening of institutions. The second microplan was prepared for four demonstration villages.

### ***Mangrove Management Units***

The FD has allotted the entire area of the Coringa Wild Life Sanctuary for protection through people's participation. The Mangrove Management Units (MMU) of 5 EDC/VSS villages in both Krishna and Godavari, covering an area of 8,000 ha, have pristine and degraded mangrove areas where restoration of mangroves/ desilting was undertaken with the help of the respective village level institutions.

### ***Land based alternatives for reducing pressure on mangroves***

Land-based activities in four JMM villages were implemented for reducing dependency on mangroves for fuelwood, fencing, fodder and timber. Training in coir rope making was arranged through the Coir Board, Rajahmundry. Smokeless chullahs (113) sourced from the Forest Department and kerosene stoves purchased from project funds were distributed to the village community with an equal contribution from them. The community was motivated to use Prosopis, Palmyrah and Coconut wastes as alternatives for fuel and fencing. Soil samples were collected from community lands and homestead areas and analysed for plant nutrients. Based on the results, FYM and fertilizers were recommended to improve the fertility of the soil.

### ***Training and capacity building***

In Dindu, 15 women were given training in tailoring. Two women who own sewing machines will take up tailoring. In Dheena-dayalapuram, ten women are undergoing training facilitated with the help of Mandal Development Officer (MDO). In Dindu, 15 women were trained in coir rope and doormat making. Two women are earning Rs. 1,500 per month as instructors in the DRDA project. In Matlapalem, training was imparted to 2 women in coir rope making and to 8 women in doormat making.

### ***Training on topographic survey using DGPs jointly with the forest department***

In Krishna mangroves, one of the main causes for degradation is the formation of elevated areas, which have become saline

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embankments due to the absence of tidal flushing. Hence a topographic survey was considered necessary in Yelichetladibba RF to prepare a model management plan for Krishna mangroves. In this connection a training program on the use of Differential Global Positioning System (DGPS) for topographic survey was organised at Hyderabad jointly with AP Forest Department, in which 7 staff of the Forest Department and 4 staff of MSSRF participated. A topographic survey was conducted jointly with the Forest Department at Yelichetladibba RF in Krishna mangroves using DGPS in an area of about 1 sq km. A topographic map was prepared showing the elevations to design and dig canals to facilitate adequate tidal flushing.

### ***Daily loan scheme***

A daily loan scheme with low interest has been introduced for women, thereby reducing the high interest burden. Earlier the villagers used to borrow from money lenders, purchase fish or prawn and sell them at Kakinada. In the evening they would repay the loan with Rs. 10 as interest for Rs. 100. After discussions with the money lenders, the daily loan scheme was started with an amount of Rs. 4,000. The fisher-women take the loan every morning from the animator, purchase fish or prawn and sell it at Kakinada. They repay the amount with an interest of one rupee for Rs. 100 to the animator in the evening. The women use the money saved from high interest during the lean fishing season. Nearly 40 members are being benefited by this scheme. The loan amount varies from Rs. 100 to Rs. 500.

### ***Poultry rearing***

In Dindu, 114 "Giri Raja" chicks were distributed to 19 families in February 2001.

These chicks will start laying by August. In Bhairavalanka, 117 "Giri-Raja" chicks were distributed to 25 families in January. By July 2001 these chicks will start laying. These chicks are capable of laying eggs continuously for 160 days in a year. At present each egg is sold at Rs. 2. With this scheme 25 families in Bhairavalanka are likely to get Rs. 150 x 5 = Rs. 750 per 5 chicks per year. The price of Giriraja chicken meat is sold at Rs. 60 per kg. Each bird weighs 3-4 kg on maturity.

### ***Information, awareness and policy discussion***

During the EDC meetings, discussions on awareness of JMM were held. Video programmes were conducted. Folk media were used for better animation of prudent mangrove resource management. Exposure trips to mangroves involving the NGOs, local government officials and panchayat leaders and competitions for school children of Matlapalem and Dindu were conducted. In Bhairavalanka, a street play was put up on the activities carried out so far and JMM.

### ***Mangrove conservation club***

Mangrove conservation clubs were established in the schools of the project villages with project sponsorship. Benches were provided to the school children at Matlapalem. An exposure trip to the Coringa Wildlife Sanctuary and Hope Island was organized. In Bhairavalanka, a Mangrove Conservation Club was established in the school with a fixed deposit of Rs. 3,000. Benches and blackboards were provided at a cost of Rs. 5,500 to the school.

**Community and policy makers**

*Workshop on Awareness for Mangrove Conservation and Management at Dheenadayalapuram, Krishna Mangroves* : A workshop on mangrove conservation and management and an exposure trip to Sorlagondi RF were conducted at Dheenadayalapuram. The objective of the workshop was to create an awareness among the community and administrators in the coastal villages. About 500 people (including Village Sarpanch, EDC members and traditional leaders, DWCRA group members and Government and non-governmental officials) participated. Importance was given to the role of traditional village leaders and EDC members in the conservation and management of mangroves. A field trip to mangrove forests and to restoration sites of MSSRF and FD in Sorlagondi RF was organised for the District Collector and other officials for leveraging support. Discussions were held in the field on the tidal flow and various aspects of restoration and conservation of the mangroves.

**101.3 Orissa**

The project has been established in two river mouth sites viz., Mahanadi Delta in Kendrapara district and Devi mouth site in Jagatsinghpur district. A total of 14 villages, seven in each site, have been taken as project demonstration villages. (Table 1.3)

A "Luna Jangala Samrakshyana Samittee" (LJSS) has been set up in each village with adult male and female members of all the households in the village as members.

**Mangrove conservation and management**

*Restoration and protection*: Each demonstration village has a well-demarcated MMU. The activities undertaken during this year are given in Table 1.4.

**Mangrove Nursery**

Temporary nurseries have been established in the demonstration villages to meet the requirement of seedlings for gap filling and planting. At present a total of 61,409 different seed stocks are available in the villages for gap filling.

Table 1.3 : *Demonstration villages in Mahanadi and Devi deltas in Orissa*

Mahanadi delta		Devi delta	
Old Villages	New Villages	Old Villages	New Villages
Kandarapatia	Kalatunga	Bandar	Dhanuharbellari
Kharinasi WN 11	Jambu WN 14		Kerabellari
Kajalapatia	Kharinasi WN 6		Naupal
	Badatubi		Amarapat
			Dandabedi
			Nendhera

Table 1.4 : *Restoration activity in demonstration villages in Orissa*

Village	Size of MMU (ha)	Area available for restoration (ha)	Area Restored in (ha)		Seedlings planted	Survival %
			1999	2000		
Kandarapatia	80	20	5.5	0.25	2,500	25
Kharinasi WN 11	65	25	5.0	11.00	16,200	45
Kajalapatia	95	35	—	30.00	2,05,075	45
Bandar	130	60	—	48.00	2,44,568	50

**Mangrove Genetic Resource Centre (MGRC)**

Owing to the fast depletion of some of the important mangrove species, the state forest department has requested MSSRF to establish a resource centre for mangrove plants. In keeping with the planned objectives of restoration and redevelopment, a site at Kansaridiha Forest Block has been selected and the approval of the Forest Department obtained. A nursery which accommodates 19 true mangrove species has been raised at Jambu.

**Land based alternatives**

The overuse of resources and consequential damage over the years have been threatening the very existence of the mangrove ecosystem and the livelihood security of the coastal community. The overuse is caused by the lack of suitable alternatives to supplement their

several needs. To overcome this problem, it was decided to develop individual as well as community wood lots with fast growing multipurpose trees to meet their requirements. Accordingly, seedlings of Acacia, Neem, Babool, Eucalyptus, Teak, Sisso, Casuarina, Coconut, Areca nut and Bamboo have been planted in the villages, as reported in Table 1.5.

Through this activity, an area of 2.2 ha of common land and 11.8 ha of homestead plantation have been put under tree cover.

**Establishment of homestead and community nurseries**

Instead of purchasing seedlings from private nurseries, farmers were encouraged to develop nurseries of their own and sell the seedlings for raising plantations. Accordingly, community based Multi Purpose Tree species (MPT)

Table 1.5 : *Seedlings planted in homesteads and common lands in Orissa sites*

Village	Homestead			Common land	
	Eucalyptus	Casuarina	Bamboo	Eucalyptus	Casuarina
Kajalapatia	15,953	1,600	2,100	200	—
Kharinasi	2,000	1,450	500	1,000	550
Kandarapatia	2,000	2,000	54	8,000	6,000
Bandar	4,000	1,064	—	1,000	1,000
Total	23,953	6,114	2,654	10,200	7,550

nurseries were established in all the demonstration villages either by individual farmers or by the community as a whole.

The basic aim of promoting individual homesteads and community nurseries is to build the capacity of the community and individuals in raising nurseries and augmenting their income by buyback arrangements.

***Supply of fruit plants and commercial timber species***

During the 'super cyclone', a number of coconut trees were uprooted or damaged, affecting the economy of the rural poor. To overcome this loss, 1,500 coconut seedlings were planted in five villages. Commercial timber species like teak were supplied to the villagers. In addition, 1,660 teak and 500 bamboo seedlings were also planted by the participating community in the five demonstration villages.

***Providing improved portable chullah***

The improved portable chullah, developed by Orissa Renewable Energy Department Authority (OREDA), has been introduced in four villages. This is one of the possible alternatives for reducing the dependence on

mangroves for fuel, as it saves 30-40% of fuel. Further, wood, twigs, leaves, cow dung etc. can also be used as fuel. It reduces health hazard and is eco-friendly.

The cost of the chullah is Rs.260, of which the villagers have contributed Rs.50 per household and Rs.210 is borne by the project. Most villagers are using the units. Chullahs have been supplied to 79% of the households as may be seen from Table 1.6.

The mangrove dependency survey indicated that there was 31% reduction in fuel consumption due to the use of the portable chullah.

***Self Help Groups (SHGs)***

The villagers were depending on moneylenders for loans to support their household needs and small businesses. The high interest rate on the loans was found to be one of the reasons for the continued poor economic status of the households. Keeping this in mind, SHGs were organized in the villages to increase the saving potential of the village household, decrease dependency on the moneylenders and enable them to use the available funds for income generation activities (Table 1.7).

Table 1.6 : *Distribution of chullahs in the demonstration villages in Orissa*

Village	Total households	No. of chullahs distributed
Kandarapatia	41	41
Kharinasi (Ward No.11)	93	93
Kajalapatia	289	182
Bandar	120	120
<b>Total</b>	<b>543</b>	<b>436</b>

Table 1.7 : *Savings and SHGs in the demonstration villages in Orissa*

Village	Total SHGs	Total members	Avg. monthly saving (Rs.)	Total saving (Rs.)	Loan amount disbursed (Rs.)
Kandarapatia	3	33	50	45,225	28,000
Kharinasi WN 11	7	130	20	29,960	25,000
Kajalapatia	11	238	50	1,22,920	25,000
Bandar	6	111	20	48,100	16,700

### **Training**

Most of the members of the EDC and SHGs were given training on accounting and record keeping. The villagers of Kajalapatia and Bandar were trained in the methods and principles of raising a mangrove nursery in their villages with the help of a mangrove biologist and a field assistant. The villagers were also trained in bee keeping. A training programme on integrated pest management in coconut was also organized.

making opportunities and facilities, etc. were studied in detail for all the project demonstration villages.

- Men and women are actively involved in all the fora promoted by the project.
- Training and orientation of project staff on aspects related to gender have been conducted by Gendeavour (in-house gender and development center at MSSRF, Chennai) and also by a Gender Resource Person.

### **Gender concerns**

- All the Project activities in the villages ensured active participation by women.
- The information collection processes (PRA, base line survey, mangrove dependency survey) that were carried out in the demonstration villages were designed to elicit information from women as well as men.
- Documentation of information collected was done in both gender aggregated and disaggregated manner.
- Existing similarities/dissimilarities between men and women in the demonstration villages, pertaining to division of work, access and control (of resources, social infrastructure), decision

### **101.4 West Bengal**

Mangrove afforestation was undertaken with community participation in 20 ha in Ramganga and Raidighi ranges. Under entry point activities, five ponds have been desilted and five tube wells installed to make drinking water available. Irrigation canals to a length of 2,000 m were desilted to augment irrigation to the fields.

Under Farm Forestry, 1,80,000 seedlings have been distributed to the mangrove community for planting in 100 ha. 800 fruit grafts and 6,000 bamboo seedlings were also distributed.

Training was imparted to 95 Forest Protection Council Members in Pisciculture, Animal husbandry and Agri-Horticulture.



To facilitate alternate income for the mangrove community, oyster culture and crab fattening activities are being organized with technical assistance from SD Marine Biological Research Institute and GREEN in Bhagabatpur and Raidighi ranges respectively.

### **101.5 Geomorphological, Hydrological and Sedimentological Studies**

Apart from the various social causes of degradation, geomorphological, hydrological and sedimentological factors have also been found to influence the health of mangroves. The project aims at understanding these processes to evolve a long-term plan for mangrove management.

#### ***Hydrodynamic characteristics of Pichavaram mangrove wetlands***

Pichavaram wetlands are subject to tidal flushing throughout the year. Detailed studies were carried out to understand the hydrodynamic processes in the mangrove ecosystem. Data on tides and currents was collected for the pre-monsoon season, thereby completing the last phase of hydrodynamic measurement. Salinity and temperature were measured along the axis of the creek during this season. The tidal characteristics of Pichavaram wetlands during different seasons show that the tide is of the semi-diurnal type with slight inequality. Based on the current measurements, it was found that the major inflow of tidal water takes place from Coleroon inlet where the maximum current velocity of 0.75m/s was observed during the north-east monsoon, while it remained nearly the same during the other

seasons. Salinity remained relatively higher during fair weather season, ranging between 26 and 34 ppt. During the north-east monsoon, the salinity values had fallen to less than 5ppt.

#### ***Geomorphology of Pichavaram mangroves***

The Pichavaram area is a vast plain with a gentle slope towards the Bay of Bengal. The area is drained by Upannar, Coleroon and Vellar rivers which are distributaries of the Cauvery river. The marine processes influencing this area are tidal oscillation and circulation. Aeolian processes influence the transport of beach sediments. The major environments of deposition are marine, fluvio marine and fluvial. The geomorphic formations are Porto Novo formation, Mutlur formation and Vellar-Coleroon formation.

#### ***Geomorphology of Muthupet mangroves***

The Mutupet area forms the southernmost extension of the Cauvery delta. It is a plain interspersed with creeks and lagoons. The present geomorphic layout of the area is a result of progradation of the coast with the original shoreline at a distance of 6 - 23 km from the present position and also a combination of fluvial action of the Pamaniyar, Valavanar, Killaithangiyar and Mulliyar rivers, aeolian action, weathering and temperature changes. The area depicts both erosional and depositional landforms. The drainage pattern is sub-dendritic with the development of sub-deltaic features. There are four major morphological units in this area, namely, Muthupet formation, Perumalai formation, Pamaniyar formation and Madukkur formation.

***Hydrodynamic characteristics of Krishna mangrove wetlands***

Preliminary analysis of the discharge data of the Krishna river from Vijayawada shows that from 1967 to 1997, the supply of fresh water to the mangroves was unsteady, which might have resulted in the degradation of the mangroves. Measurement of *in situ* salinity and temperature was carried out at selected stations along the axis of the three channels of Gollamattapaya, Nadimeru and main Krishna river during the south-west monsoon season, thereby completing the salinity study for the main river. Salinity and temperature of both the surface and bottom were measured. In addition, salinity and temperature profiling was also done at selected stations along the axis of the three channels. Position fixing was done using GARMIN GPS12 XL. Salinity showed variations from 8ppt to 36ppt while temperature showed variations from 28°C to 30°C. The salinity-temperature data was plotted on GIS to generate maps.

***Topographic survey using DGPS***

A training programme on the use of DGPS for topographic survey was organised at KBR National Park, near Hyderabad, on 4<sup>th</sup> and 5<sup>th</sup> July, 2000 with the AP Forest Department, in which 7 staff of the Forest Department and 4 staff of MSSRF were trained.

A topographic survey was conducted jointly with the Forest Department in an area of 1 sq km at Yelichetladibba RF in Krishna mangroves using DGPS. A topographic map which can be used to design canals for mangrove restoration was prepared.

In the Krishna mangroves, the restoration areas were surveyed using GPS. Canals were

designed and maps were prepared showing the restoration areas.

***Hydrodynamic characteristics of Godavari mangrove wetlands***

Preliminary analysis of the discharge data for the period 1962 -1999 from Dowleswaram barrage shows that the flow of fresh water into the mangroves has not been steady and might have resulted in mangrove degradation. Tidal salinity and temperature variation at Corangi restoration site were measured during the pre-monsoon season. It was found that the tidal variation was of the order of 1.3m. Salinity showed variation from 22 ppt to 29 ppt while temperature showed a variation from 28°C to 34°C.

***GPS survey of restoration areas in Godavari mangroves***

In the Godavari mangroves, the restoration areas in Rathikaluva RF and in Coringa sanctuary were surveyed using GPS and maps were prepared separately for sanctuary and non-sanctuary areas. Canals for mangrove restoration were designed in the Godavari area.

**101.6 Remote Sensing and GIS Applications**

The Atlas of Mangrove wetlands - Part - I (Tamil Nadu) was released on 30th August 2000 by the Governor of Maharashtra, Hon'ble P C Alexander. In Tamil Nadu, there are 5 mangrove wetlands viz., Pichavaram, Muthupet, Pudhupattinam, Gulf of Mannar and Palk Strait. The atlas contains detailed information on Pichavaram and Muthupet.

It is in digital form (CD-ROM) also. The thematic maps are prepared from remote sensing data and GIS is used for integrating the spatial and aspatial information to derive different thematic maps such as vegetation change map, shoreline change map, etc., and for easy updating and retrieval of data.

Preparation of Part II (Andhra Pradesh) and Part III ( Orissa ) of the atlas is in progress.

### **Sub Programme Area 102**

#### **Nuclear and Biotechnological Tools for Coastal Systems Research**

The coastal ecosystem suffers from the absence of integrated attention to conservation and development. Since it forms a vital link between the terrestrial and aquatic ecosystems, its preservation is essential to maintain ecological balance and biodiversity. Despite the ecological and economic significance of both inland and coastal areas, unsustainable resource use practices leading to adverse anthropogenic pressures on the coastal ecosystem are evident. The ongoing programme initiated in the year 1998 as a joint project between MSSRF and the Department of Atomic Energy (DAE) has been effective in addressing the problems of natural resources restoration and enhancement of livelihood security in the coastal regions of Tamil Nadu. It is further intended to develop models of sustainable development in the coastal regions for strengthening the livelihood security of the rural communities by blending frontier sciences and technologies such as nuclear tools and biotechnology with the traditional

wisdom of the coastal rural communities. The project operates in a participatory mode and addresses issues of both basic and applied nature through biotechnological interventions such as gene technology and studies on soil amelioration using bioremediations. Basic and anticipatory research being undertaken in the programme focus on identifying the present and future problems that the coastal regions might face, and developing a knowledge base that would help in either preventing or mitigating the problems. Considerable work has been carried out at MSSRF in identifying genetic material capable of offering resistance to coastal salinity. An alternative approach for practising cultivation in saline environments is the amelioration of soil salinity in agricultural lands using a biological approach.

#### ***Isolation and characterization of stress tolerant genes***

This aspect concentrates primarily on studies relating to identification of novel genetic combinations with particular emphasis on salt tolerant genes from the coastal mangrove species. One of the species identified for the present study is a wild relative of rice i.e. *Porteresia coarctata*, a species of the mangrove ecosystem. The study involves construction of enriched gene libraries, characterisation of novel genes for salinity tolerance and their subsequent mobilization into crop species of importance in the coastal area. During the year a number of genes have been isolated from the cDNA library constructed from this species. Studies are being undertaken on the structure and expression levels of the genes isolated from the mangrove species. Details of the transcriptional

and translational regulation of one such gene is given below.

A full-length cDNA clone (PVA 1) corresponding to V-ATPase subunit c was isolated from *P. coarctata* cDNA library. DNA sequence analysis from both strands revealed that PVA 1 is 876 bp long. Translation initiation codon ATG was found at the region of 72- 74 bp and the stop codon TAA at 567- 569 bp. The 5' end was flanked with 71 bp untranslated region (UTR) and the 3' end with 306 bp UTR. The polyadenylation signal AATAAA was found between 793 and 800 bp. A poly (A)+ tail of 19 bp length was detected in the 3' end. The deduced amino acid sequence of the PVA 1 showed that this cDNA encodes for a polypeptide of 165 amino acids and calculated molecular mass was 16.5 kDa. The protein sequence showed significant homology with V-ATPase subunit c of *Oryza sativa* (GenBank accession No U27098) and *Avena sativa* (GenBank accession No M73232). The amino acid sequence was 99 and 98% identical with *Oryza sativa* and *Avena sativa*, respectively. However, the nucleotide sequences of the coding region showed 92% homology with *Oryza sativa* and 88% homology with *Avena sativa*.

Multiple alignment and hydropathy analyses showed that PVA 1 contains four hydrophobic transmembrane domains (I-IV). Three extramembrane domains (L1-L3) are present between the transmembrane domains. This analysis also showed that PVA 1 protein sequence contains a stretch of hydrophilic amino acids in the carboxyl end. A glutamate residue (E) at the position of Glu-142 was observed on the transmembrane domain IV, which is the site of dicyclohexyl

carbodiimide (DCCD) inhibition, as in the case of the sequences reported for all the other species.

Southern analysis showed that more than one fragment was hybridized with PVA 1 probe in all the restriction enzymes combinations even after stringent hybridization washes. The fragments varied in size from 0.63 kb to 24 kb. It produced seven fragments with EcoR I, Sac I; six with Dra I, Hind III; five with Pvu II, Bgl II. These results indicate the possibility that the subunit c is encoded by a multigene family.

Transcript level for subunit c in roots and leaves of *P. coarctata* was determined by Northern blot analysis. This indicated that there is no significant increase of the subunit c transcript level in the leaves of 5 h salt treated plants. However, the transcript level increased on prolonged exposure of the plants to NaCl. The increase in the transcript was 2 fold after 24 h salt treatment, 3 fold after 48 h salt treatment and 2.6 fold after 72 h salt treatment compared to the control plants. The subunit c transcript level declined to normal, 24 h after salt withdrawal.

The transcript level after 5 h increased 2 fold compared to the control and was about 5 fold more after 72 h in the roots of salt stressed plants. After the salt withdrawal the transcript levels started declining. The level of transcript declined to 2.5 fold after 10 h of salt withdrawal and to 3.3 fold after 24 h compared to the 72 h salt stressed plants. Significant increase in subunit c transcript level was noticed both in the leaf and root portions of the salt stressed plants. These results clearly show the up regulation of subunit c transcripts upon NaCl stress in *P. coarctata* both in roots and leaves.

The immunostaining experiment showed that the 2E7 monoclonal antibody strongly hybridized with 60 kDa and the 7A5 hybridized with 70 kDa of *P. coarctata* tonoplast proteins. Increase in the intensity of 60 kDa and 70 kDa proteins was observed in the lanes loaded with tonoplast proteins from the salt treated plants. The polyclonal antibodies against PVA 1 protein showed cross reaction with 16.5 kDa protein of the V-ATPase and significant increase in the intensity was observed in the salt treated plants. Western blot and immunostaining experiments using both polyclonal and monoclonal antibodies of V-ATPase with *P. coarctata* tonoplast membrane indicated the increase of translational product of 70 kDa (subunit a), 60 kDa (subunit b) and 16.5 kDa (subunit c) of V-ATPase in 0.5M NaCl treated *P. coarctata*.

The studies suggest that there is a contributory role of the V-ATPase to the salt stress response in *P. coarctata* which is possibly due to the simultaneous induction of V-ATPase and a Na<sup>+</sup>/H<sup>+</sup> antiporter, which provide the cells with an efficient mechanism for vacuolar salt sequestration. Further work on these lines has been initiated to clone the vacuolar antiporter gene from *P. coarctata* cDNA library.

### **Soil biological criteria and bioremediation**

In many coastal regions excessive exploitation of groundwater has caused intrusion of seawater, thus worsening the salinity problem. In the initial years of soil degradation, cultivators tend to switch to more tolerant crops like rice, only to find that even the production of tolerant crops is substantially reduced and that their

production accelerates the degradation of additional areas due to inefficient water use. It has been increasingly realized that there is a need to adopt an integrated approach to management and development of resources including soils, water, crop, forests and livestock, based on the natural ecological unit of the watershed, using biological approaches.

Towards this end salt tolerant culture *Anabaena torulosa*, along with *Anabaena strain AL31* was given for testing and demonstrating in the southern coastal region as alternative sites to test this hypothesis. These strains were tested earlier in Mettupalayam (a site with canal irrigation) and Poondiyankuppam (with well irrigation) and the results have already been reported. A field trial was carried out in Kuriyamangalam (Chidambaram) in the absence of paddy cultivation to assess the sequestering capacity of NaCl of the isolate from saline soils. The study plot of 21 cents was divided into one-cent experimental plots and the Randomized Block Design (RBD) was used. *A. torulosa* was released in two concentrations of 1,000ml/cent and 500ml/cent. Soil samples and algal mats were collected at the end of 30 days and taken up for analysis. Nitrogenase activity was enhanced in the soils in which *A. torulosa* had been applied. Sequestering was very efficient as observed on analysis for electrical conductivity in the mats removed from the field trial. Up to 64% removal was observed when the inoculum was added while even in control, removal up to 36% was observed; this could be due to the local strain that grew well in control conditions. The significance was explained to the farmers.

***Hydrodynamics of fresh water-saline water interface in coastal aquifers***

Hydrological studies in relation to ground water have become essential to monitor pollution and prevent seawater ingress. The use of radiotracer techniques in recent years has been particularly useful to monitor the hydrologic status and the water quality in the aquifers. As mentioned in the previous report, 30 piezometers have been constructed in the Tiruvanmiyur aquifer near Chennai to study water quality parameters, understand the causes of salinity and monitor the variations in the water quality and water table fluctuations in the aquifers. Samples from these piezometers were collected at bimonthly intervals and are being analyzed. It is expected that the analysis once completed would provide vital understanding of seawater and coastal aquifer interaction and dilution of the sewage and pollutants from industrial waste dispersed into the river system or the sea.

***Activities being undertaken in the experiment-cum-demonstration plot at Kalpakkam***

The experimental-cum-demonstration plot at Kalpakkam was developed in 1998 for demonstration of an integrated farming system model in the coastal region. The basic model envisages applying a number of activities in a single location. The important features of this demonstration plot are organic agriculture, forward-backward linkages, critical water schedule and low energy input.

Activities in the demo plot have been further intensified with a number of new interventions such as new crop varieties and use of farm and field wastes for biocomposting.

During the year, the entire manure requirement for the demo plot was generated from the field itself. One of the major aims of the demo plot was to train local communities in various aspects of sustainable agriculture. Training was given to 12 batches of 20-25 participants per batch. In addition, the project staff has developed a training module and has imparted training in villages adjoining Kalpakkam. The project has also developed close interaction and collaboration with the Agriculture Department and many of the Agricultural officers have undergone training ranging from 1-4 days at the site. Difficulties were faced in carrying out training programmes at the Kalpakkam site because of security reasons. To overcome the difficulties and to reach out to more people, a 2.5 acre plot has been taken on lease outside the IGCAR campus and is being developed as a model plot for imparting training on integrated farming system, demonstration of new varieties and various other options.

***Activities being undertaken in the experiment-cum-demonstration plot at Kudankulam***

The on-going project intends to develop models for sustainable natural resources management and development in Kudankulam, where the Nuclear Power Corporation of India Limited (NPCIL) is building a nuclear power reactor. The proposed interventions are intended to evolve practical methodologies for effective use of the natural resource base. Kudankulam and adjoining regions are characterized by low rainfall and poor soil conditions. The average rainfall of around 200mm is very erratic and unpredictable, leading to frequent crop failures. The texture, depth,

calciferosness and salinity/ alkalinity of the soil affect productivity. Most of the area is only marginally suitable for field crops.

Detailed soil surveys have been undertaken in collaboration with the National Bureau of Soil Survey and Land Use Planning (NBSS&LUP), Nagpur in 3 adjoining villages (Vijayapatti, Irrukandurai and Kudankulam) covering a total area of 8,500 ha. The parameters included were soil texture, depth, porosity etc. Based on the soil survey, suitability maps for major agricultural crops have been developed. The local people were involved in the activity, and were also briefed about the outcome. This is the first ever detailed soil survey carried out in the region.

Nursery development for fruit trees, green belting and agricultural crops has been tested. The yield and performance of different crop varieties under rain fed conditions, exploring options of introducing new crop species in the region, demonstration of low-input, organic, recycling and water use efficiency in rain-fed agriculture systems and application of rare earth elements have been carried out in the demonstration plot.

Kudankulam is a water-scarce region. Activities were undertaken to identify the watersheds so that they could be managed effectively. Three major watersheds were identified in the NPC campus and water harvesting structures were developed in association with NPC. To avoid seepage, fly ash from thermal waste was used and showed longer retention of water. This harvested water was a boon to the local communities for satisfying their pressing needs as well as for green-belt irrigation. Micro-watersheds along the green belt were also developed, based on contour mapping.

Major emphasis, however, was placed on developing the model for green belt development around the Atomic Power Plant in Kudankulam. 5,220 plants belonging to 15 species have survived. The species tested for green-belt development include Tamarind, Neem, Acacia, Albizia, Leucena, Casuarina, Bambusa, Pongamia, Ficus, Rosewood, Cassia, Agave and Ashoka.

During the year of report, the project activities were extended and a genetic garden for fruit crops was developed in a 4 acre plot in the NPCIL site at Kudankulam. The DAE-MSSRF genetic garden aims at introducing and assessing the adaptability of 56 varieties collected from different agroclimatic conditions in Tamil Nadu. The fruit crops being demonstrated include Mango, Sapota, Guava, Cherry, Amla, Acid Lemon, Pomegranate, Naval, Apple, Jack Fruit, etc. It is envisaged that the DAE-MSSRF's genetic garden in the NPCIL site at Kudankulam will serve as a window into the new world of opportunities which awaits rural women and men in the area. The genetic garden was inaugurated by Dr Anil Kakodkar, Chairman, Atomic Energy Commission and Secretary to the Government of India, Department of Atomic Energy in the NPCIL Campus, Kudankulam on 24th April 2001.

Experiments pertaining to the application of rare earth elements in improving productivity of agricultural crops such as groundnut, sorghum and red gram were also carried out in the demonstration plot in Kudankulam. It is reported that Rare Earth Elements (REE) comprise chlorides and nitrates of major macro elements and trace quantities of micronutrients. In China and Australia, these have been tested for improved agricultural

production. The performance has been assessed in various concentrations of REE with and without recommended NPK in RBD in these three crop species. Data collected on their morphological and yield parameters is being analyzed.

The major emphasis of the on-going project is to disseminate the development models among the rural families of the coastal areas adjoining the Nuclear Power Plant. A farmers' interaction programme was organized and 150 farmers of the area visited the demonstration site. Equal participation of both men and women was ensured. Impressed with the model and the activities, the collector of Tirunelveli district has instructed the VAOs to interact regularly with our staff at the demo plot. The project also addresses the organization of self-help groups to improve the livelihood options and opportunities of the local people. Three self help groups have been formed in the Kudankulam region and various activities are being explored.

### **Sub Programme Area 103**

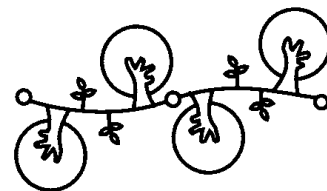
#### **Promoting Alternative Options for Livelihood Security in the Gulf of Mannar Region**

The Ministry of Rural Development (MORD) and United Nations Development Programme (UNDP) have approved a proposal to

promote alternative options for livelihood security in the Gulf of Mannar Region. The project aims at technological and economic empowerment of the poor, living in the vicinity of the Gulf of Mannar Biosphere Reserve (GOMBR), which in turn will create an auxiliary effect in bringing down the dependence of these poor families on the resources of the Biosphere Reserve. The project is being implemented in the Ramanathapuram and Tuticorin districts. MSSRF is implementing marine-based livelihood activities such as oyster farming, pearl oyster farming, seaweed farming, establishing an agar production plant and fish pickle units and implanting artificial reefs, in the buffer zone area of the Gulf of Mannar Biosphere Reserve to enhance the availability of fish and shellfish in the fishing grounds. MSSRF has established a site office at Mandapam for coordinating all these activities and two specialists and two social workers have done preliminary work to start marine-based community-owned enterprises.

DHAN Foundation, a leading NGO in community banking and micro credit, is one of the major partners in these efforts and has started implementing programmes relating to the formation and strengthening of the SHGs, renovation of tanks and land based activities such as charcoal making, dairy farming, etc.





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# Biodiversity and Biotechnology

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*Progress was made in strengthening the insitu on-farm conservation traditions of tribal and rural women and men. Medicinal rices received special attention in Kerala and Orissa, while in Kolli Hills new economic opportunities were created through organic farming and regeneration of millet cultivation. A Community Agro-biodiversity Centre was constructed at Kalpetta, Wayanad.*

*Progress was made in the isolation and characterisation of salt-tolerant genes. Genetic transformation, study of microbial diversity and lichen research made good progress. Technical assistance was given to the establishment of a Golden Jubilee Biotechnology Park for Women, near Chennai.*

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**Sub Programme Area 201**  
**Community Based Agro-  
Biodiversity Conservation and  
Management**

Community based agro-biodiversity conservation programmes are being implemented in Tamil Nadu, Kerala and Orissa. The major approaches of conservation followed are chronicling and revitalisation of conservation traditions, participatory plant breeding to secure a sustainable livelihood and integrated gene/grain and water management.

**201.1 Conservation Traditions: Chronicling and Revitalisation**

Chronicling and revitalisation of conservation traditions included *in-situ* on farm conservation, training and capacity building, germplasm conservation of endangered species, sacred grove conservation and rehabilitation, conservation of gardens and seed banks for landraces. These activities were largely supported by SDC, under a larger context of conservation, enhancement and sustainable and equitable use of biodiversity.

The first phase of the SDC supported activities was thoroughly reviewed this year in November, 2000 by Dr R S Rana and Ms Seema Bhatt who strongly recommended continuation of the second phase for the next five years. The second phase of the project which started in April 1, 2001 envisages to further the gains of the first phase by facilitating the emergence of networks among self help groups, NGOs and Panchayats, strengthening quality seed production practices among tribal farmers, participatory

plant breeding and establishment of village level seed banks and area level grain banks with the aim of promoting *in situ* or farm conservation practices of rural and tribal households. Establishment of databases and documentation of successful approaches and strategies and development of communication modules for effective dissemination are also envisaged.

The projects in Kolli Hills, Wayanad and Jeypore Tract continued during the year. The significant achievements are:

- Notable progress has been made in revitalizing *in-situ* on farm conservation traditions of tribal and rural families, by organising the production and distribution of quality seeds of locally adapted landraces of paddy and minor millets. Farmer-to-farmer seed exchange systems have been strengthened.
- *In-situ* on farm conservation of agrobiodiversity provided a strong backup by establishing Community Seed Banks with suitable linkages with the Community Gene Bank at Chennai. They have been set up by the volunteer villages and managed by the Self Help Groups, with technical inputs from the project teams in the field sites.
- Sacred groves in Kolli Hills and Wayanad were restored with native tree species with the active involvement of the local people. Community Medicinal Plant Gardens have been established in Jeypore Tract to conserve over 260 species under the protection of local deities.
- Work on the preparation of Community Biodiversity Registers has been

completed in several hamlets in Kolli Hills and Wayanad.

- Networking and capacity building activities are in progress.
- Another outstanding achievement is the formation of several Self Help Groups (SHGs) in Kolli Hills and Wayanad, involved in biodiversity-based enterprises.
- Processing of minor millets in the Kolli Hills involves drudgery for women and has been one of the main reasons that led to the phasing out of several landraces of minor millets. A mechanised dehusking machine for processing of minor millets and paddy has been made available through the SHGs.

The activities undertaken contributed to a revitalisation process bringing the following realisations:

- Both *in-situ* on farm conservation of intra specific variability in economic plants, and *ex-situ* on farm conservation of economic, ecological and spiritual keystone species have been initiated through sacred groves.
- An integrated management strategy helped to generate interest in tribal and rural families in the sustainable management of natural resources, particularly soil, water and forests. Thus biodiversity conservation catalyses commitment to integrated natural resources management.
- Carefully designed models for commercialisation have created an economic stake for rural and tribal families involved in the revitalisation of their *in-situ* on farm conservation traditions

- Initiatives in the different sites have made important contributions towards stemming the erosion of agrobiodiversity in the region. For example, in Kolli Hills, minor millets and legumes would have disappeared as a result of the expansion of pineapple and Cassava cultivation, but for the work done under this project to find markets for such underutilized crops.

### **201.1.1 Kolli Hills**

Revitalisation of *in-situ* on farm conservation traditions was undertaken in the region as one of the major activities.

*Minor millets seed multiplication:* The interviews of the focus group with the tribes revealed that the community is interested in *in-situ* on farm conservation of minor millets. At the same time they have also expressed their problems in revitalizing minor millets cultivation, such as seed shortage and low yield per acre, inability to market the surplus, reduce the drudgery of manual dehusking and increase local consumption. Solutions for these problems were discussed with the local community and they were advised to take up minor millet seed multiplication on land acquired on lease.

Seven landraces of little millet and 7 landraces of Italian millet seeds were collected and multiplied. 2,436 kg of five different landraces of little millet and 1,313 kg of five different landraces of Italian millet were produced without applying chemical fertilizers and pesticides.

*Seed exchange:* While documenting their traditional farm practices it was found that the

tribes in Kolli Hills have been following a unique system of seed exchange for generations. They borrow seeds and return it two-fold after harvest. The same traditional seed exchange system was used for meeting the seed shortage and for conserving genetic diversity. Minor millet seeds were exchanged on various festive occasions and at weekly markets. The names and addresses and signatures or thumb impressions were recorded in the seed exchange register in Tamil. 697 people have borrowed 1,989 kg of seeds under this system. 69% of the seed borrowers were men and 31% were women.

The cultivators in Kolli Hills borrowed 60% of the seeds and cultivators in Namakkal district borrowed 17% of the seeds, while the cultivators in 11 other districts of Tamil Nadu took the remaining 23% of the seeds. 40% of them used the seeds for cultivation; that is to say, roughly 100 acres of land were brought under minor millets cultivation.

*Community seed banks:* In continuation of last year's modification in the community seed storage structure (*Thombai*), a new system of records for seed-keeping has been introduced this year. Information about the seeds in the banks is recorded in seed loan registers. Those who borrow from the bank have to affix their signature/thumb impression in the loan register and return double the quantity borrowed after the harvest. The entire operations are managed by 2 women selected by the members of the SHGs.

*Sacred groves:* Certain regulations and beliefs prevalent among the tribes have helped to conserve the biodiversity and natural vegetation in the sacred groves of Kolli Hills. The sacred grove concept followed by the tribes is a

manifestation of the community biodiversity management system. However, even these sacred groves are now under threat due to various reasons. So, 15 sacred groves have been taken up for documentation and study.

Some stakeholders were mobilized to save 2 selected degraded sacred groves. The villagers selected suitable tree species and planted them. 13 different species (40 saplings) were planted in the two sacred groves.

It was observed that interest in and knowledge of the sacred groves have been declining among the youngsters. To revive interest in the traditional community conservation system, a sacred grove model was also created in a school by involving the students. Community management of sacred groves (as a revitalisation strategy) requires to be further strengthened.

*Black paddy and black banana:* While documenting traditional farm practices last year, it was found that black paddy and black banana are two traditional species under threat in Kolli Hills. So efforts were made to identify and support the families conserving and growing them. The woman who conserved the black paddy seed was recognized and rewarded symbolically by being given the responsibility of managing the community seed bank. The three cultivators of black banana were also identified and supported by the project in growing and conserving it.

### ***Capacity building and networking***

Training, capacity building and orientation were given to local participants on transacting business and on how to plan, establish and run the minor millet cum rice mill.

A higher secondary school in Semmedu was chosen to spread awareness of biodiversity and the M S Swaminathan Nature Club was formed. Now 100 students of this school are active members. Last year they cleared the bush and created 3 models in the school land with the help of wage labourers for minor millets, traditional hill banana and sacred grove.

This year, the maintenance of the models was continued. One interesting development is that hill bananas worth Rs.25,000 are getting ready for harvest in a model plantation. The challenge now is to protect and market them.

Seeing this interesting development a local SHG has offered a tie-up with the M S Swaminathan Nature Club to take up protection and marketing. 75% of the income will go to the Club and 25% to the SHG.

### ***Conservation and utilization of biological diversity – market linkages***

*Local market:* To cater to the needs of the local market, a minor millet cum rice mill was set up and run by the Chinnamangalam SHG. On seeing its success another mill was set up by the Iyarkai Padhukappor Sangham in A.Thannimathipatti. Within the first six months, more than 100 tribal households have dehusked the minor millets and started consuming them as in the past.

*Market outlets for minor millets in Namakkal:* A scrolling Tamil advertisement was given in the local cable TV channel to popularize value-added minor millet items such as dehusked *samai* and *thinai ravai* and flour. These items were packed in half kg packets and displayed in 3 major supermarkets in

Namakkal town. Within one month *samai* and *thinai ravai* and powder worth Rs.1,000 were sold. There is a regular demand for them from the supermarkets. MSSRF has given interest-free loans amounting to Rs. 55,000 to the SHGs for value addition of minor millets to be sold in Namakkal town and Kolli Hills. A minor millets recipe book in Tamil is under preparation for the sake of consumers and to popularize the traditional food items prepared from minor millets.

*Organic certificate and export market:* After an inspector from a German-based certifying agency called ECOCERT inspected the fields in Kolli Hills, the agency has given an ECOCERTIFICATE stating that minor millets are organically grown here and that they may be exported to European and American countries. An export order of 20 tons has been received. The items are being supplied by involving various stakeholders like tribal SHGs, TRIFED and IEEF.

### **201.1.2 Wayanad**

The main thrust of Community Agro-biodiversity Conservation is on strengthening the capacity of resource poor communities and grassroot institutions for conservation and sustainable management. Activities in the year 2000 concentrated on three major areas: strengthening the community conservation systems through diversification of crop varieties and income generation, participating with grassroot networks for building the capacity of various formal and informal institutions for conservation and sustainable use of biodiversity and improving the conservation strategies for life-saving plants and animal species.

*Studies on Dioscorea (Conserving Life Saving Plants):* Wild yams and tubers are still major sources of food supply to poor forest communities in many tribal and rural regions in India. Out of the 620 species known all over world, about 50 species reported from India occur largely in the west, east and northeast regions. The western and eastern peninsular regions, which represent the true Indian flora hold about 12-16 species of *Dioscorea*, but many of them are with high morphological variations. The herbarium surveys in this region show that only 6-9 species are frequently collected from these two regions. The species like *D. wightii*, *D. kalkaprashadii*, *D. wallichii*, *D. puber*, and some varieties of *D. oppositifolia* and *D. pentaphylla* have not been recorded in the recent past. The cultivated diversity of this genus in this region is also equally rich as evidenced by the diverse varieties with unique properties that contribute to both the food and health security of the local mass. A biosystematic investigation of the genus *Dioscorea* distributed in the western and eastern peninsular regions of India using both morphological and molecular characters/markers was initiated during the year.

The study shows that Wayanad alone has about 16 different *Dioscoreas*, of which 13 are edible and serve as vital food for the forest dwelling tribes during famine months. Ethno-botanical information about many species was chronicled with the participation of tribal communities and by accessing already existing reliable data from selected key sites in the region. Rare and endangered species like *Dioscorea kalkaprashadii*, and *D. hamiltonii* were selected for

micro propagation, domestication and reintroduction into their original habitat.

This year the centre completed the work of preparing the checklist of the medicinal plants of this area and it shows that about 650 medicinal plants are known and used in the district by both formal and non-formal systems. A separate study has been undertaken to understand the use pattern and marketing of medicinal plants of the district. This shows that the use of herbs as such (entire plant) is more than that of roots and seeds alone. Currently many of these medicinal plants are available only in interior forests and the local people have to walk long distances into the interior forest to collect these plants. Tribal men and women are employed in the collection of many of these plants for commercial purpose. There is a vast difference between the price paid to the tribals (buying price) and the open market price.

*Saving endangered plant species:* The recovery of species is being continued under a separate scientific survey on Rare, Endemic and Endangered Plants (REE Plants). The main activities under this programme are:

- Identification, collection and study of rare, endangered and endemic angiosperms and wild relatives of crop plants of Wayanad District
- Categorization of these species according to their IUCN threat status
- Preparation and maintenance of herbariums of the REE plants
- *Ex-situ* collection and maintenance of germplasm of REE plants, wild orchids and wild relatives of crop plants

- Multiplication, distribution and re-introduction of REE plants
- Education and training of youth, students and teachers in the subject of Plant Taxonomy and issues related to conservation
- Making links with the Forest Department for action leading to *in-situ* conservation

**Significant Results**

- For *Ex-situ* conservation of many rare and threatened species in the Centre, an Orchidarium and Arboretum have been established with a collection of more than 100 live species of orchids and 78 threatened species that are taxonomically and ecologically of great interest.
- The number of herbarium accessions have increased to >4000 samples in about 1200 taxa which include the REE plants, wild food species, poisonous plant species, etc.
- The analysis shows that about 180 species collected are endemic to the Western Ghats, of which 10 are

restricted to Kerala. Eight species listed out in the Indian Red Data Book were collected and recommended for micro propagation (see Table 2.1).

- The Centre has collected around 350 angiosperm taxa totalling over 1,200 taxa in 1,430 accessions from an area of roughly 100 sq. km, in which 850 plants have been identified at the species level, 270 at the genus level and 98 at the family level.

*Collection of traditional rice varieties:* This year the Centre promoted vegetable cultivation through diversification of horti-crop varieties apart from supporting the farmers in the cultivation of special rice varieties like *Navara*, *Gandhaka sala*, *Jeeraka sala* *Chennellu* etc. The farmers are ready to cultivate paddy and vegetables by adopting eco-friendly methods as they get a higher price and there are instant market for such products. Efforts were taken to get good quality seeds of 8-10 varieties of rice, and 8 species of vegetables and cultivate them in different tribal and rural pockets in the district.

**Table 2.1 : Red Data Book species collected and maintained at Wayanad, Kerala**

Name	Family	Status
1. <i>Cynometra bourdillonii</i> Gamble	Caesalpinaceae	Endangered
2. <i>Milium nilagirica</i> Beddome	Annonaceae	Endangered
3. <i>Aponogeton appendiculatus</i> Van Bruggen	Aponogetonaceae	Indeterminate
4. <i>Bulbophyllum aureum</i> (Hook.f.) J.J Sm.	Orchidaceae	Rare
5. <i>Ipea malabarica</i> (Reichb.f.) Hook.	Orchidaceae	Endangered
6. <i>Syzygium travancoricum</i> Gamble	Myrtaceae	Endangered
7. <i>Capparis rheedii</i> DC.	Capparidaceae	Rare
8. <i>Salacia beddomei</i> Gamble	Celastraceae	Rare

Wide propaganda has been given to the nutritional superiority of the medicinally known rice varieties including *Navara* that are cultivated by adopting purely organic methods.

### *Significant results*

The Centre's collection of rice varieties has increased to 110 and the number of seeds of different varieties of vegetables, roots and tubers has also increased. There are at least 13 medicinal rice varieties in this collection, which are nutritionally superior to any of the rice varieties grown in Kerala. During the year, collections of seven such varieties have been made from different regions of the state (see Table 2.2). These varieties are to be cultivated in large areas involving farmers' fora, agricultural officers, NGOs and farm scientists in their respective areas as well as in some selected sites in the district.

The Centre has trained farmers in preparing and using treated coir-pith compost. There is an increase in the number of traditional rice varieties (from four to thirteen in the district) and traditional farmers (from 6-14 to 40-50). The health of soil, water and associated biodiversity in the agro-ecosystem has been enhanced in many of the experimental sites.

For marketing of rice, the Centre has adopted a 'product differentiation' method by ensuring its quality through organic farming. Women SHGs and Farmers' groups have started marketing *Navara* and other special rice varieties in Kalpetta town.

Many rice varieties of Malabar region were exhibited during the District Horticultural Exhibition held from 25-30 January 2001. A separate stall was used for organically produced and manually processed rice, herbal

products, value added food products, mushrooms, herbal soaps, ornamental plants, bamboo based products etc, produced by women Self Help Groups and promoted by MSSRF. The net sales turnover during this show was more than Rs.12,000. Traditional varieties of rice like, *Veliyan*, *Chomala*, *Adukkal*, *Kalladiyaran* and scented varieties like *Gandhakasala* and medicinal varieties like *Navara* and *Chennellu* were introduced in the market.

A "gene fund" of a modest amount (Rs. 6,500) has been raised with the aim of rewarding farmers who have conserved valuable genes and materials. It is planned to give a cash award worth Rs. 2,000 every year for the best farmer of the district who follows low external-input, sustainable agricultural methods.

*Working with grassroot networks:* CAbC has formed active grassroot level networks in Wayanad among NGO's, Women Self Help Groups and youth clubs for strengthening the efforts in the conservation of biodiversity and sharing each other's knowledge and experience in the social sector.

This year witnessed NGOs like OFCO, Santhi Trust & Vana Moolika Samrakshana Sangam working in close collaboration with the Centre. This networking has helped the Centre in linking community oriented conservation activities with formal systems like *Grama panchayath*, *Kudumbasree* (a project of the Government of Kerala aiming at poverty alleviation among the tribal and rural poor), District Literacy Mission, Forest Department and Agriculture Departments in the preparation and maintenance of Peoples' Biodiversity Registers.



Table 2.2 : *Rare medicinal rice varieties of Kerala*

Name	Duration days	Place of cultivation	Remarks
1. Erumakkari	120-130	Ernakulam-Thrissur	Upland rice, cultivated in coconut gardens
2. Jaatthi Suggi*	120	Kasaragode-Karnataka border	II season crop, highly preferred variety for consumption as well as medicinal purposes
3. Jeeraka Chembavu	120	Thiruvananthapuram	Very small and slender grains; white kernel; highly preferred for consumption
4. Chetti virippu*	150	Alappuzha	I season crop (virippu) cultivated only for medicinal requirements
5. Karutha Chembavu	120	Thiruvananthapuram	Entire grain is black in colour, including husk, bran and kernel; used in place of Navara
6. Valiya Chitteni*	180	Thrissur	Considered as the king of paddy
7. Kolaran	85-90	Kasaragode	Dark purple grains; used in place of Navara if it is not available
8. Kunji Nellu*	120	Kannur	Upland rice; scented, highly preferred for consumption, especially during sickness
9. Chennellu*	180	Kannur	Considered royal; only variety used for making <i>Nirapara</i> during rituals; kernel red; said to be medicinal; consumed for curing piles with blood discharge
10. Naron	60	Kannur	Upland rice, used in place of Navara
11. Navara* (purple & golden)	60-90	In the plains and midlands of Kerala	All-season crop; upland, medium and lowland; widely known as medicinal; employed in Ayurveda
12. Vadakkan	85-90	Kannur	Upland rice; grains purple
13. Vattan* (purple & golden)	90	Thrissur, Palghat and Malappuram	Similar to Navara but grains are slightly bolder; used in place of Navara; short cooking time.

\*Varieties collected during the year

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### Significant results

- Involving largely women (> 500) and a few men (15) 21 Self Help Groups were formed in Meppady panchayat. Now there are 34 SHGs with more than 80% of the women falling below poverty line. They were given skill improvement training in a wide range of activities (see Table 2.3).

They have been mobilizing the required capital expenditure through thrift and credit accounting and linking with formal financial institutions.

- An eco-club named *Prakrithi* has been formed in Meppady panchayat with 60 student members. It has been created to organize the student and youth community to protect *Manikkunnumala*, a hilly terrain nearby. Students and youth are brought under the purview of knowledge empowerment by way of classes, discussions, painting competitions, quiz competitions, training and field trips focusing on biodiversity and traditional knowledge.

- NABARD, Krishi Vigyan Kendra, Kerala Agricultural University, Kerala Khadi and Village Industry Commission and Rural Development and Self-Employment Training Institute (RUDSETI) are in direct link with MSSRF in providing technical support to tribal and rural women.

- A local training center for sustainable production of bamboo baskets has been started in collaboration with *Pulari*, an SHG formed by MSSRF.

The Centre has developed an integrated approach in conservation by linking *in-situ* conservation, *in-situ* on-farm conservation, and *ex-situ* preservations. Towards the *in-situ* conservation developments, the Centre undertakes programmes on surveying and inventorying endangered plants (saving endangered plant species programme), medicinal plants and life saving crops like *Dioscorea*. The *in-situ* on farm conservation is supported by participating with farmers in their on-farm management and improvement of traditional cultivars of rice.

Table 2.3 : *Details of SHGs and their activities at Meppady Panchayat, Wayanad, Kerala*

Microenterprises	No. of SHGs involved	No. of women involved
Herbal Soap Making*	3	12
Value added food processing*	5	23
Bamboo basket making	1	10
Mushroom cultivation units	4	28
Herbal medicine preparation	4	19
Vegetable cultivation *	4	24
Rice processing and marketing	1	12
Nursery raising	1	14

\*both for market and self use

### 201.1.3 Jeypore Tract

#### Community medicinal plant gardens

The initiative taken last year resulted in the successful establishment of five Community Medicinal Plant Gardens (CMPG) in Baliguda, Mohuli, Patraput, Pujariput (K) and Tolla. The special feature of the CMPG is the active involvement of village practitioners and healers. Table 2.4 gives the number of medicinal plants raised in each garden and the number of Traditional Health Practitioners (THP) / Traditional Birth Attendants (TBA) associated with each.

#### Significant results

- At least 5 plants in each CMPG are very rare genotypes or difficult to find in dense forests and difficult to grow but have significant medicinal value.
- Every week at least 6 persons are being treated. Awareness of the value of forest resources and their management for the future has strengthened the Joint Forest Management (JFM) programme.
- The drudgery of collection is minimised as the medicinal plants are now grown

by some women in their backyards. Thus they have access to hidden health information through this programme.

*Community seed banks:* The following traditional varieties are stored in community seed banks by women farmers to support and revitalise traditional crops and practices.

In Tolla village, 29 villagers (13 men and 16 women) stored seeds of 9 local landraces of rice (14 kg), 2 millet varieties, 1 variety of sorghum, 4 varieties of oilseeds, 8 vegetables, 4 varieties of spices and one of amaranthus in their seed bank.

In Pujariput village, 30 villagers (12 men and 18 women) joined together to store 4 local landraces and 8 high yielding varieties in the seed bank. The quantity stored was 61 kg, 20 kg of which was collected as interest from last years operation of CSB in the village. 3 farm families were benefited.

In Mohuli village, 70 villagers, of whom 10 are women, organised a CSB to store 293 kg of seeds of 13 local landraces, 5 high-yielding varieties and 2 varieties of millet. 163 kg of rice was obtained as interest from the last 2 year's operation of CSB. 23 farm families benefited.

Table 2.4 : *Community medicinal plant garden in Jeypore Tract*

Name of village	No. of medicinal plants raised	No. of THP / TBA		No. of plants contributed by MSSRF	Area in sq.m
Baliguda	38	2	2	10	391
Mohuli	67	10	3	15	286
Patraput	59	4	2	8	1,500
Pujariput (K)	28	3	1	14	725
Tolla	71	8	2	8	855

THP - Traditional Health Practitioners; TBA - Traditional Birth Attendants

In Barangput village, 24 villagers, 22 of whom are women, organised the storage of 54 kg of seeds of 3 high yielding varieties of rice and one landrace. 16 kg was obtained as interest from last year's CSB operation. 7 farm families benefited.

In Patraput village, 42 villagers (equal number of men and women) organised a CSB wherein 180 kg of seeds of 11 local landraces and 3 high yielding varieties of rice were stored. They also stored seeds of blackgram, country beans, pigeon pea and cow pea. 60 kg of rice was collected as interest from last year's operation of CSB. 13 farm families benefited. In all 261 kg of rice was collected as interest by the 5 CSBs and 46 families benefited.

The direct outcome of this is the emergence of a "seed help group" which has evolved from Self Help Groups. These groups have rendered voluntary help to the poor in two villages.

*Networking and capacity building:* The Jeypore team ran a joint programme with the Forest Department on the conservation of forest resources and traditional knowledge systems. MSSRF resource persons conducted interactive training sessions for local forest officials. This was followed by an exposure trip to Ramgiri Forest.

Celebration of Environment day and Bana Saptah celebrations by involving the youth and school children with participation of networking NGOs, exhibitions and meetings in villages are some of the highlights of the year. A seminar on biodiversity conservation and development was organised in KBK region followed by training on the application of science and technology in agriculture and the concept of community seed banks.

### **201.1.4 Participatory Management of Simlipal Biosphere Reserve**

The Simlipal Biosphere Reserve (SBR) is located in Mayurbhanj district of North Orissa and stands as a link between the flora and fauna of South India and sub-Himalayan North-east India. It is one of the tiger reserves in the country and notified as Simlipal Wildlife Sanctuary since 1979. The Government of India constituted SBR on 21 June, 1994 to conserve biodiversity and improve the socio-economic conditions of the people living in and around the reserve.

The study, supported by the Summit Foundation, USA, aims to integrate the Biosphere management system in an eco-regional context of human development through the formation of Simlipal Biosphere trust with multi-stakeholder involvement in its management and in its conservation for the benefit of present and future generations.

Towards achieving the goal, a SWOT analysis was carried out to assess its strengths, weaknesses, opportunities and threats, based on literature survey, secondary data, field study and interaction with local communities and institutions in the area. The profile and the seasonal activities of the people of the three villages where the work is under way viz., Baniabasa, Nawana and Kukurbhuka, were documented through a PRA.

The PRA has shown the need for awareness and educational programmes to impart conservation values to the local people. It has also revealed that before independence, people in the selected villages were engaged in many non-wood forest products-based business like Tassar cultivation, lac industry,

ropes made of sabai grass and leaf plates made out of Sal (*Shorea robusta*), some of which still continue. The scope for other activities like honey collection, bee keeping, mahua fruit collection, orchid cultivation, mushroom growing etc. exists. It was felt that micro-enterprises with the help of micro-credit facilities, will help to improve the livelihood status of the people in this area. This would improve the basic infrastructure of the villages. The development of well-planned community-driven eco-tourism was found to be another option to improve local livelihoods and reduce the pressure on natural resources. It was also felt that the stakeholders and local NGOs need to be motivated and strengthened through training and seminars/workshops on conservation of natural resources and sustainable resource management. Activities are being planned and introduced on the Biovillage model of sustainable human development.

## **201.2 Participatory Plant Breeding: Path to Secure Livelihood**

### **201.2.1 Jeypore**

The main activity for the year was to arrange large plot demonstrations in the farmers' fields to ground the benefits of formal technology realised in small experimental plots. The programme plan was discussed in a PRA in May and a mid-course appraisal done in August. The results of the evaluation of the 22 landraces in Kharif 1999 on a set of nine yield-influencing traits were presented in the PRA and the merits of the top two varieties in upland, medium land and lowland were debated. Participating farmers have already evaluated the performance of the varieties in

Kharif 1999 and have drawn their selection. It was interesting to observe that the varieties, Paradhan for upland, Sapuri and Limbachudi for medium land and Barapanka and Kalajeera for lowland, selected by statistical evaluation, were those selected by the farmers as well. However, there were differences of perception in ranking between the two selected for medium and lowland. It was decided therefore to leave it to the farmers' choice to opt for one or both of the varieties selected. No scope existed to insist on a fixed plot for the demonstration as the size of the farmers' holdings and their priorities varied widely. It was, however, agreed that each farmer would allot as big a plot size as possible for the demonstration and follow strictly the formal method of cultivation. Though 40 farmers came forward initially, as the season progressed only 23 continued the demonstrations. Three plots failed before reaching crop maturity. Thus only 20 demonstrations could be sustained to provide data. In each demonstration plot, three random samples of 1m<sup>2</sup> were earmarked much before maturity for the scientists to collect grain and straw yield for a finer analysis. Farmers harvested their plots at physiological maturity and provided the data on grain and straw yields from their plots.

The plot sizes varied widely (Table 2.5). A minimum of 519m<sup>2</sup> and a maximum of 3036m<sup>2</sup> was seen from the 20 demonstrations. The inferences drawn would therefore be subject to initial plot size variation. Estimates of per hectare yield would be higher on small plots than on large plots. Likewise there was a wide variation in the management of the crop by the farmers. Despite a formal package of practices extended, the time of sowing, amount of rainfall at crucial stages

Table 2.5 : *Maturity profile and yield traits of identified rice landraces in farmers' demonstration in Jeypore, Kharif 2000*

Land Type	Landrace	Method	N	Maturity Profile			Yield Traits				Plot Size (m <sup>2</sup> )
				D1	D2	D3	D	G	S	HI	
Upland	Paradhan	FO	1	-	62	36	98	277	472	37	1,608
		FA	2	-	45-62	32-36	81-96	36-167	63-234	36-42	810-1,401
Medium land	Sapuri	FO	6	22-49	55-71	37-48	131-150	47-961	169-1,325	22-42	720-3,036
		FA	1	28	66	50	144	542	632	46	1,231
	Limbachudi	FO	4	26-57	52-70	27-47	129-139	116-590	194-667	37-47	519-1,389
Lowland	Kalajeera	FO	1	34	88	31	153	489	536	48	1,178
		FA	2	49-50	56-66	35-51	150-157	325-404	354-462	47-48	570-879
	Barapanka	FO	3	37-50	63-71	21-56	142-159	342-1,384	389-1,540	42-49	990-2,400

FO: Formal technology; FA: Farmer's method; N: No. of farmers; D1: No. of days from nursery to transplantation; D2: No. of days from transplantation to flowering; D3: No. of days from flowering to maturity; D: No. of days to mature; G: Grain yield (kg/ha); S: Straw yield (kg/ha); HI: Harvest index (%).

of crop growth and monitoring of the crop by timely weeding, thinning, plant protection etc. have led to variable yields. This was also amply reflected in the high variation of grain and straw yields realised from the same variety by different farmers. Due to various reasons, farmers decided their own date for transplantation of nursery seedlings. Across the three land types, 22 to 57 days-old seedlings were transplanted (Col. D1 in Table 2.5). There was a consequent high variation in the time of flowering (Col. D2 in Table 2.5) and the available reproductive period (Col. D3 in Table 2.5).

An analysis of variance of the traits, grain yield, straw yield and harvest index (HI) based on data on 1m<sup>2</sup> samples showed that a major portion of variance was due to differences among upland, medium land and lowland crop growth. It was quite clear that the formal method of cultivation gave a maximum advantage of 50% over farmer method in lowland, 80 to 110% in medium land and about 6.7 times in upland plots. Farmer to farmer variation was substantial, as would be expected in such a participatory demonstration. Overall, the straw yields of the landraces have been equally high. The landraces also showed high harvest indices. Of the 20 plots, 20-30 percent HI was recorded by only 2, 31-40 HI by 5 and 41 and above by as many as 13 plots (individual data not shown). It was interesting to observe the highest yield of 1,384 kg/ha grain and 1,540 kg/ha straw yield in the plot of a progressive farmer who raised a 2,400m<sup>2</sup>-demonstration and obtained a HI of 47%.

It would then be interesting to discover how the grain yield variation is influenced by the components, D1, D2, D3 (cf: Table 2.5), the

area sown under each demonstration (DA) and harvest index. A stepwise regression run on the data on medium and lowland demonstrations (data on upland were few and erratic) clearly demonstrated that DA was the most important, accounting for 65% and harvest index accounting for an additional 7% of total variation. While the regression coefficient of DA on grain yield was 0.37 and highly significant, that of harvest index was not. The highly significant positive correlation ( $r = 0.805^*$ ) of area sown in demonstration with grain yield provided further confirmatory evidence of the earlier observations. The observed yields were corrected for the effects of the two selected variables and expected yields computed using the regression equation. A re-ranking of expected yields showed that the top 8 ranks out of the 17 demonstrations (medium land = 11, lowland = 6) were distributed as medium land – formal method = 5, medium land – farmer method = 1 (total medium land demonstrations accounting for  $\frac{6}{11} \approx 55\%$ ), and lowland – formal method = 2 ( $= \frac{2}{6} \approx 33\%$ ). The landraces involved in the upper half (ranked) of the 17 demonstrations were Sapuri (4 cases), Limbachudi (2 cases) and Barapanka (2 cases). This result is in-conformity with the farmers' perception of Sapuri as the most favoured landrace. Obviously out of the top 8 ranks, 7 were of formal and 1 was of farmer method of cultivation.

The analysis of data on demonstrations of Kharif 2000 have thus brought to light the following salient conclusions:

- The formal method has demonstrated a consistent advantage over the traditional method.

- Despite inferences constrained by varying plot sizes and dates of transplanting, the landraces taken for demonstration performed well; with a little more experience, the farmers would be able to obtain higher dividends.
- There was a vast gap between realisable and realised yields of landraces and a majority of the farmers were yet to tune themselves to effective implementation of the formal technology. This would become obvious if we take note of the difference in the realised grain yields of landraces under formal technology itself: for instance, 342 and 1,384 kg/ha of Barapanka in lowland, 116 and 590 kg/ha of Limbachudi in medium land. Such differences were very large in upland areas.
- The maturity period of landraces tested under medium and lowland conditions was quite similar and ranged from 140-150 days. Traditionally varieties have been assigned to various land types by farmers as a matter of course. Since the maturity profiles of landraces under medium and low land were not markedly different, there is scope to test the adaptability of medium land varieties in lowlands and vice-versa. This would require a planned evaluation programme.
- The time of transplanting (= days from nursery to transplanting, D1) has a direct influence on grain yield. This would suggest that an optimal date for nursery planting and one for transplanting of seedlings at the right stage are crucial in realising a higher yield potential. It would be worth discussing the implica-

tions of these results with the farmers to arrive at an optimal date of nursery and transplanting and extend them in the formal method of cultivation.

The results imply that formal methods of cultivation on a farmer-to-farmer extension deserve priority to consolidate the gains made in introducing scientific methods of cultivation. Further, data gathered on more than 30 landraces so far provides the essentials to make an appropriate choice of parents for hybridisation. A programme of pure line breeding with a major role by the tribal farmers is feasible to be set in action during Kharif 2001.

### **201.2.2 Kolli Hills**

This year, 20 farmers (14 men and 6 women) from 2 panchayats (Alathur Nadu and Vazhavanthi Nadu) with different climatic conditions, came forward for participatory plant breeding. The planning was done by the farmers and the staff in a participatory way. This time, the farmers have chosen the following landraces, Kattavetti Samai, Vellaperun Samai and Vella Samai. The plot size is bigger than last year (about 0.5 acre). Both the formal and farmers practices of cultivation of little millets were adopted for this exercise in August and September (late Kharif season). The delay was due to delayed rainfall.

Formal and farmer practices were discussed. In the formal practice it was agreed to multiply seeds from saved seeds in multiplication plots, maintain 25 cm spacing between rows and 10 cm between plants, weed twice and apply organic fertilizer (FYM). In the farmer practice, saved seed multiplied in plots would be broadcast. Weeding, thinning and cross



ploughing would be done. The participants will use the quality seeds harvested from their plots in the coming season.

### 201.3 Integrated Gene Management

This is a comprehensive *in-situ*, *in-situ* on-farm, *ex-situ* conservation approach involving farm families and integrating various strategies such as the establishment of community gene bank (*ex-situ* conservation, medium-term storage), community seed bank and community medicinal plant garden (*ex-situ* conservation at the village level), and participatory community conservation of traditional crop varieties in the field (*in-situ* and *in-situ* on-farm conservation).

#### 201.3.1 Chennai

Community Gene Bank Activities were given considerable importance.

##### **Germplasm Collection**

- Important traditional paddy cultivars have been added during the year from different parts of Kerala through the community agrobiodiversity centre, Wayanad. They include *Njavara* and *Vattan* for medicinal purpose, *Chettivirppu* and *Chovvayan* for salt tolerance, *Jeerakasala* and *Gulvadisamai* for flavour, *Thekkanthovvan* and *Vellathovvan* for drought tolerance and *Kuttadon* for flood resistance.
- Traditional cultivars of paddy such as *ambasamudhiram*, *bangalorekar*, *gundu*, *jeerakasamba*, *karuppu*, *kullankar*, *neikitchidi*, *pulithikar*, *thuyamalli*, *vadansamba* and *vellaponni* were

collected from Chengam taluk, Thiruvannamalai district.

- Traditional cultivars such as *arsicumbu*, *kalarangattainellu*, *kallirmutayamnellu*, *kulimathichannellu*, *mochai*, *nattucumbu*, *nattuvellaicholam*, *poongarunellu*, *pulithikarnellu*, *samai*, *sigappuirumbucholam*, *thinai*, *thitakalnellu*, *varagu* and a few varieties of *kadugu* and *thuvurai* from southern Tamil Nadu were obtained from an NGO called Covenant Centre for Development located at Madurai.
- Wild germplasm such as *Abutilon*, *Diospyrus*, *Elaeocarpus*, *Garcinia*, *Gmelina*, *Grewia*, *Lawsonia*, *Mangifera*, *Phoenix*, *Spondias*, *Syzigium*, and *Terminalia* have been collected from Wayanad. The duplicates of these collections have been deposited with the National Gene Bank at the National Bureau of Plant Genetic Resources (NBPGR), New Delhi.

##### **Distribution**

- At the time of multiplication trials at Jeypore, 18 paddy gene bank accessions, such as *Bandikuiidhan*, *Baramashi*, *Barkoli*, *Basumathi*, *Bodamangi*, *Dadhmani*, *Dahanaprasada*, *Dhobkoji*, *Gothia*, *Haldichudi*, *Kalamohana*, *Kandulakathi*, *Kerandi*, *Kudeiphula*, *Mahulakunchi*, *Makaradhan*, *Sapurichudi* and *Singhpuri*, were distributed to the tribal communities at Gundaguda, Pujariput (J). Currently these materials are not available in the field, but they had been collected earlier and preserved in the community gene bank at the Foundation.

The three defective dehumidifiers have been replaced. This has resulted in very satisfactory maintenance of temperature and humidity in the gene bank. A separate format has been developed to issue receipts at the time of collection and circulated to the site offices. One copy of the receipt would be given to the farmers as a proof of their invaluable germplasm contribution stored at the Community Gene Bank. Systematic documentation is being done regularly. The data is being fed into the computer using software developed by the International Plant Genetic Resources Institute (IPGRI), known as Genebank Management System (GMS). Besides hard copy, manual register and photographs of gene bank accessions are also being maintained in a separate album.

### **Community Herbarium**

As of now, the community herbarium at Chennai holds 277 numbers. Classified voucher specimens include 84 families, 219 genus, 320 species, 55 duplicate specimens and 40 drawings of the voucher specimens. There are about 400 specimens yet to be classified. This herbarium collection of rare, endangered, medicinal and traditional cultivars serves the purposes of reference material and checklist.

Herbaria of *Baccaurea courtallensis*, *Cassia angustifolia*, *Diospyros melanoxylon*, *Elaeocarpus oblongus*, *Elaeocarpus tuberculatus*, *Enicostema axillare*, *Grewia disperma*, *Grewia gamblei*, *Grewia tiliifolia*, *Grewia umbellifera*, *Lawsonia inermis*, *Mallotus philippinensis*, *Syzygium caryophyllaeum*, *Syzygium cumini*, *Syzygium gardneri*, *Syzygium hemisphericum*, *Syzygium laetum*, *Syzygium stocksii*,

*Syzygium tamilnadensis*, and *Wrightia tinctoria* were prepared from the plants collected in the wild. Duplicate sets of these have been deposited with the National Herbarium at the National Bureau of Plant Genetic Resources.

### **On-farm conservation**

As part of the biodiversity conservation programme, through the National Agricultural Technology Project it was decided to focus on on-farm conservation of traditional crop varieties in select and strategic places in both Tamil Nadu and Wayanad with the participation of the local communities.

The overall objective of on-farm conservation is to conserve local crop diversity at the farm level, promote and enhance on-farm conservation, promote a participatory approach in the establishment of a village seed bank at the village, enhance and validate the role of both women and men in conservation and management of local germplasm, and link village level seed banks with the community gene bank at MSSRF.

Conservation of medicinal plants at Pichavaram, Cuddalore district (coastal area), traditional crops at Galigattum, Dharmapuri district (remote of hilly area), and traditional paddy at Chengam, Thiruvannamalai district (Plains – rural area) have been planned in Tamil Nadu. In Wayanad, colonies such as Pallookappil, Nedungode and Panyia, which will focus on horticultural crops have also been planned. Baseline survey and documentation are under way.

### **Grassroot level awareness programme**

Based on the preliminary steps and initiatives taken in Galigattum and Chengam, it was

decided to raise awareness and sensitise the people through a seed fair and a workshop.

**Seed Fair:** In this connection, a one-day seed fair was organised in Galigattum, a remote hilly forest area. 23 varieties of traditional crops, which have been under continued cultivation generation after generation, were displayed.

**Workshop:** A one-day workshop on conservation and management of traditional cultivars was organised at Chengam. There was participation of both women and men farmers, from Chengam as well as from nearby villagers. The Save the Eastern Ghats Organisation at Chengam, an NGO, took a lead role in organising this workshop. Many of them still cultivate traditional varieties in this remote village and also get reasonable income at the market. Villagers also pointed out that some of the traditional varieties were lost due to shift in agriculture, introduction of modern agricultural practices, transfer of technology and so on. Traditional crop varieties, cultivation practices, cropping pattern, reasons for cultivating and traditional knowledge that is passed on to younger generation were described by a farmer cultivating traditional crops. He has passed on his traditional knowledge about a 60-year cycle, seasons, and weather to his 5 year-old grand-daughter.

### ***Community gene, seed, grain and water systems in management (Simlipal)***

A Community Gene Management System has been initiated in the three biodiversity rich districts, of Koraput, Kalahandi and Kandhamal of Orissa, to conserve genetic diversity and to alleviate poverty. This is

being carried out through revitalization of *in situ* on farm conservation traditions of the farmers, to assess the adaptation yield, potential and agronomic attributes of the available local land races, keeping in view the needs of the tribal communities and desired genetic base and to develop a mechanism for linking conservation and commercialization in a mutually reinforcing manner. PRA were conducted at Kasiguda (Koraput), Gunduri (Kalahandi) and Lavanyanagar (Kandhamal) to obtain information on the agricultural status of the area. Traditional agricultural practices including seed sources, storage systems of seeds and grains and local landraces of the area were also documented. A joint micro-plan was prepared to address the seed, food grain and water scarcity mentioned in the PRA exercise. A training and implementation phase followed the micro-plan formulation. A Community Seed Bank and Grain Bank have been set up in all the three villages. A participatory system has been devised to conserve 28 ragi, 31 rice and 2 pigeon pea landraces. Based on the information obtained from PRA, two acres of land has been taken on lease for the purpose of establishing a field gene bank and demonstration plots. A community water security programme has also been initiated to meet the needs of the people in these villages.

### **201.4 B R Barwale Chair in Biodiversity**

The B R Barwale Chair in Biodiversity provides technical assistance to the biodiversity components of the various projects, with particular emphasis on agrobiodiversity.

**201.4.1 Agrobiodiversity Conservation Activities**

The Agrobiodiversity Conservation Corps (ACC), comprising 212 volunteers who received training in conservation practices, carried out various activities, which are summarised in Table 2.6.

**Dharmapuri**

The IV Batch of 16 ACC volunteers was recruited in May 2000. They have collected baseline data on eight villages - Karikattanoor, Erimalai, Seengadu, Mel-Seengadu, Keel-Seengadu, Samankottai, Mel-Samankottai and Belluhalli and approached the Conservator of

Table 2.6 : *Summary of activities carried out between 1996 and 2001*

Activities	Details
<i>Research</i>	Expanding the knowledge base through <ul style="list-style-type: none"> <li>• Participatory Rural Appraisal (PRA)</li> <li>• Resource mapping</li> <li>• Preparation of charts and posters</li> <li>• Herbarium preparation</li> <li>• Collection of seeds</li> <li>• Inventorying and Monitoring</li> </ul>
<i>Training and capacity building</i>	Ongoing training programmes: <ul style="list-style-type: none"> <li>• Preparation of training materials, lessons and notes relating to the ACC programme</li> <li>• Exposure visits and workshops to enhance existing skills and knowledge</li> <li>• Specific training and capacity building sessions to initiate the formulation of ACC</li> <li>• Integration of the existing group with new volunteers through structured programmes</li> </ul>
<i>Institutional building</i>	<ul style="list-style-type: none"> <li>• Supporting the formation or existence of ACC corpus fund</li> <li>• Providing means/implements for preparing herbarium sheets, seed collection etc.</li> <li>• Strengthening local facilities for conducting training programmes</li> <li>• Building up Clubs, Societies, Village groups and Institutions</li> </ul>
<i>Conservation and information empowerment</i>	<ul style="list-style-type: none"> <li>• Meetings</li> <li>• Folk plays and songs</li> <li>• Display of signboards and banners</li> <li>• Nurseries</li> </ul>

Forests and the District Collector of Dharmapuri for providing a piece of common land, located in their village, to start a nursery to grow medicinal plants.

In August 2000, ten ACC volunteers were taken on a tour to Kolli Hills to participate in the *Adi* festival at Arapaleeshwarar temple. A poster exhibition in collaboration with the World Wide Fund for Nature – India (WWF-India) on conservation and diversity of crops in Kolli Hills, genetic diversity, checklist of flora and fauna, and changes in agricultural trend over the last 20 years etc. was organised at the stall. The stall attracted 2000 local visitors.

### **Kolli Hills**

In September 2000, 20 students of IX and XI classes of the Government High School (Vazhavanthi Nadu) belonging to the M S Swaminathan Nature Club were inducted and recruited as volunteers for the IV Batch of the ACC. A two-day training and orientation programme was conducted. The ACC volunteers decided to meet on the third Saturday of every month to discuss the activities in their respective villages. Volunteers have collected basic information on biodiversity by preparing a checklist of medicinal plants and their uses, faunal distribution, traditional seed and information regarding indigenous knowledge of their respective villages. Some of these materials have been deposited in the school library for future reference.

### **Kalpetta, Wayanad**

The IV batch of ACC volunteers was recruited and trained in various aspects of biological diversity and access to genetic diversity.

Thirikkaipatta village of Meppadi Panchayat has been identified by the local volunteers as a local heritage site for the conservation of agrobiodiversity. Four ACC volunteers have taken a keen interest in locating and restoring a degraded sacred grove covering an area of half an acre, which includes a small pond with fishes, turtles and plants and shrubs around it. A tree-planting programme was held in September and saplings belonging to locally endangered species *Symplocos*, *Alstonia*, *Syzigium* and *Ficus* sp. were planted at the site.

ACC volunteers have been trained in forming women's groups in their respective localities. So far 20 women SHGs have been formed by the team. Periodic Participatory Rural Appraisal (PRA) is being conducted by the volunteers to build rapport with villagers. Some of the ACC members have started to cultivate traditional vegetable crops with the help of Self Help Groups (SHGs).

### **Jagatjori**

After induction members of the fourth batch of ACC volunteers were given training on basic ecological principles such as food chain, biogeochemical cycles, classification of animal kingdom, evolution of life, keystone species and their role in nature, importance of lichens and their characteristics, role of insects and amphibians as bioindicators etc. The importance of mangroves was also stressed.

In September 2000, the volunteers helped the forest department authorities by raising a nursery and plantation and also took up watch and ward functions to prevent grazing and destruction of mangrove forest.

They played an active role by making door-to-door visits to spread the concept and importance of agrobiodiversity and its sustainable use. So far 15 villages, two high schools and seven primary schools have been covered in the process.

In February 2001, they were taken on a study tour to Hokitola Island. The volunteers explored the distribution of flora and fauna and listed the mangrove species of the island.

#### **201.4.2 Forum for Sustainable Management of Biodiversity**

##### **People's Biodiversity Register (PBR) - Kollī Hills**

This year the core group members consolidated the 16 registers of biodiversity

details of the Valappur Nadu into a single register. It contains more than 150 different plant species and birds, insects, and animals.

The core group members recommended keeping the consolidated PBR in a rented room in Periyakoilur village. So far, 60 men and 40 women have seen the register.

##### **People's Biodiversity Register - Wayanad**

The PBR exercise continued during the year and included meetings (180 man-days), Interviews (305 individuals), PRAs (6 days), Awareness campaigns (14 days), collection trips with the communities (40 days) and focus group discussion (10 man-days). An analysis of the strategy adopted in the preparation and maintenance of PBR (see Box I) is given below.

#### **Box-I : Establishment of Biodiversity Management Committee and identification of Knowledgeable Individuals**

- Step 1. Sensitization for the study, survey and management through Grama Sabhas
- Step 2. Formation of biodiversity conservation corps
- Step 3. Training in identification and collection of data on biological resources and traditional knowledge
- Step 4. Collection of data
- Step 5. Analysis and validation of data
- Step 6. Identification of heritage sites
- Step 7. Preparation of the PBR
- Step 8. Procedures to reward knowledge holders and farmer conservers
- Step 9. Maintenance of PBR
- Step 10. Computerization of the information on resources
- Step 11. Development of action plans based on the information available in PBR
- Step 12. Implementation of a short- term action plan.

This exercise has helped to reduce the apprehension among the people, train them in plant taxonomy and give them a leading role in village activities. They have become interested in the biological diversity.

There are about 870 species used by the communities of this area. (See Box II)

A well-prepared biodiversity register will give a clear picture of the various agrobiodiversity components of an area. It can be of use in promoting sustainable management of nature resources and support genetic resources claims of communities and individuals.

<b>Box-II : <i>Biological resources data and individual contribution to PBR in Meppady</i></b>	
<b>Attribute</b>	<b>Total Number</b>
Individuals contributed to PBR on Biodiversity (Traditional healers and Knowledge holders)	20 (8 Women and 12 men)
Number of Medicinal Plants with well-documented Use	160
Number of Different Ecosystem types	10
Tree species	123
Fruit Trees	39
Total Number of Medicinal Plants	191
Aromatic Plants	6
Commercial Crops	10 species with 45 varieties
Oil Seed Crops	10
Fruit Crops	42
Wild Food Plants	12
Minor Forest Produces (MFP)	11
Tuber Crops	15
Traditional rice varieties	5
Banana varieties	15
Birds	102
Snakes	27
Fish	30
Animals	42
<b>Total number of species</b>	<b>870</b>

## Sub Programme Area 202

### Molecular Mapping and Genetic Enhancement

The molecular mapping and genetic enhancement programme has been making concerted efforts over the last few years in addressing some of the pressing problems of coastal ecosystems viz. depleting natural resources and decreasing agricultural productivity, through modern biotechnological interventions. The work being undertaken under this programme has wideranging practical implications in identifying and consolidating genotypes capable of adapting to the anticipatory problems that may arise due to the rise in sea level and also developing practical breeding materials that could offer resistance/ tolerance to abiotic stress and in particular, coastal salinity. The major objectives of this programme are to analyse genetic diversity and species relationship among the Indian mangrove species and isolate and characterise stress tolerant genes, to develop salt tolerant crop varieties for coastal agriecosystem.

#### 202.1 Molecular Marker Assisted Genetic Indexing of Coastal Agrobiodiversity

Studies initiated, for the first time world-wide, by the group have provided sufficient insight into the genetic characterization, species identification and the pattern of genetic variation in 28 mangrove species occurring in India, species relationship and underlying evolutionary differentiation in 22 mangrove gen-

era using various marker systems. They have also helped in identifying priority areas and species for conservation and consolidation of mangrove genotypes.

Comprehensive investigations were carried out to understand the extent and nature of genetic variation at the inter-generic and inter- and intra-specific levels in ten species belonging to the mangrove family Rhizophoraceae. Genetic diversity studies were undertaken using both protein (total leaf protein and isozymes) and DNA based markers (RAPD, RFLP) so as to arrive at an understanding of the phylogenetic and evolutionary trends among these tree species. All the ten species of Rhizophoraceae were characterised with 36 chromosomes in their somatic cells. The karyotype of Rhizophoraceae was primarily median/submedian in nature, implying that they are stable and might have undergone limited divergence during the course of evolution. The wide range of chromosome numbers encountered in all the mangrove species studied suggests an independent origin of these species both in space and time. It appears that mangrove species might have had independent origins, although they share common habitat preferences.

The ongoing programme intends to assess the diversity on a continuous basis, taking into account more species and population. During the period of report, AFLP analysis was carried out in 33 mangrove species collected from 10 mangrove populations along the Indian coast using 12 primer combinations. These combinations yielded a total number of 896 loci across the species. Further analyses are under way to develop population specific as well as species-specific markers for mangrove species.



## 202.2 Diversity and Species Relationship among Nutritious Millets

Nutritious millets (minor millets) include seven important species; *Eleusine coracana* (L.) Gaerth. (finger millet), *Paspalum scrobiculatum* L. (kodo millet), *Panicum sumatrense* Roth. ex Roem. & Schult (little millet), *Panicum miliaceum* L. (proso millet), *Setaria italica* (L.) Beauv (foxtail millet), *Echinochloa colona* L. (sawa millet), and *Echinochloa crus-galli* L. (barnyard/ Japanese millet). Traditionally cultivated in most parts of India and Africa, they form an indispensable component of dryland farming systems. The most striking feature of millets is that they have managed to survive under harsh agro-climatic conditions under which other crops fail to thrive. For the tribal and other resource poor people living in hilly and remote tracts, where modern agriculture has not yet penetrated to any appreciable extent, these crops have served as vital life support species under extreme environmental situations, contributing immensely to the food and nutrition security both as staple food and feed crop. Little attention has been paid to conserving and retaining the traditional cropping and dietary practices of small millets with *E. coracana* being the sole exception. As a result, the number of millet species/subspecies and landraces is fast declining and their true value is not appreciated. The diverse regions in which these millets are grown and the different cultivation practices followed in various regions have given rise to a number of landraces, the identification of which is often confusing. Till date there have been no efforts made to identify these landraces in a comprehensive manner. The criteria for identification of these species/

subspecies/ varieties/ races are based solely on morphological parameters that are highly variable, given the diverse agroecological zones in which these millets are cultivated. In the present study we have analysed seven nutritive millet species represented by 106 accessions for random amplified polymorphic DNA (RAPD), restriction fragment length polymorphism (RFLP) and amplified restriction fragment length polymorphisms (AFLP) to infer their suitability as markers for fingerprinting, species relationship and estimation of genetic diversity. This is the most comprehensive analysis undertaken so far to account for species diversity and relationships in this group.

The landraces of millets analysed with 30 random primers produced 115 amplification fragments of which 70, (61%) were polymorphic across the genera. At the inter-specific level it was observed that the 2 species of *Panicum*, *P. miliaceum* and *P. sumatrense* showed 20.6% polymorphism with 20 polymorphic amplification products of the total 97 recorded in these species. The number of amplification products in these species ranged from 3 (OPA 09) to 14 (OPA 14). Species-specific profiles were observed for these two species with the primers OPA 02, OPD 02, OPD 20 and OPD 04. Two species of *Echinochloa*, viz., *E. colona* and *E. crus-galli* showed 22 polymorphic fragments of the 93 recorded, i.e 23.65% polymorphism. Species-specific profiles were observed with primers OPA 02 and OPD 04. At the intra-specific level, lowest level of polymorphism, 2.5% was observed in *P. sumatrense* and the highest 14.08% in *E. coracana*.

A total number of 87 restriction fragments were recorded in all the 24 landraces analysed using five enzyme and five probe combinations, of which 62 (71.2%) were polymorphic across the genera. At the intra-generic level *Panicum miliaceum* and *P. sumatrense* showed 49.2% polymorphism, while *Echinochloa colona* and *E. crus-galli* showed 34.37% polymorphic loci. The percentage of polymorphism at the intra-specific level ranged from 5.26% in *P. miliaceum* to 19.04% *E. coracana*, with no detectable polymorphism in *S. italica*. *BamH I* in combination with the probe *trnL-UAA* produced genus-specific profiles. However, this combination also showed distinctions between the three landraces of *Paspalum scrobiculatum*. The probe *trnL-UAA* in combination with *EcoR I* and *Dra I* could distinguish the three genera, *Eleusine*, *Setaria* and *Panicum*, while *Echinochloa* and *Paspalum* shared a similar profile. *BamH I / pTA 71* showed a distinct profile for only *S. italica*. The only other enzyme/probe combination that could differentiate between the five genera was *Hind III / pTA 71*. Species-specific differences were observed between the two species of *Panicum* with the combinations *Dra I / trnL-UAA* *Hind III / pTA 71* and *EcoR I / pTA 71*.

AFLP analysis using twelve primer combinations generated 869 fragments of which 821 (94.47%) were polymorphic across the five genera under study. The inter-specific variation between the two species of *Panicum* was 66.5% with 327 of the 491 loci being polymorphic. These two species showed distinct profiles with most primer combinations used. The minimum polymorphism was observed for these two species with the primer combination  $E_{AAC}/M_{CTT}$  (54.16%) and the maximum

for primer combination  $E_{AAC}/M_{CAC}$  (86.2%). Two species of *Echinochloa*, viz., *E. colona* and *E. crus-galli* showed similar profiles for primer  $E_{AAC}/M_{CAC}$  and had a total of 512 fragments of which 192 were polymorphic (37.5%). The two species showed distinct profiles for the primer combinations  $E_{ACT}/M_{CTA}$ ,  $E_{AGC}/M_{CAA}$  and  $E_{AGC}/M_{CAC}$ . *E. coracana* and *S. italica*, showed almost similar profiles for the  $E_{ACT}/M_{CAC}$ ,  $E_{ACT}/M_{CAA}$  and  $E_{AAC}/M_{CAC}$  primer combinations, while *P. scrobiculatum* shared a number of loci with the two species of *Echinochloa* rather than with other species under study.

The intra-specific analysis of the landraces from seven millet species showed AFLP loci ranging in number from 62 in *E. coracana* and *S. italica* (primer combination  $E_{ACT} \times M_{CAA}$ ) to 164 in *E. coracana* (primer combination  $E_{ACT} \times M_{CAC}$ ). *E. coracana* was found to be the most polymorphic species, with four landraces (*elongata*, *vulgaris*, *plana* and *compacta*) showing 794 (58.9%) polymorphic loci of the 1,348 AFLPs observed with the 12 primer combinations. Four races of this species were distinguishable in 7 out of 12 primer combinations.

A low level of polymorphism was observed between the landraces of *S. italica*; 38 of the 1,138 loci recorded were polymorphic in pair-wise comparisons. However the four primer combinations,  $E_{ACT} \times M_{CTA}$ ,  $E_{ACT} \times M_{CAC}$ ,  $E_{AGC} \times M_{CAA}$  and  $E_{AGC} \times M_{CAC}$  were useful in distinguishing the three races of this species. The three races of *P. scrobiculatum*, (*regularis*, *irregularis* and *variabilis*) analysed in the present study showed a total of 1,161 loci of which 78 (6.71%) were polymorphic across them. The polymorphic loci were observed for all the three combinations of  $E_{ACT}$

and two combinations of  $E_{AGC}$  used in the analysis while  $E_{AAC}$  primer did not reveal any differences among the races. The maximum differentiation of these three landraces was seen with the primer combination of  $E_{AGC} \times M_{CAC}$ , wherein 34 polymorphic loci were observed of the total 101 loci.

Two species of *Panicum*, viz., *P. miliaceum* and *P. sumatrense*, at intra-specific level showed a very low level of polymorphism, i.e., 1.87% and 1.89% respectively. The four races of *P. miliaceum* produced a total of 1,118 loci of which 21 were polymorphic and the two landraces of *P. sumatrense* produced 1,055 loci of which 20 were polymorphic. Among two species of *Echinochloa*, *E. colona* showed 0.84% intra-specific polymorphism which was the lowest recorded among all the species analysed and *E. crus-galli* showed 6.26% polymorphism. The four races of *E. colona* produced a total of 1,070 loci of which only 9 were polymorphic and the four landraces of *E. crus-galli* produced 1,149 loci of which 72 were polymorphic. Polymorphic loci were observed for all the primer combinations except  $E_{AAC}$  primer combinations. Primer combination  $E_{AGC} \times M_{CAA}$  showed maximum polymorphism among the four races of *E. crus-galli*.

Individual dendrograms were constructed for each of the marker systems and the overall species relationship was observed to be the same. Therefore a common dendrogram was constructed based on 953 polymorphic loci of the total 1,071 loci across the seven species of the five genera (Fig. 2.1). Four races of *P. miliaceum* (*patentissium*, *contractum*, *compactum* and *ovatum*) and two races of *P. sumatrense* (*nana* and *robusta*) had percentage similarity of 0.56.

It was observed that the three races of *S. italica* (*moharia*, *maxima* and *indica*) were clustered at a percent similarity of 0.52 with *Panicum* species cluster. Two *Echinochloa* species with their seven races clustered at 0.61 similarity. Three races of *P. scrobiculatum* (*regularis*, *irregularis* and *variabilis*) joined this cluster at 0.48 similarity. The *Echinochloa-Paspalum* cluster grouped with *Setaria-Panicum* cluster at 43 similarity levels. The four races of *E. coracana* (*elongata*, *plana*, *compacta* and *vulgaris*) formed a separate cluster at 0.73 similarity and joined the *Setaria-Panicum-Echinochloa-Paspalum* group at 0.40 similarity.

Profiles differentiating all the seven species were observed in all the primer combinations of AFLP and RFLP with rDNA and chloroplast gene regions. It was observed that the rDNA probe *pTA 71* and the chloroplast gene region *trnL-UAA* were particularly useful in distinguishing the individual genus, and two species of *Panicum*, respectively. The dendrogram generated from the data of the three marker systems did depict the formation of two major clusters, indicating a closer relationship of *Setaria* to *Panicum*. This was also evident by the number of loci shared by these two genera in most of the analysis. The second cluster was formed by two *Echinochloa* species and *Paspalum*. The clustering of these four genera together is in accordance with their classification into a single tribe of Paniceae under the sub-family Panicoideae; while genus *Eleusine* which is classified under subfamily Chloridoideae under the main Chloridoideae assemblage remained distinct.

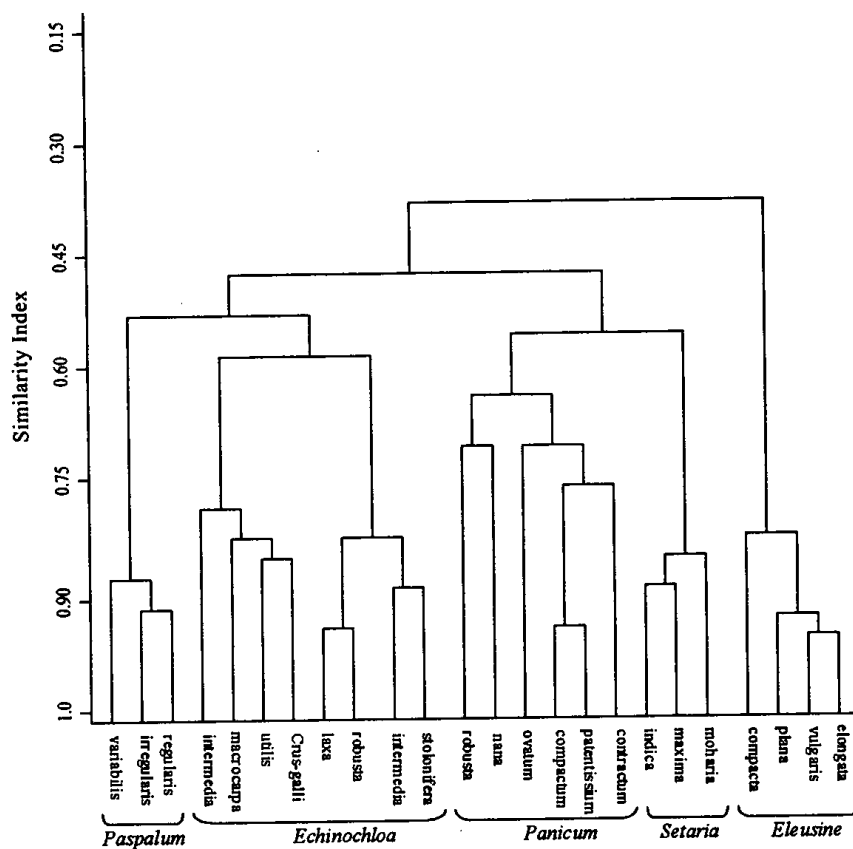


Figure 2.1 *Species relationships of nutritious millets based on molecular markers*

Species-specific marker systems developed for each species would be of immense significance for any future studies related to genetic resources characterization and genetic enhancement in this group of nutritive and economically important species. The study reveals a low level of genetic variability at inter-specific levels pointing to the narrow genetic base of the species analysed. Analysis of a greater number of genotypes from a wider range of agroclimatic conditions would help in identifying new sources of genetic variations. This would be of immense significance to the genetic enhancement and productivity improvement of this group of neglected crop species. Experiments are being undertaken in this direction.

### 202.3 Isolation and Characterisation of Salt Tolerant Genes

Coastal ecosystems, which suffer from the twin problems of low productivity and uncertain yield form an important part of the natural resource base of our country. Growing population pressure, increasing soil erosion and water pollution caused by intensive farm practices, sea water intrusion and attendant soil and water quality problems caused by ground water depletion have all caused various forms of stresses on the coastal ecosystem. The objective is to develop characterised pre-breeding genetic material capable of offering resistance/ tolerance to coastal stress

for grassroot level breeders for developing location specific crop varieties. This programme therefore intends to develop genetic material containing novel genes for resistance to abiotic stress, particularly salinity.

### 202.3.1 Isolation of stress induced genes

This approach involves developing gene libraries enriched with stress induced

genes and screening for potential genes conferring stress tolerance. It also involves characterisation, evaluation and controlled expression of the promising genes. Three cDNA libraries have been constructed from the most predominant mangrove species *A. marina*. By screening with heterologous probes from other organisms or through RT-PCR probes, a number of potential stress tolerant genes have been isolated. Details of these genes are given in Table 2.7.

Table 2.7 : *Genes isolated from the cDNA libraries of Avicennia marina*

Gene	Genbank/EMBL No.	Base pairs	Function
Betaine Adlehyde Dehydrogenase	AF170094	1717	Tolerance to salinity and cold temp
Glyoxalase I	AF328860	1000	Tolerance to Salinity
Cu-Zn Superoxide Dismutase	AF328859	768	Tolerance to oxidative stress
Catalase 1	AF328861	1754	Tolerance to oxidative stress
Inositol 6-phosphate synthase	AY028259	1845	Tolerance to osmotic stress
Glutamine synthetase	AF338444	1374	
Phosphoethanolamine N-methyltransferase	AF328858	1794	Choline synthesis
Enoyl-CoA-hydratase	AF190450	1536	Oxidation of lipids and fat
Ubiquitin Conjugating Enzyme	AF262934	850	General stress management
Lipid Transfer Protein	AF331710	604	Tolerance to salinity and drought
V-Type ATPase (Subunit c)	AF331709	910	Osmotic tolerance
V-Type ATPase (Subunit c)	AF286464	876	Osmotic tolerance
Metallothionein Class I Type 2.1	AF333385	651	Bioremediation of metals
Metallothionein Class I Type 2.2	AF334141	659	Bioremediation of metals
Metallothionein Class I Type 2.3	AF329968	666	Bioremediation of metals
Metallothionein Class I Type 5	AF257465	581	Bioremediation of metals
Sporamin	AF012840	829	Insect resistance
40S Ribosome (Subunit S7)	AF098519	833	Structural Protein
18S rRNA	Y17766	1805	Structural Protein
Histone H3	AF109910	678	Structural Protein
Aluminium Induced Gene	AF363286	1192	Tolerance to Al toxicity
Mitochondrial Processing Peptidase	AF363285	1870	Editing of Mt proteins

### **202.3.2 Cloning and Characterization of Catalase from *A. marina***

Catalase is a tetrameric, heme-containing enzyme providing oxidative protection against reactive oxygen toxicity. Catalase functions by removing active oxygen radicals that are produced during salt, drought or chilling stress. In our efforts to isolate and characterize useful genes conferring abiotic stress tolerance, a gene encoding for catalase has been isolated from the cDNA library of the mangrove species *A. marina*.

This catalase gene from *A. marina* designated as AmCAT1 was isolated from the leaf cDNA library by using a heterologous probe from *N. plumbaginifolia* (L.). The clone was subcloned into two fragments of 1.4 and 0.4 Kb released by *Sal* I digestion. The 1.4 kb fragment was further subcloned into 700bp fragment using *Bam*HI. All the sub clones were sequenced from both the ends and overlapped to get the full-length clone. The sequence was compared with known sequences from NCBI database and initial analysis confirmed that AmCAT1 codes for Catalase in *A. marina*. The Catalase gene is 1,754 bp long, has an initiation codon ATG at 21 bp and a potential stop codon TGA at 1,499bp. A poly-adenylation sequence AATAAA is present between 1,719-1,724. A poly (A+) of 15 bp in length is functionally present at 1,740-1,754 bp for the purpose of m-RNA processing and targeting the m-RNA for splicing in the cytoplasm. The cloned catalase from *A. marina* has been deposited in the gene bank under the accession number AF328861. Screening for catalase sequence variants from the same species was also undertaken and AmCAT2, which is 2,280 bp long was obtained. It seems that there is a 400 bp

insertion that disturbs the coding region of AmCAT2 and further analysis of this gene to understand the functions of catalase gene family is under way.

### **202.3.3 Transformation of tobacco with AmCAT1**

A plant transformation vector with AmCAT1 was constructed using the binary vector pBI121. The construct included AmCAT1 under CaMV 35S promoter, and a plant selection marker *nptII* driven by the nopaline synthetase promoter. This construct was used for *Agrobacterium tumefaciens*- mediated transformation of tobacco (Wisconsin 35). Twenty plants were generated and screened for the presence of *nptII* gene by PCR and then for the Catalase gene by Southern hybridization. Analysis of the putative transgenics for Catalase enzyme activity using gel based assay is underway.

### **202.3.4 Cloning and Characterisation of Superoxide dismutase (SOD) from *A. marina***

Superoxide Dismutase (SOD) is an enzyme found in all aerobic and anaerobic organisms. It is primarily involved in an organism's defense against highly reactive oxygen species by removing the superoxide anions. These highly reactive oxygen species are particularly generated in excess during environmental stresses like salt stress, chilling stress, drought and oxidative stress. This enzyme is enhanced in plants during salt stress and plays an important role in conferring salt tolerance.

Two genes coding for two isoforms of Cu/Zn SOD have been isolated from the *Avicennia*

*marina* cDNA library using heterologous probe and named as AmSOD1 (full-length) and AmSOD2 (5' partial). AmSOD1 was fully sequenced and submitted to gene bank database under the accession number AF328859. The AmSOD1 is 768bp with an initiation codon at 47 bp and a potential stop codon at 503bp. The poly adenylation signal was present between 602bp and 608bp. A poly(A+) is present in full length for the purpose of m-RNA processing from 737bp to 768bp. BLAST search of this gene confirmed that it codes for cytosolic Cu/Zn SOD in the mangrove species *A. marina*.

### **202.3.5 Transformation of *Brassica juncea* with AmSOD1**

A binary vector containing the gene AmSOD1 has been constructed by sub cloning the gene in *Sma*I and *Sna*B1 sites of pB121. The SOD1 gene was transformed into mustard, *Brassica* var. B85 by *Agrobacterium*-mediated transformation. In order to screen for the putative transgenic plants for the gene introduced into the plants, genomic DNA was isolated from 13 plants and was subjected to PCR analysis using *nptII* gene specific primers. Amplification of the *nptII* gene sequence in the samples revealed the presence of the construct in the plant genomic DNA. Southern hybridization using probes specific to AmSOD1 for confirmation of integration and analysis of putative transgenics for overexpression of SOD enzyme by gel assay is in progress.

### **202.3.6 Sequencing of Expressed Sequence Tags**

Apart from stress related genes, a number of randomly selected ESTs were partially

sequenced at 5' ends. About 200 ESTs were sequenced initially and the first batch of 70 annotated ESTs was submitted to the gene bank dbEST database in October 2000. 45% of the ESTs showed varying degrees of homology with already reported DNA sequences (full-length genes or ESTs) and 55% of the ESTs were unique to the mangroves. This is the first ever bulk submission of ESTs from any laboratory in India.

## **Sub Programme Area 203**

### **Monitoring Ecosystem Health Using Microbial Diversity**

This sub-programme addresses the twin goals of indexing and documenting beneficial, growth-promoting bacteria in the coastal agri-ecosystem and prospecting them for their efficiency as well as developing a site-specific ecological methodology to quantify lichen diversity and forest quality of the Siruvani Hills in the Western Ghats

### **203.1 Microbial Diversity in Coastal Agri-ecosystems**

One of the major manifestations of degradation due to salinity is increase in the concentration of soluble salts in the root zone of soils. The identification of bacterial strains and in some cases host cultivars that are tolerant to these stresses opens the way for alternate, low cost solutions to these problems. Although it is not possible to eliminate many of the stresses currently limiting crop production under low-input conditions, some success may be achieved in identifying better

host-strain combinations as a polyphasic approach in characterizing the various groups of isolates used. With reference to better plant growth management, the effectiveness of the beneficial organisms needs to be tested under certain kinds of stress prevalent in the study region. The tolerance of all these organisms under varying salt concentrations has been tested.

Screening of *Azospirillum* sp. and *Acetobacter* sp. under control and saline stress has been completed. This showed nearly 70% of strains isolated from all four study sites to tolerate upto 3% NaCl. The *Azospirillum* strains, when tested for their nitrogen fixing efficiency showed that 40% isolates perform equally under control and salt stress (250mM), while another 60% showed some degree of variance.

All the isolates with host specificity, from groundnut, cowpea and blackgram have been analyzed for their salt tolerance. Of the 70 isolates tested for salt tolerance in groundnut *Bradyrhizobium* it was observed that 52% of them could tolerate 0.5% salt concentration while the remaining 48% could tolerate 3%. In the blackgram nodulating rhizobia the same trend was observed. But when this study was performed on cowpea all the isolates tested were found to tolerate only 0.5% thereby indicating that there was not much of a selection taking place with reference to adaptation to this condition. Preliminary nodulation studies in blackgram have also been initiated for the first batch of *Rhizobium* sp. isolated and characterized as mentioned above. Of the 15 strains tested, almost all showed an equal number of pink nodules numbering 20-25 /plant. This varies from the type strain as here the nodules observed were

white. It was observed that ineffective nodules lacked the leghaemoglobin content when a cross section of this was observed.

The phosphate solubilisers were taken up for efficiency tests under saline conditions and it was observed that 57% of isolates could solubilise phosphates in the presence of 500mM.

Laboratory level biocontrol assay of the salt tolerant *Pseudomonas* species has been completed and green house studies are underway to study the efficiency of the potential strains against bacterial leaf blight (*Xanthomonas oryzae*), sheath blight (*Rhizoctonia solani*) and blast (*Pyricularia oryzae*) in paddy. Studies with rice variety IR50 revealed encouraging results with 9/11 (tested in the first phase) strains showing a drastic decrease in disease symptoms against all three pathogens.

### 203.2 Lichen Research

Lichens are very responsive to environmental stresses in forests including changes in forest structures like tree density, age of the stand, canopy spread, height and diameter of trees etc. Their diversity and distribution patterns also vary in different forest types, and inside the forest type, the changes in the habitat conditions (viz. light intensity, substrate pH, texture, moisture etc.) further determine the species composition of the lichen community. Any variations in the community composition, based on the changes in the habitats, can be used to monitor ecosystem continuity. Therefore in biomonitoring studies, each forest type has to be surveyed independently, using an ecological methodology suitable to that particular ecosystem, to understand the relationship between the



forest structure and the lichen communities within, to find the indicator value of each lichen community. In the present study, transects have been laid down at three different forest types namely the Dry Deciduous forests (DDF), the Moist Deciduous forests (MDF) and the West Coast Tropical Evergreen forests (WTEF) within the Siruvani Hills and data collected on both forest structure and lichen communities. The combination of both these data is being used in identifying the indicator lichen communities.

Lichens also have important biological roles in many forests, including nitrogen fixation, mineral cycling, food for micro-invertebrates (parts of lower level food chains), nesting material for small birds and so on. So in addition to indicating ecosystem continuity, these organisms need to be monitored as an important component of biodiversity. The unique and the delicate leaf colonising lichen community (foliicolous lichens) provide vital clues about the status of biodiversity in that location and serve as the first reflector of changes in the ecosystem continuity.

The ongoing programme concentrates on developing biomonitoring methodologies using lichen diversity in Siruvani Hills. This program also assesses the ecological characteristics of the DDF, MDF and WTEF within Siruvani Hills, using ecological methodologies.

The data collected from 50 transects was analysed to find the lichen community structure that includes diversity per unit area ( $\alpha$  diversity), its composition and the dominant and rare species, through ecological indices like the Importance Value Index (IVI) for each species recorded within the transect. The lichen communities were further analysed

on the basis of various lichen growth forms (crustose, foliose, fruticose and gelatinous etc.) and their photobionts (photosynthetic partners) both separately and in combination.

On the basis of data from 50 transects, on changes in forest structure like tree density, age of the stand, canopy spread, height and diameter of trees etc., 37 transects were found to be undisturbed where the lichen diversity increased with that of community with *Porina mastoidea* (agg.) as a dominant member with species like *Phyllopsora parvifolia*, *Leptogium cyanescens*, *L. denticulatum*, *Pyrenula*, *Megalospora* as co-dominants in the above forest sites.

Fourteen transects were found to be disturbed with lesser tree density, more young trees with less height and diameter, open areas etc. They possess a lichen community with species of *Parmelia* as a dominant member and species of *Heterodermia*, *Brigantiaea*, *Graphis*, *Lecidea* etc as co-dominants.

The lichen species belonging to both these associations form assemblages depending upon the varying levels of the ecosystem continuity/disturbance prevailing in the sites. Since the above dominant and co-dominant species have an ability to colonise wide ecological niches and the three forest types studied occurred as a continuum in the study site, the gross pattern of community structure indicative of ecosystem continuity was found to be the same throughout Siruvani hills. Further studies need to be carried out to find whether these lichen distribution patterns could be used for monitoring ecosystem health.

Considerable variations in lichen diversity were observed within the three forest types

of Siruvani Hills. In an ecological niche, the unidentifiable components (due to lack of sexual stages) of lichen diversity like the sterile thalli and thalli with asexual propagules also coexist and compete for resources. In this study, these components of diversity were also included. The MDF possess 59 units (48 species, 6 sterile, 3 sorediate, 2 isidiate crusts) followed by DDF 44 units (33 species, 6 sterile, 3 isidiate and 2 sorediate) and WTEF 41 units (29 species, 7 sterile, 3 sorediate, 2 isidiate).

The documentation of foliicolous lichen diversity indicated the presence of 50 lichen species within Siruvani Hills. Follicolous lichens are especially valuable as a compact community reflecting the ecological status, when environmental factors are complex and large data sets are needed for their evaluation. Promising possibilities are therefore seen in the indication of micro climatic conditions within the forest type. In Siruvani Hills, the lichen diversity on leaves ranged from a single species to an assemblage of twelve species. The analyses indicated that a large number of species on leaves are associated with forest sites with high ecological continuity.

### **Sub Programme Area 204**

#### **Conservation and Bioprospecting of Endangered, Medicinal and Mangrove Species**

In continuation of last year's activities efforts were carried on to develop micropropagation protocols for *Andrographis paniculata* and *Bacopa monnieri* and indirect organogenesis

protocol for *Porteresia coarctata*, a mangrove wild relative of rice. The study of essential oils present in *Syzygium spp.* and test of their antimicrobial and antipest properties were continued. Analysis of the nutritive value of *Sesuvium portulacastrum* and *Salicornia brachiata* and study of the genetic diversity in *Salicornia brachiata*, begun last year, were continued to validate earlier findings.

### **204.1 Medicinal Plants**

*Andrographis paniculata* and *Bacopa monnieri* have been extensively used in the field of phytochemistry for their medicinal properties. These herbs have been listed in the medicinal and aromatic plants of bulk demand in Indian systems of medicine and oriental perfumery (Rajendra Gupta, 1998). The decoction of the plant *Andrographis paniculata* is a blood purifier. It is used as a cure for torpid liver and jaundice. The plant extract exhibits antityphoid and antifungal activities. It is also used as an antidote for snake bite venom and other poisons (Gupta and Srivastava, 1994; Singh and Kaushal Kumar, 1999; Thangadurai, 2000).

The plant *Bacopa monnieri* (Brahmi) is used in the indigenous systems of medicine for the treatment of asthma, hoarseness, insanity, epilepsy and as a potent nerve tonic, cardio- tonic and diuretic (Bhakuni, et. al., 1969). Studies have also shown Brahmi to increase intelligence, longevity and memory and to decrease senility.

#### **204.1.1 Micropropagation**

Studies were undertaken to develop both direct and indirect organogenesis protocols for

the above mentioned plant species of medicinal value. Several explants viz. uninodal segments, leaf disc, embryos etc. were used in this study to compare the efficiency of plantlet regeneration and their survival during the hardening stage.

### ***Andrographis paniculata***

*Direct organogenesis* : Uninodal explants were used. Murashige and Skoog medium supplemented with Kinetin (2ppm) + PVP (1000mg/l) + Glucose (3%) showed best shoot induction which was followed by MS medium supplemented with BA (0.3ppm) + NAA (0.1ppm).

*Indirect organogenesis - Using leaf explants* : Murashige and Skoog medium with Kinetin (0.4ppm), Kinetin (0.1ppm) and 2, 4-D (0.5ppm) supplemented with Casein hydrolysate (250ppm) showed good callus initiation. Kinetin was found to influence the callus induction more than 2,4- D. An increase in the concentration of Kinetin enhanced the response but a further increase beyond 0.4ppm resulted in a decline in the response. Satisfactory results were obtained with lower concentrations of 2,4- D by combining it with Kinetin.

*Using embryo explants*: Murashige and Skoog medium supplemented with 2,4-D (0.7 PPM) and Kinetin (0.2ppm) showed the best callus initiation. Callus initiation was also observed only in those embryos which were incised. Green coloured calli were observed in MS medium containing NAA (0.2ppm) and BA (4.0ppm).

The callus induction was found to be good in all the combinations of 2,4- D and the

addition of Kinetin did not evoke a better response.

*Using nodal explants* : Murashige and Skoog medium supplemented with Kinetin (2.0ppm), PVP (1000ppm) and Glucose (3%) showed the best callus initiation.

### ***Bacopa monnieri***

Uninodal explants were used for direct/indirect organogenesis in MS medium supplemented with BA (2.0 to 6.0 ppm) + NAA (0.1 to 0.2 ppm). Initial response was callusing and the calli later differentiated into shoots in the same medium. The shooting response was 100% in all the hormone combinations.

Root induction in *B.monnieri* was observed in the same shoot multiplication medium and MS Basal medium. Analysis comparing the number of shoots regenerated using the present protocol with that of the published reports is under way.

A separate experiment was carried out to assess the effect of high concentrations of TDZ, which is widely used in commercial tissue culture. TDZ(6ppm) in combination with GA<sub>3</sub> (3ppm) brought about profuse callusing response. The green calli later differentiated into shoots though shoot elongation was poor. Studies are under way to enhance shoot elongation.

### **204.1.2 Bioprospecting for bioactive compounds**

#### ***Essential oil analysis in two species of Syzygium***

Fresh leaves of *Syzygium travancoricum* and *S. tamilnadensis* were hydrodistilled to yield

colourless (0.1 - 0.2%) and pale yellow (0.12%) essential oils respectively. The oil sample was diluted with acetone 10 times and 1 ml was injected. A fused silica SPB-1 column (30m x.0.32 mm, film thickness 0.25 mm), coated with polydimethyl siloxane, was used with nitrogen as carrier gas with the flow rate of 1 ml/min; injection port temperature 150°C; detector temperature 250°C. Oven temperature was maintained initially at 60°C for 4 min and then increased to 200°C at the rate of 2°C/min and maintained for 5 min. Retention indices for the entire constituents were determined according to Kovat's method using n-alkanes as standards. The constituents were identified by comparing their Kovat's indices with those matching the fragmentation patterns based on the published

spectra. Twenty-five and forty six components were present in *S. travancoricum* and *S. tamilnadensis* respectively. Fourteen components representing 86.9% of the total oil were identified, of which trans- $\beta$ -Ocimene (59.0%) and  $\beta$ - Caryophyllene (11.6%) were the major constituents (Table 2.8). Trans  $\beta$ - Caryophyllene, bisabolol, amorphene and copaene were identified from *S. tamilnadensis*.

The purified essential oil from *S.travancoricum* was subjected to bioassay studies with selected bacterial and fungal pathogens. Essential oil at 100% showed effective inhibition against all the tested pathogens and at 25% concentration was active against *Staphylococcus aureus*, *Bacillus subtilis* and *Shigella flexneri*.

**Table 2.8 : Components in percent volume of essential oil from *S. travancoricum***

Component	Percentage(v/v)
Ocimene	59.0
$\beta$ -Caryophyllene	11.6
$\alpha$ -Humulene	2.8
Myrcene	2.6
Aromadendrene	2.1
Nerolidol	1.9
Allo aromadendrene	1.8
$\alpha$ -Cubebene	1.6
$\alpha$ -Farnesene	1.2
Linalool	0.6
$\alpha$ -Terpineol	0.6
Caryophyllene oxide	0.6
Cadinene	0.5
Citral	0.3

At 50% concentration, it was active against *Salmonella typhi* and *Pseudomonas aeruginosa* in addition to other bacteria mentioned above.

Fractionation of bioactive compounds was carried out in three species viz. *Excoecaria agallocha*, *Syzygium travancoricum*, and *S. tamilnadensis*. In the case of *Excoecaria agallocha*, three active fractions were obtained and one of them was  $\beta$  - Sitosterol. Two terpenoids were identified from the other two fractions.

### **Studies on anti-pest properties**

Solvent extracts at a concentration of 10% obtained from *L. nicotianaefolia*, *S. travancoricum* and *S. zeylanicum* were tested in the laboratory for their efficacy against adult longevity, egg laying capacity and egg hatchability of *Helicoverpa armigera*. The ethyl acetate extract of *S. travancoricum* was effective since the adult longevity was just 24h. *L. nicotianaefolia* hexane extract recorded the minimum number of eggs laid (192) and meager hatchability of 2.6% whereas in control 80.2% hatchability was observed from 1,327 eggs. *S. zeylanicum* hexane extract recorded 376 eggs and only 1.6% hatchability though the adult longevity was 10 days.

## **204.2 Mangrove Plants and their Associates**

### **204.2.1 Micropropagation**

#### ***Porteresia Coarctata***

*In vitro Seed/Embryo Germination:* Seeds were collected from plants growing in MSSRF

plots, during November 2000. There is need for a better understanding of the physiology of *P.coarctata* and its salt tolerance. One of the ways through which the physiology of this plant could be studied is by increasing the efficiency of seed germination.

Seeds were surface sterilised using commercial disinfectant and 0.1% Mercuric chloride. Ninety percent of dehusked seeds that were cultured in Woody Plant Medium (WPM) supplemented with TDZ (2.0ppm) germinated. There was 75% germination rate in WPM supplemented with high concentration of BA (15ppm). When seeds were germinated in 1/2MS medium there was a delayed and reduced response. In both the cases, about 10% of the seedlings were achlorophyllous.

When isolated embryos were treated in the same media, the germination efficiency was only 30%.

The major problem encountered during *in vitro* germination studies was the contamination of cultures by endophytic fungi present in the seeds. This problem was minimal when embryo explants were used.

### **Indirect Organogenesis**

Uninodal, seed and embryo explants were used for this study. Though callusing could be observed in seed and embryo explants initially (20% of explants used), there was no callus proliferation. Callusing response of uninodal explants varied with the plant material used. When explants were obtained from those plants which were maintained under greenhouse conditions for a long time and were showing a characteristic 'bending' at the nodal regions, callus initiation could be observed. Callus initiation started after 10

days in N6 medium supplemented with 2,4-D (1.5ppm). This might be attributed to the localised higher concentrations of auxin at the bent nodal regions.

Further multiplication of the callus was done using the same medium. The duration taken for the callus to multiply to about two-gram mass was between one and two months. When calli were transferred to regeneration medium (MS with 2.0ppm (BA), 1.0ppm (NAA and Kinetin) and 3.0ppm(Spermidine)), only rooting was observed.

### 204.2.2 Bioprospecting for nutritional value

#### *Nutritive analysis of Sesuvium portulacastrum and Salicornia brachiata*

*Sesuvium portulacastrum* is a mangrove plant is used by the local people living near the mangroves as a green vegetable. However, there are no reports on the nutrient value of *Sesuvium portulacastrum*. So, with the view of promoting this mangrove plant as a food crop in coastal areas in an effort to optimise the sustainable utilization of coastal wastelands, chemical analyses for its nutritional value were performed.

*Salicornia brachiata* is yet another plant growing in the mangroves that is used by the local people as vegetable and for making pickles. This genus is also widely used in French culinary for green salad preparations. This plant can also be popularised as a nutritive food in India if its nutritive value is scientifically validated.

Fresh plant materials collected from Pichavaram mangrove forest were shade dried and analysed using AOAC (Association Of Analytical Chemists) method. A table comparing the nutritive value of *S. portulacastrum*, *S.brachiata* and other leafy vegetables is presented below (Table 2.9).

### 204.3 Genetic Diversity Studies in *Salicornia brachiata*

Interpopulation diversity studies were carried out using phenotypic, molecular (RAPD) and biochemical markers (total proteins). The diversity at the morphological level was not found to be much at the molecular and biochemical levels.

Genetic diversity studies based on RAPD markers and total protein profiles showed

Table 2.9 : Comparison of the nutritive value of *Salicornia brachiata*, *Sesuvium portulacastrum* and other leafy vegetables

	<i>S.brachiata</i>	Agathi	Amaranth	Beet greens	Carrot leaves	Cabbage	<i>S.portulacastrum</i>
Protein (%)	7.45	8.4	4.0	3.4	5.1	1.8	11.1
Crude fat (%)	0.25	1.4	0.5	0.8	0.5	0.1	0.32
Calorific value ( KCal/100g)	159	93	45	46	77	27	To be analysed

9.9% polymorphism. Three random primers (OPAB 17, OPAB 20, OPAB 11) out of 25 primers tested showed monomorphic bands. The maximum polymorphism was obtained with primers OPAB 9 and OPAB 13. The total protein profile also showed no significant difference. The dendrogram based on hierarchical cluster analysis (SPSS 2000) showed a maximum rescaled distance of 25, with populations 1,3,4,5,7,8 and 9 falling in single major cluster. Populations 2, 6 and 10 were more dissimilar as they were falling apart.

These results indicate that all the populations of *S. brachiata* in Pichavaram were initially a single major population which later fragmented into minor populations due to island formations. Environmental factors viz. soil texture, structure, salinity, temperature and proximity to the sea might determine the variability at the phenotypic level.

### **Sub Programme Area 205**

#### **Golden Jubilee Biotechnology Park for Women**

The Golden Jubilee Biotech Park for Women conceptualized by M S Swaminathan Research Foundation and implemented by TIDCO with predominant funding from the Department of Biotechnology, New Delhi, was inaugurated on the 24 November 2000 by the Hon'ble Chief Minister of Tamil Nadu, thereby bringing a concept to a reality. H E Fawzi H Al-Sultan, President, International Fund for Agricultural Development, Dr K Venkatasubramanian, Member, Planning Commission, for Education, Health, Women

and Children, Dr Manju Sharma, Secretary, Department of Biotechnology and Thiru A K Moorthy, Member of Parliament, Chengalpattu Constituency, also participated.

Presently, the Park has 20 pre-built industrial sheds in a functional layout with a good quality finish (1,000 sq. ft. in 2,800 sq. ft. of land) designed to suit various types of industries. The Park also offers on long and short lease 40 land modules of 11,200 sq. ft. each (approx), for building factories to meet operational requirement or to set up agro-biotech activity. The Central Hub, built up in an area of 4,000 sq. ft. will house the following facilities: advanced telecommunication systems, state-of-the-art Informatics Centre, Training Centre, Business Centre and area marked for a Bio-supermarket where the products produced by the members of the Park will be marketed. A Local Area Network will be established as part of the state-of-the-art Informatics Centre. The home page for the Park was ready as early as 1 November 1998 and has been recently updated (23 November 2000). The web page has links to the sites of all the promoters. Each entrepreneur has her own web page with on-line order forms. This can be viewed at <http://www.biotechpark.com>

As the first step towards introducing environment-friendly, renewable energy technologies, the Park has already fixed 10 solar lamps by *Solker Industries*, Chennai, with the help of TEDA through MNES. A herbal garden is being laid in an area of 14,000 sq. ft to reflect thematically the five agro-ecological zones described in the ancient Tamil text *Tholkappiyam* viz. *Kurunji* (hills and associated hilly environs), *Mullai*

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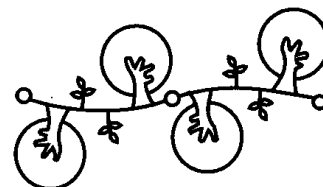
(forests and wooded lands), *Marutham* (cultivated lands of the plains and rivers), *Neithal* (coastal belts) and *Palai* (desert lands).

It is envisaged that the factory modules will be fully occupied by the end of the first year from the time of completion of works at the site, land modules will be occupied to the extent of 90 % in 3 years time and should be fully occupied by the end of the 5<sup>th</sup> year. Break-even is expected in the third year in time with the start of the loan repayment. The Chief Executive Officer has been appointed from October, 2000 and is supported by an able administration group. Nine women entrepreneurs have taken up eleven sheds in the first phase. Thus the society has started functioning as an independent body.

The Golden Jubilee Biotech Park for Women is a good example of a multi-stakeholder partnership exercise and the first pilot initiative resulting from the Chennai Declaration, which was the outcome of a meeting held at the Foundation in December 1996 by the Women Scientists and Technologists of the Asia Pacific Region. The Biotech Park with all its facilities will serve as a model for a facility where opportunities are available for the technological, economic and information empowerment of urban women to become entrepreneurs, and in turn provide additional employment to women.

We would like to thank the Hon'ble Chief Minister of Tamil Nadu and Dr Manju Sharma Secretary, Department of Biotechnology, for the support extended.





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# Ecotechnology and Food Security

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*The National Network on Biovillages and Community Banking and the NABARD Resource Centre for Precision Farming made good progress. Producer-oriented marketing was strengthened through e-commerce facilities. Work on low-external input sustainable aquaculture was strengthened.*

*A Food Insecurity Atlas of Rural India, prepared jointly with the UN World Food Programme, was released by the Prime Minister of India on 24 April, 2001. A ten point action plan was developed for achieving substantial progress in the elimination of poverty-induced hunger by 15 August, 2007, which marks the 60<sup>th</sup> anniversary of India's independence.*

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## Sub Programme Area 301

### JRD Tata Ecotechnology Centre

The mission of the JRD Tata Ecotechnology Centre is to evolve methodologies for operationalising sustainable development in the field of agriculture and rural development through participatory research. In this process attempts have been made to develop grassroot level institutions. The ecological viability, economic feasibility and social acceptability of the interventions are evaluated.

The focus continues to be on the concept of biovillage. Biovillage is ecotechnology in action. It represents forward-backward linkages within the rural society, for sustainable development. Resource use efficiency thus assumes importance. The activities are reported under three sections representing the different ecosystems of coastal lowland, hill and semi-arid regions.

In addition the National Network on Biovillages and Community Banking has also been carried out. The activities of NABARD Resource Centre for Precision Farming for Poverty Alleviation has been integrated in the area-wise report.

The important developments which took place during the year are as follows:

- A project at Pudukottai was launched to develop an agriculture system in alfisol soil under rain-fed conditions. The project is being implemented with the technical collaboration of Ohio State University.
- With the completion of the UNDP supported project, the Pondicherry Biovillage programme entered a crucial phase of consolidation. The Biocentre has become the focal point of the activities.
- Nearly 200 tribal farmers of Kolli Hills have obtained certificates as organic farmers from an international accredited agency, for farm products such as minor millets, pineapple and banana.
- The institutionalisation of the Biovillage programme at Kannivadi was the highlight of the year. The Reddiyarchatiram Seed Growers Association (RSGA) continued its training and developmental activities. The second unit of biopesticide production was also launched during the year.
- Modern information and communication technology was introduced in Kannivadi region with the establishment of a Knowledge Centre. A website called <http://www.oddanchatrammarket.com>, which provides information on the price and stock of vegetables in the market of Oddanchatram, was also launched.
- The government of Pondicherry handed over a piece of land (9 ha) near Karaikal to facilitate the project on coastal ecoaquaculture.
- The Centre has identified the potential of grass carp in controlling the spread of water hyacinth in the community ponds in villages around Chidambaram.
- The Integrated Intensive Farming System (IIFS) at Keelamanakudi near Chidambaram has created an impact on the agriculture of the village.

- In addition to *Dodonaea*, which was studied during 1999-2000, the three species *Clausena dentata*, *Cipadessa baccifera* and *Melia dubia* were considered for possible use as biopesticides.
- The National Network on Community Banking and Biovillage was evolved. The activities of 276 Self-Help Groups (SHGs) with nearly 4,000 members are being coordinated.
- Nearly 12,000 trainee days of training programmes were conducted
- Biovillage activities were launched in Orissa.

### 301.1. Coastal Region

The activities of JRD Tata Ecotechnology Centre in the coastal region stress the need for efficient water management and diversification in the cropping pattern. The project also focuses on issues such as disaster management in vulnerable areas.

#### 301.1.1. Chidambaram

Models for sustainable development suitable for coastal regions are being studied in villages around Chidambaram. These models focus on agriculture, aquaculture and common property resources such as village ponds vis-à-vis the management of water and soil.

#### Ecoaquaculture

In recent times, coastal and inland aquaculture have raised many environmental issues. To address these issues, the centre has been demonstrating fresh water aquaculture for culturing *Macrobrachium rosenbergii* under Low Intensive Sustainable Aquaculture (LISA) using harvested rain water. The demonstration is carried out under zero-water exchange system. The absence of instruments such as aerators, fertilization of ponds using cow dung and avoidance of chemicals and antibiotics are some of the important characteristics of the demonstration.

The experience during the last three years shows that production of *Macrobrachium rosenbergii* depends upon the number of culture days. The data presented in Table 3.1 shows that the decline in the productivity could be due to the decline in the number of culture days.

One of the important observations was that storage of water in the pond system could lead to increasing salinity in the neighbouring soil. Soil samples were collected at every ten feet from the pond in all four directions up to a distance of 100ft. The samples were collected before storing water in the pond and after five months of storing and checked for EC value.

Table 3.1 : Days of stocking and productivity

Period	Days of stocking	Production (kg/ha)
1998-1999	195	1,024
1999-2000	144	403
2000-2001	150	360

Electrical Conductivity (EC) was also checked upto 100ft from the pond, at every 10 ft. The EC value was comparatively high (1.4 mmhos/cm) up to 20 ft and even up to 60 ft. (1.2 mmhos/cm) and reduced to 0.9 at 100 ft. Seepage of water through bunds and the storage of harvested rain water beyond ground level could have led to the movement of sub-soil soluble salts to the surface. The study also indicated the distance at which the impact is maximum. Another study was conducted to analyse the sub-surface soil at different distances from the pond. This study reflected the higher concentrations of soluble salts in the sub-surface near the pond compared to the amount of soluble salts in the neighbouring fields. These studies will be continued during 2001-2002, in order to understand the impact of pond ecosystems on the environment.

***Sustainable management of village ponds***

The biovillage programme has been stressing the need for efficient use of common property resources such as community ponds. In the previous years the potentials of the community ponds were studied and villagers were mobilized in the form of Self-

Help Groups (SHGs) to manage the ponds. One of the major problems in pond management is the prevalence of water hyacinth (*Eichornia crassipes*). Studies have been conducted all over the world in managing water hyacinth. The biological control method using carps, particularly grass carps, has been experimented with and these experiments have indicated the limitations in its use.

An experiment was conducted in the pond at Keelamanakudi-Kuriamangalam village. Six nylon cages called *happas* with openings only at the top and six nylon cages with openings at the top and the bottom were installed in the pond. Using a randomized block design method the cages were placed in different parts of the pond. Through the top opening, one kilogram of water hyacinth was introduced in each of the nylon cages. Data on the biomass of water hyacinth was collected for a period of thirty days. The result showed that the amount of water hyacinth in the nylon cages with openings at the top and bottom declined rapidly, compared to the amount in the nylon cages with openings only at the top (Table 3.2).

**Table 3.2 : *Impact of fishes in controlling water hyacinth***

Treatment	Weight of water hyacinth (wet weight in grams)	
	On the day of introduction	30 days after introduction
Nylon cage with opening only on the top	1,000	4,436
Nylon cage with opening on the top and bottom	1,000	71
SE <sub>d</sub>	—	219.74
CD (P < 0.05)	—	489.62

SE - Standard Error; CD - Critical Difference

The study shows that the amount of water hyacinth in the open cages declined rapidly compared to the other cages. The open nylon cages would have facilitated the grass carps to consume the water hyacinth. On the other hand, the closed cages would have restricted the movement of fishes, which in turn would have provided the appropriate environment for the growth of water hyacinth.

The project conducted further experiments on the impact of grass carps in controlling water hyacinth. Using a random block design, nine ponds of 25 m<sup>2</sup> were dug and filled with water from the community pond. Water hyacinth of 2,000 grams was added to each of the ponds. Three ponds without fish served as control (T1). Two grass carps weighing 50 grams each were introduced into three of the ponds (T2). Two grass carps weighing 500 grams each were introduced into three other ponds (T3).

The experiment showed that the bigger grass carps were able to control the water hyacinth when compared to smaller grass carps (Table 3.3). Data regarding the impact of the intervention in terms of water quality and quality

of the fishes is being studied. If proved, a simple solution for controlling water hyacinth using appropriate size of grass carps could be arrived at.

***Integrated Intensive Farming System (IIFS)***

IIFS is based on the principles of on-farm inputs, soil conservation, efficient water management, crop diversity and integration with livestock and fishery. The model was introduced in 1996-97 in Keelamanakudi and the farmers in the village were told not to follow the model immediately. They were requested to observe at regular intervals the various dimensions of the dynamics of the model. They were given training in reviewing and evaluating the model. A select group of farmers have been regularly conducting an audit of the farm accounts to study the economic and financial management of the farm.

The model had paddy-cum-fish culture for 0.70 acre and fish, *Azolla* pond and mushroom unit in 0.08 acre. The thick bunds of the field had nearly 150 banana trees and 40 numbers of *Sesbania grandiflora*. In the space between the *Sesbania grandiflora* cultivation of various crops such as snake guard, castor

**Table 3.3 : Impact of different size of grass carps in controlling water hyacinth**

Treatment	Weight of water hyacinth (wet weight in grams)	
	On the day of introduction	30 days after introduction
T1	2,000	5,006.7
T2	2,000	2,941.7
T3	2,000	491.7
SE <sub>d</sub>	—	467.46
CD(P<0.05)	—	982.1

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and cow pea as well as floriculture, was carried out as trap crops in the bunds. Buffalow grass was cultivated on the banks of the fish and *Azolla* ponds. The farm had cows, goats, poultry, turkeys and pigeons.

The productivity of paddy in the IIFS plot has been consistently increasing. Figure 3.1 shows that while paddy productivity in IIFS

has been consistently increasing during the last four years, it is still lower than the productivity obtained by the farmers through the application of chemical fertilizers and pesticides. However, the cost-benefit analysis is more favourable to the IIFS (Figure 3.2).

IIFS has been studying the impact of farm management practice on the quality of the

Figure 3.1 : Comparison of productivity of paddy between IIFS and 32 selected farms at Keelamanakudi

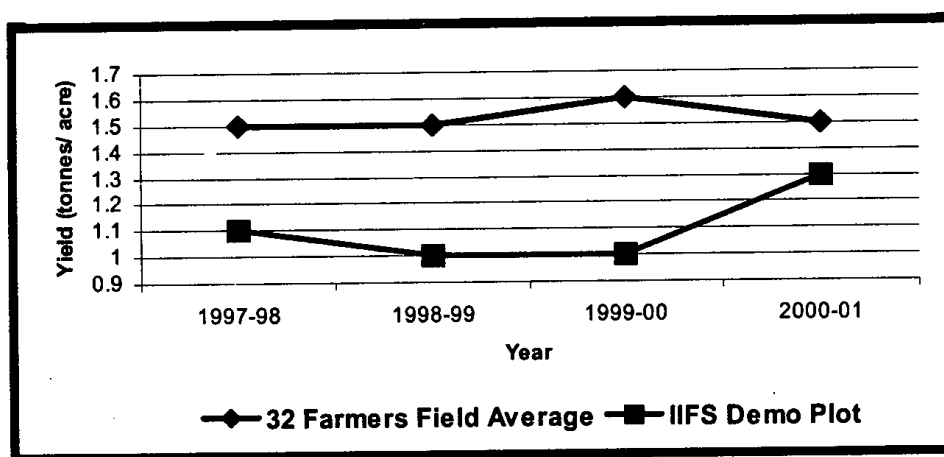
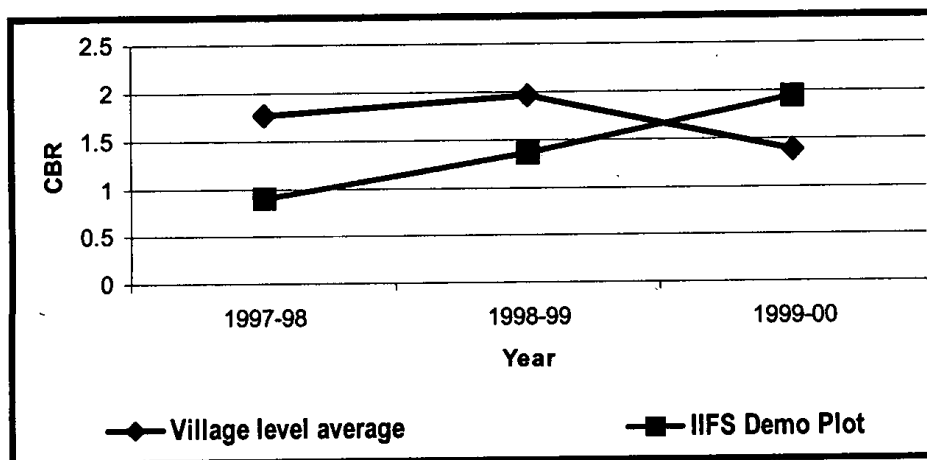


Figure 3.2 : Comparison of Cost-Benefit Ratio (CBR) between IIFS and 32 selected farms at Keelamanakudi



soil. Organic carbon content and microbial strength are the chosen indicators of soil health. Soil samples, regularly collected during March-April of every year from the IIFS demonstration plot and from two of the farmers' plots, were subjected to analysis. The data for organic carbon, analysed over a period of four years is given in Table 3.4.

It can be seen that the level of organic carbon in the IIFS demonstration plot is more or less uniform, whereas in the farmers' fields, with inputs such as chemical fertilizers and pesticides and mono-cropping, the level of organic carbon has been fluctuating substantially.

Soil samples were also analysed for microbial population. The soil samples were collected before the beginning of paddy cultivation (Table 3.5).

The presence of high microbial population in the IIFS demonstration plot indicates the

health of the soil. The study will be conducted during May-June 2001 for comparison between pre-sowing and post-harvesting seasons.

The demonstration of the IIFS model in terms of productivity, soil health and capacity building has generated a significant impact on the region.

It has been observed that Farm Yard Manure (FYM) and biopesticides like neem extracts are being increasingly used (Figures 3.3 and 3.4). The data is based on a sample survey from 32 randomly selected farms.

The influence of the project has spread to eight neighbouring villages. Certain aspects of IIFS are being demonstrated in nine farms in six villages. Ten women and four men SHGs have been formed. These SHGs are involved in various micro enterprises including livestock management and mushroom production.

**Table 3.4 : Percentage of organic carbon in various fields**

Year	IIFS Demonstration Plot	Farmer's Field 1	Farmer's Field 2
1998	0.61	0.30	0.10
1999	0.52	0.41	0.42
2000	0.65	0.50	0.50
2001	0.69	0.29	0.27

**Table 3.5 : Microbial population in different fields**

Microbial Population	IIFS Demonstration Plot	Farmer's Field 1	Farmer's Field 2
Bacteria (THC)x10 <sup>5</sup>	94	46	56
Actinomycetes (CFU)x10 <sup>4</sup>	42	6	16
Fungi (CFU)x10 <sup>3</sup>	86	44	55

THC - Total Heterotrophic Count; CFU - Colony Forming Unit

Figure 3.3 : *Use of FYM in Keelamanakudi*

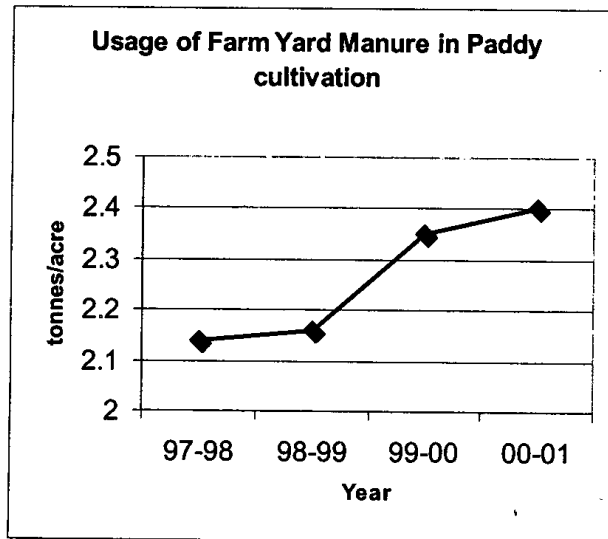
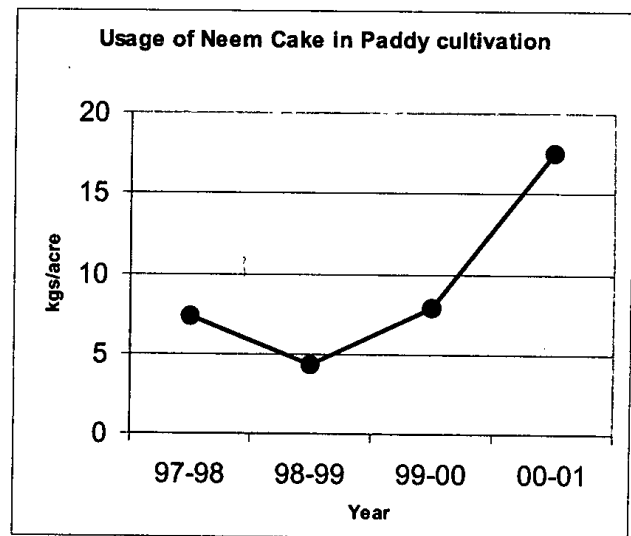


Figure 3.4 : *Use of neem extract in Keelamanakudi*



### **Backyard ornamental fish culture**

Thirty women and three SHGs involved in breeding and management of ornamental fishes and major Indian carps and cat fishes, earned a supplementary income of Rs. 500 to 700 per month. An analysis was made to study the low productivity. The fecundity rate declined from 50 to 25 due to water hardness, continuous breeding from the same parental stock and decline in the protein content of the feed. To overcome these issues, the feed combination has been modified. Attempts are also being made to introduce new parental stock and new species.

An analysis was carried out based on the observations of the past several years on the biological and economic factors subjected to stochastic sensitivity analysis. The biological factors (length, weight, fecundity, hatching and survival rate), are inherently varied as against the economic factors (input and output).

This project has recently been extended to three women SHGs of Kannivadi. Use of proper feed, its composition and preparation

have been taught to them and the results would create an impact on ornamental fish breeding.

### **301.1.2. Karaikal**

With the active collaboration of the Pondicherry Administration, land has been identified near Karaikal for both hatchery (2 ha) and grow-out ponds (7 ha). MSSRF will develop a training centre around the grow-out ponds and hatchery. This training centre will include a feed unit and information centre. Thus MSSRF will serve as the Technical Resource Centre for the Women's Eco-Aquaculture Estate and provide seed, feed, training and information on market linkages.

The objectives of the project are :

- To demonstrate prawn production technologies which are environmentally sustainable, economically feasible and socially equitable
- To develop and demonstrate backyard type prawn hatchery



- To organize training courses for fisherfolk, technicians and managerial level personnel and create job opportunities for women through skill and managerial empowerment.

### **Progress during the year**

12 ha of brackishwater land in Keezhavanjore for growout and 2 ha for hatchery at Akkaraivattam of Karaikal were transferred from Pondicherry Fisheries Department to MSSRF for the Mission Mode Project on Prawn Aquaculture to be carried out by rural women.

Participatory Rural Appraisal (PRA) was conducted by the MSSRF team at Keezhavanjore village and interactive group discussions held with the people which resulted in changes being made in the design of the proposed project site.

The salient points which emerged during the PRA are as follows:

- The main stakeholders, viz., the villagers of Keezhavanjore (especially women), State Fisheries Department, Karaikal and MSSRF, Chennai have agreed to collaborate in planning and executing the project.
- It was decided that a joint action plan for pond construction would be prepared immediately after the proposed land transfer from the Fisheries Department to MSSRF.

Three Self Help Groups have been formed in Keezhavanjore village with 15 women members in each. One of the existing SHGs has also been strengthened. Training on shrimp farming was given to 25 members of

four SHGs. These SHGs will manage the aquaculture ponds. They are being trained in various aspects of aquaculture, including environmental issues.

The design of the pond includes a green belt in the buffer zones and settlement ponds. The project has studied the quality of soil and water in the aquaculture zone and the agriculture zone for constantly monitoring the environment. The villagers are being trained in such monitoring practices. A proposal including the design and action plan has been submitted to authorities in the Government of Pondicherry to obtain permission from the Aquaculture Authority of India.

### **301.1.3 Pondicherry**

The Biovillage Project at Pondicherry has entered a crucial phase. With the completion of the UNDP supported project in December 2000, the activities at Pondicherry began to focus on the Biocentre. The third tripartite review meeting recommended that the following areas should be concentrated on :

- Continuation and selective intensification of ongoing activities
- Biocentre and the Biovillage Society
- Documentation and spreading the message
- Biovillage and Community Banking Network
- Development and Investment Plan for converting all the 250 villages of Pondicherry into Biovillages by August 2007
- Training in food safety and *Codex Alimentaris Standards*.

The project has been focusing on the areas of capacity building, integrated natural resources management, marketing, sanitation, fodder and animal husbandry.

***Training and capacity building***

Intensive training programmes totalling more than 2,400 trainee days, were conducted during this period (Table 3.6).

Studies are being conducted to analyze the impact of training.

***Integrated natural resources management***

- Hundred and seven farmers are using leaf colour charts for nitrogen management. The project has been helping these farmers in monitoring nutrient management.
- In addition to the community pond at Kizhur, two more ponds at Poraiyur and Vambupet were brought under the management of the Self-Help Groups (SHGs), and have started yielding income.
- Ten mushroom groups have been evolved and have established common production facilities.

- Seventy-seven households have taken up floriculture activities.
- The Government of Pondicherry has allocated a space for mushroom marketing for the producers from the Biovillages in the *Uzhavar Sandhai* (Farmers' market).
- Two villages have acquired sanitation facilities from the Block Development Office through the support of the Biovillage project.
- Biofertilizer for paddy is being popularized in two villages.

***Biocentre and the Biovillage Society***

The Biocentre at Pillayarkuppam has emerged as the extension centre for this region. 3,300 people have benefited from the extension services. 1,500 livestock were treated out of which 800 animals were given artificial insemination.

*The Biocentre has the following production activities :* Mushroom spawn centre, Mushroom demonstration centre, *Trichogramma* parasitoid production centre, Animal husbandry centre, Low cost greenhouses for

**Table 3.6 : *Details of the training programmes in Pondicherry Biovillage Project***

<b>Particulars of training</b>	<b>Trainee Days</b>
Accounts and book keeping	797
Activity based training	1,016
Biovillage Council formation/meetings	460
Livestock technician training	12
Kizhur Biocentre training	138
<b>Total</b>	<b>2,423</b>

floriculture, an information centre with a Local Area Network (LAN) connected to the hub at Villianur, Aquaculture pond, Fodder production centre and Integrated nutrient management demonstration plots.

The *Trichogramma* parasitoid culture is an innovative method for sustainable management of pests in sugarcane, cotton and horticulture crops. The sugar mills have shown a keen interest in buying the parasitoid. The spawn unit is used for distributing the seed materials for mushroom producers.

Two representatives from each village have been selected and a Biovillage council consisting of 40 members has been formed. However, a new idea has emerged, which is being considered by the members of the various Self Help Groups. A three-tier body is being envisaged in which 107 Self Help Groups will be formed into 10 cluster groups. From each of these cluster groups, two members will be elected to form a federation of the Self Help Groups. This federation will be transformed into the Biovillage Council and will manage the Biocentre. Discussions through Participatory Rural Appraisal are also being conducted in this regard.

### ***Documentation and dissemination***

The well-known Tamil journalist Gnani has produced a twenty-five minute documentation. This video cassette is also available in CD form and it has been shown to the officials of the Government of Pondicherry, banks and NABARD. Copies will be made and distributed on demand.

Doordharshan, New Delhi, has telecast a programme on Biovillage Pondicherry in the national network in the News as well as in

the science programmes (Imaging Science). Brochures, posters and pamphlets on various activities have been distributed.

The local television network is also regularly carrying programmes on Biovillages.

### ***Biovillages and community banking network***

The project has initiated 107 Self Help Groups (SHGs) in 19 villages. On the request of the Department of Rural Development it has helped to train 51 SHGs from all over Pondicherry. The project has also initiated the development of a software package for on-line community banking. The software is being tested and it will be shortly introduced in the information centres in 9 villages. The SHGs can negotiate transactions through these online banking facilities. The project has been interacting with other Non-Governmental Organisations like DHAN Foundation. Members of the SHGs in Pondicherry are visiting other regions for interactive training programmes.

### ***Development and investment plan for Pondicherry***

A development and investment plan for converting all the 250 villages of Pondicherry into biovillages has been submitted to the Government of Pondicherry, which is processing the report. The Lt Governor of Pondicherry discussed the modalities of operationalizing the plan with Mr Mark Malloch Brown, the UNDP Administrator, when he visited Pondicherry in February 2001.

### ***Training in food safety and Codex Alimentaris standards***

Two senior staff of MSSRF have been trained in *Codex Alimentaris* standard for food safety

by FAO. In turn, they have trained the project staff in Biovillages in maintaining the food standards for mushroom and aquaculture. Rigorous quality standards are being applied in mushroom production.

#### **301.1.4. Gayaspur and Mallikapur in Orissa**

##### **Gayaspur**

Gayaspur village lies 15 km east of Kendrapara District. It is a small village with 64 households. Most of them are agricultural labourers. The Centre has been working here since 2000 and in the last one year it has mobilized the entire village in the form of three SHGs and one village level committee.

It is also one of the villages affected by the super cyclone and hence the project started focusing on building cyclone shelters cum multi-purpose buildings, including a grain bank. It insisted that the villagers join together, design the building and take necessary steps for constructing the building. The responsibility of constructing and management would be that of the villagers. The project would supervise and monitor the progress of the construction.

For this purpose the villagers formed a committee. They identified a piece of common land for the construction of the building. However, there were two problems:

- According to the revenue record, the land is a road, though at present no road exists in that place. Hence, declassification of the land for the purpose of constructing a building was necessary.

- Women have been using the land for ablution.

The villagers have addressed the first issue by representing to the district revenue authorities for the declassification of the land. They have met senior officials at the district level and state level and their persistent effort has started yielding results. The Office of Consolidation has given a no-objection letter for constructing the building on the basis of a request from the Tahsildar. The villagers have also approached an architect and have designed a building. As soon as the letter from the District Collector is obtained, the construction will begin.

The second issue of sanitation has been addressed by providing household sanitation facilities. Through the three SHGs, the project is supporting the provision of the facilities for which the household contributes 50% of the expenses. The construction began in May 2001.

In order to bring the entire household above the poverty line, the project is planning to initiate micro enterprises through credit facilities from "Friends of MSSRF". Backyard poultry is being introduced in 40 of the 64 households through the 3 SHGs. If successful, this venture will help to increase the net income of the household by Rs.3,500 to Rs.5,000 per annum. Other potential value-addition activities are also being studied.

The project hopes that by March 2002, Gayaspur will not only have a community-initiated development programme, but will also act as an agency for development in the region. The capacity of the villagers to come together, to negotiate with Government

agencies and initiate development are some of the positive aspects of the Gayaspur project.

### ***Mallikapur***

The project is also operating in Mallikapur village with its five hamlets and the other small villages of Narainpur, Narilo and Nathapada. This cluster of villages lies 4 km from Baliguda in Jagatsingpur District and was severely affected by the super cyclone in 1999. The local economy depends on rainfed paddy cultivation. The bimodal rainfall of around 1,800 mm per annum helps to raise two crops in a year. The existing cropping pattern, land tenure and employment, the pattern of usage of natural resources and the status of human resources are some of the issues which need to be addressed for the sustainable development of Mallikapur. A cyclone shelter is being constructed.

The cluster of villages has nearly 600 households. A substantial number of the village workforce are small and marginal farmers and landless agricultural labourers. Sharecropping is one of the widely prevalent forms of land tenure system in the region. Lack of employment, poverty, livelihood insecurity and degradation of natural resources are the major problems. The status of the women is another important issue which needs to be addressed.

## **301.2. Hill Region**

The methodologies for sustainable development, blending biodiversity and food security, are being studied in the hilly regions.

### **301.2.1. Kolli Hills**

The Kolli Hills Biovillage is being developed as a model for creating an economic stake in the conservation of biodiversity by linking primary conservers with the market and enhancing the productivity of traditional land races of minor millets through improved cultivation practices. The Centre has used a multi-disciplinary approach in developing such a model.

#### ***Micro nutrient studies on little millet (*Panicum sumatrense*)***

Little millet contains high amounts of iron and zinc compared to other crops. Further improvement in their nutrient profile offers vast scope in food fortification and providing a balanced diet against multiple micro nutrient deficiencies. An experiment was initiated in Kolli Hills on enhancing the quality (nutrient content) and productivity of little millet through the application of micronutrients such as iron and zinc. The experiment was laid under randomized block design with five replications under rainfed conditions. The soil of the field site is red sandy loam with slightly acidic pH and low to medium in zinc and iron availability. Available zinc and iron elements accumulate in the surface soil with organic matter and the frequent removal of top soil by erosion reduces the availability of nutrients to the plants, though the soil is rich in total nutrients. Micro-nutrients were applied @25kg/ha in different methods of application (Tables 3.7 and 3.8).

Table 3.7 : *Effect of micro nutrient iron on the productivity of little millet*

Treatments	Plant ht (cm)	Root length (cm)	No. of leaves	No. of productive tillers	Grain yield (g/plant)
Control	79.8	9.12	30.2	5.6	5.23
Soil application	81.8	8.6	24.2	5.8	6.18
Foliar application	84.6	8.7	29.4	6	5.98
Soil & foliar application	80.8	9.7	29	5.8	5.87
SE <sub>d</sub>	8.28	0.8	5.7	0.5	0.38
CD (P = 0.05)	NS	NS	NS	NS	NS

NS – Non Significant

Table 3.8 : *Effect of micro nutrient zinc on the productivity of little millet*

Treatments	Plant ht (cm)	Root length (cm)	No. of leaves	No. of productive tillers	Grain yield (g/plant)
Control	75.4	9	35	5.9	6.4
Soil application	79.3	9.8	35.7	6	7.14
Foliar application	77.2	9.2	35.6	6.5	6.78
Soil & foliar application	81.2	8.5	35.6	6.4	6.42
SE <sub>d</sub>	2.8	1.3	4.5	0.54	0.32
CD (P = 0.05)	NS	NS	NS	NS	NS

Though the yield and growth parameters were slightly higher than the control they were not statistically significant. The nutrient content (quality) of the grains is being analysed.

The positive effects of nitrogenous biofertilizers (eg. *Azospirillum*) in improving the productivity of little millet landraces were checked in the spatial and temporal contexts. Nearly 100 farmers used the biofertilizer during the last season. A yield increase of about to 25-30% was recorded. The issues of timely

availability and quality input further strengthen the replication process in using biofertilizers.

#### **Food fortification**

New initiatives were started in market linkages through post-harvest value addition processes. The value added products such as dehusked millets (grains) and flour were packed and marketed in the super markets of nearby cities by the SHG members. Details of the nutrient composition and recipes were also displayed along with the products.

A leading food company in Chennai conducted food fortification trials in various products such as bread and cake and initiated a product development phase. A blind test was performed and evaluated on organoleptic properties of bread and cake. Efforts were continued in reducing the product and operational costs and increasing the nutritional value of the products while introducing a product in the market. The possibilities of introducing food products such as rusks, buns, chips and chapattis using millet flour are being explored.

### ***Revitalizing household food consumption***

The lessons learnt from previous experience reveal the significance of local festivals in spreading the message of millets consumption. Last year the members of SHGs organized a traditional food fair cum sale during the Tamil month of Adi at the festival of the Arapaleswarar temple in Kolli Hills.

The most limiting factor in household food consumption is the drudgery involved in processing (dehusking) millets. The constraint in processing was addressed with the installation of mechanical processing mills to dehusk the millets, which encouraged the local people to include millets in their daily diet and provided new opportunities in value addition and market linkages. Two such processing mills were established by SHGs with the technical support of MSSRF. The traditional food preparations of millet species are being collected and consolidated and it is planned to publish them in the form of a book in Tamil.

### ***Documentation and analysis of folksongs***

The collection of folk songs continued and new songs from the interior parts of Kolli

Hills were added to the list. An external expert was approached to review the collection. The process followed in identification, collection, review and consolidation and the concept, which facilitated the whole process, were meticulously recorded. The analysis has helped to increase the understanding of the cultural setting, institutions, norms and values of the Malayali tribe and also the bio-cultural diversity interlinkage, which have helped substantially to improve the quality of planning for biodiversity management.

### ***Self Help Groups and their activities***

Last year's experience with regard to market linkage with Tribal Co-operative Marketing Federation of India Ltd. (TRIFED) for selling minor millet through Self Help Groups enabled the SHGs to take up project initiatives and activities. Hence the process of forming new Self Help Groups continued. At present eighteen SHGs are operating effectively. Each group has 15-20 members and the total savings of the eighteen groups is around Rs. 1,50,000. The group composition includes men, women and mixed groups. Discussions are under way to assess the performance and grade the groups of six months' standing with the local commercial bank to receive revolving funds and financial support up to Rs 3,00,000 which would increase the capacity of the groups for internal credit and starting micro enterprises. An orientation workshop for SHG leaders focused on 'multiple livelihoods and entrepreneurship' was organised. Twelve proposals have emerged as an output of the workshop. A few groups have started their activities on micro enterprises: two groups are working on processing mills for millets and paddy and

three groups on collection centres for organic pineapple marketing. Preliminary discussions were initiated to amalgamate the existing groups into a federation with the aim of increasing the speed of self-replication, to create an environment of mutual help and also to share the lessons and experiences. The federation would take the responsibility of establishing a link between the line departments and Self Help Groups.

### ***Strengthening rural livelihoods through agro-industries***

Efforts were made to strengthen rural livelihoods through agro processing, based on the new initiatives on value addition and grassroot institution evolved last year. The project redefined its objective of value addition from fruit processing in Kolli Hills to primary post harvest practices such as grading, packing and marketing. The strategy was changed from a rigid co-operative society to SHG. Four groups were formed in different hamlets by pineapple growers.

Attempts have been made to identify the niche markets for pineapple by analyzing the comparative advantages vis-à-vis globalization. As Kolli Hills is producing pineapples organically, there is scope in the international market, where demand for organic foods is rising. Market linkages were established among SHG members, TRIFED and Ion Exchange Enviro Farms Ltd. (IEEFL), one of the largest corporate companies working on organic fruits and vegetables, undertaking contract farming and creating markets for organically grown products both within and outside India. Ecocert International Agency based in Germany was approached for organic certification.

MSSRF and CFTRI trained the farmers in organic farming practices, maintaining farm diary and primary post harvest operations with the help of IEEFL and TRIFED to form the supply chain. The inspector from the certifying agency has given organic certification for nearly 185 farmers for pineapple, guava and banana products in addition to minor millets for the year 2001-2002.

Three collection centres have been established in three hamlets to collect the produce. These collection centres and the procurement from certified farmers are being managed by SHGs. In addition to this, they have extended their support in maintaining the farm diary and monitoring the field operations and collection. IEEFL buys fruits from the three collection centres and transports the same to the certified processing unit.

### ***Association***

The Indian Association for Agribusiness Development (IAAD) was formed to integrate people's organizations with technical advisory units and to foster agro-industries linkages. It consists of selected members from the field of agribusiness and the corporate sector. Booklets highlighting the features and activities of the Association have been printed and a membership drive has been initiated among the food industries, corporate societies, individuals, institutions and students.

### ***Precision farming : Minor millet village module***

In Kolli Hills the farming communities used to grow crops like French beans and coriander after harvesting minor millets. This traditional farm practice helped them to have crop



diversity, nutritional security and soil health. During the last six months, minor millet growers in the four villages were encouraged to cultivate the second season crops mentioned above. Around 100 kg of coriander seeds and beans were given to them for cultivation. The SHG members volunteered to select good seeds from the local areas. Those seeds were also given to the cultivators.

After giving a brief orientation on PRA to the village participants, the socio-economic conditions of the two villages were documented. As the gender component plays an important role in poverty alleviation, maintaining crop diversity and food security, a gender orientation exercise was given to two SHGs in Periya Mangalam and Aleripatti.

Training in book-keeping was given to 4 SHGs. The members from two SHGs were given training on how to plan income generation activities with existing skills and local resources. The two groups in Periya Mangalam and Aleripatti showed a keen interest in procuring and selling minor forest produce such as tamarind and kadukkai instead of selling them to middlemen. Negotiations are going on with the Forest Department.

Two SHGs were taken on an exposure visit to Chinna Mangalam to see how a group formed by MSSRF is successfully running the minor millet cum paddy mill. They were also shown how a group had constructed a traditional community seed bank (thombai). After seeing this community seed bank model, the two SHGs wanted to construct such community seed banks in their villages. They have begun to construct such seed storage structures through collective effort.

### **Capacity building**

The group members (nearly 50 men and women) were given training on documentation of farm activities, certification procedures, packaging, cultivation norms for certification and collection after harvesting. CFTRI was involved in training and capacity building activities in the primary post harvest operations. Training and capacity building programmes for three SHGs were conducted to the tune of 1,377 trainee days. The organic farming practices and procedures of IEEFL and the farm diary were translated into the local language and given to the farmers.

In addition, the members of SHGs were trained in methods of precision farming, particularly in the application of biofertilizers to minor millets. Training programmes totaling nearly 3,800 trainee days were conducted in Kolli Hills.

The Centre organized the annual retreat-workshop on *Social Stratification and Process Documentation* from 26th February to 1st March, 2001 at Kolli Hills.

The objectives were:

- To familiarize the concept of social stratification (Caste, Class and Gender) and develop capacity to apply in the field situation
- To familiarize the concepts of institutions and processes influencing the project dynamics
- To acquire necessary skills for process documentation

The entire team of JRD Ecotechnology Centre participated in the workshop. A subject expert from the University of Madras and an

independent consultant served as facilitators. The following are the outputs of the workshop:

- JRD staff received training to develop process documents
- Process documents are to be prepared by JRD staff of their respective projects.

### **301.3 Semi Arid Regions**

The development of rainfed agriculture and value addition to time and labour, which are two important assets of the rural poor were given focus in the semi arid regions.

#### **301.3.1 Kannivadi**

Kannivadi region is a semi arid horticultural belt of Dindigul district, Tamil Nadu, where the livelihood in more than 50% of the households is agricultural labour. The ongoing programme aims at value addition to the time and labour of the rural poor as an important strategy for ensuring job-led growth and sustainable development through constant facilitation, capacity building, participatory research and field demonstration.

#### ***Ecopreneurships and ecojobs***

Ecopreneurship refers to technical, managerial and marketing capacities of the rural poor to organize themselves as entrepreneurs, produce materials strengthen and secure livelihoods and sustainable development. Ecojobs are employment opportunities which use natural resources efficiently and effectively without creating any environmental instability.

Rural women belonging to landless households with marginal annual income were targeted with the following objectives:

- to inculcate the habit of savings and introduce internal credit systems
- to train in skill enhancement and rural entrepreneurship and
- to initiate and manage micro enterprises to generate additional income

Discussions were held regularly with the village women to emphasize the need for, and explore the scope and feasibility of, adopting multiple livelihood strategies to improve their annual income. At the beginning of the year a workshop was conducted on 'Microfinance and Rural Entrepreneurship' for the SHG leaders to discuss the need and skills required for rural entrepreneurship and developing project proposals and micro plans for project implementation.

The following are some of the ecopreneurship being run by the SHGs in Kannivadi:

#### ***Village level biopesticide production***

The objective is to develop production of *Trichogramma* as a village level cottage industry and to empower the women agricultural labourers in the efficient management of the units by refining production technologies and marketing management. One of the women SHGs has been managing a production centre since 1999. They produced 2,500 cc of *Corcyra* which was sold to cover 850 acres of land. The SHG managing the unit has trained two other SHGs of which one has established its own production unit.

#### ***Value addition to banana wastes***

Banana cultivation is predominant in the villages around Kannivadi. The pseudo-stem of banana is thrown away as waste. The Centre took initiatives to convert waste into useful

products and one such effort is converting banana waste into enriched biomanure. Two SHGs consisting of women belonging to landless households have been trained in production and marketing. Each group has leased out one acre of land to produce biomanure and hybrid seeds. These groups are also involved in producing hybrid horticulture seed. The women members have mobilized two more women's groups and have become resource persons to train the women in biomanure production, marketing and seed production.

### ***Partition board and paper from banana and other organic wastes***

In addition to the production of biomanure, the Centre has identified the potential of producing paper and paperboard from banana wastes. The objective is to add value to the huge quantity of biomass produced in the block by converting it into partition boards and paper to enhance the annual income of the rural resource-poor households. Members of one women SHG have undergone intensive training for one month in making board and paper from organic wastes at the Centre of Science for Villages (CSV), Wardha, Maharashtra. A production unit was established with the financial support of District Rural Development Agency (DRDA), Canara Bank and "Friends of MSSRF". The group has prepared a business plan and completed the market survey. Around 10,000 kg of banana waste would be converted into boards and paper worth Rs.4,89,102 every year. In terms of employment opportunity 1,440 labour days for unskilled and 600 labour days for semiskilled labour would be generated during the first year. Twelve women belonging to landless dalit families are the owners of the unit. They have gained the capacity to

interact with the officials of banks and the local government agencies. The women have gained confidence in asset management and entrepreneurship.

### ***Backyard ornamental fish breeding***

Rural women belonging to resource poor families were trained in backyard ornamental fish breeding to enhance their annual income. As a part of the training programme an exposure visit was organized to a private company located on the outskirts of Madurai, and a series of interactive sessions were organized between the technical staff of the company and the women SHG members. Sixteen units have been established in backyards. Each unit has generated an income of Rs.700 for each harvest cycle (40 days). Buy-back arrangement with the company has ensured the supply of brooders and collection of fingerlings after every 40 days. Two more companies have shown interest in a linkup with the groups. Twenty women members have become resource persons to train other women in this region.

### ***Low cost greenhouses for hybrid seed production and high value vegetables***

To enhance the annual income of landless women through seed production and high value vegetables during the off-season, low cost green house technology was introduced. Ten units were constructed, using locally available materials. Since its construction three harvests have been completed, comprising one each of tomato hybrid seed production, tomato and radish (off-season vegetables). Capsicum (off-season) is the standing crop in the greenhouses at present. Each unit had an income of Rs.2,500 (within nine months). It is planned to increase the income by raising a nursery for high value

floriculture crops and orchids. Negotiations are on with private medical companies to find the market potential for medicinal herbs. Twenty women have become resource persons to train 40 women belonging to landless households in greenhouse construction.

### ***Other micro enterprises***

Efforts have been made to add a few more appropriate income-generating activities. A pulse-processing unit has been started with the aim of adding value to the farm product. The unit is being managed by a men's SHG. The other enterprise started as a group based activity is goat rearing through stall-feeding method. Two SHGs are involved in the activity. Encouraging results of farm level *Trichogramma* biopesticide have given confidence to the women SHGs to probe other areas of biopesticide such as *Chrysopa*, a predator for sucking pests and biofungicide like *Trichoderma viride*.

### ***Seed village project of Reddiarchatram Seed Growers Association (RSGA)***

Reddiarchatram Seed Growers Association is continuing its efforts to stand on its own as an independent organization. Apart from the regular companies for which RSGA has been producing seeds for the last five years, this year SIMA (South Indian Millers Association) is negotiating with RSGA to further increase the area under cotton seed production. National Horticultural Research and Development Foundation (NHRDF) has tied up with RSGA for chilly seed production. RSGA has also entered into a collaborative endeavor with MSSRF in designing and managing a website '<http://www.Oddanchatrammarket.com>.' with the support rendered by the commission agents of Oddanchatram Gandhi market. It is

expected that information supplied through the website would scale up the market turnover and increase the product demand. This would assure better prices for the farmers of the region. The Association has also established a Village Knowledge Centre at Kannivadi, focusing on meeting the information requirement of the farmers for sustainable agriculture and to disseminate the relevant information at the right time for the efficient marketing of their farm products.

### ***Community informatics: Village Knowledge Centre***

Modern Information and Communication Technologies (ICT) can play a major role in sustainable development. Information empowerment through computer-aided and Internet-connected systems helps to bring down the massive transaction cost which the rural community is facing and ensures the community's dual role as both recipient and supplier of information in the rural development process. It also helps in strengthening the skill and marketing ability of the various enterprises. The Centre aims at transferring generic knowledge into location specific knowledge that can be acted upon. The experience of various projects in Kannivadi region shows that information empowerment is a crucial aspect of development in the region.

A hub has been established at Pudukhathiram near Oddanchatiram. Participatory training was organized for selected men and women farmers of the region on computer applications in rural development and applying the participatory techniques to identify the need driven information to different economic sectors. The villagers extensively documented the following aspects in Tamil: agricultural

***Process of evolving micro enterprises***

Organizing PRA, Participatory Assessment Monitoring and Evaluation (PAME) and baseline survey are the regular features of the project-process. PRA was extremely useful in identifying the employment opportunities available during the different seasons in a year, details of household income, expenditure, and crisis management, daily activities and time allotted to each activity of male and female villagers and also the market network for agricultural produce. PRA tools like social mapping and wealth ranking analysis were effectively utilized to identify the project partners as the poor and the poorest of the region. In the gender analysis, an attempt was made to find the gendered division of labour, the status of women in relation to the right to use, to own and sell the different household properties and means of production of the household and the role and participation of women in decision making at the intra-household and community level. MSSRF staff and the respective women SHGs involved in the different enterprises prepared the first joint micro plan. The training and active participation helped them to gain the capacity to prepare the subsequent micro plans on their own. Inputs derived from periodical participatory evaluation helped the group members to prepare a realistic micro plan. Base line data often constitute a useful component of the situation analysis, which would serve effectively for subsequent micro planning according to the requirement and to evaluate the impact and sustainability of the intervention.

issues such as soil health, pest management for horticultural crops, post harvest management, market details - input prices and horticultural and grain prices, hybrid seed production, health aspects, government development schemes.

Men and women farmers visiting the centre are mainly interested in agricultural aspects and hybrid seed production. The other area which attracts many visitors to the centre, especially the marginal groups of society, is rural development programmes sponsored by the government. Five more hamlets were identified and discussions are going on with the villagers to establish Village Knowledge Centres.

***Precision farming for poverty alleviation***

Under this programme, various activities such as seed village, pulse village and lysimeter

experiments have been undertaken. The results are of great relevance and significance to the rural community.

***Seed Village module***

Field trials, along with training and demonstration on precision farming techniques, especially Variable Application rate Technology (VAT), were conducted. VAT refers to the process of identifying the diversity of nutrients in a piece of agricultural land and managing nutrient inputs accordingly. Cultivation of two vegetable crops (tomato and brinjal) was taken up to evaluate the economic returns as off-season crops. Training on seed production was done for bhendi, paddy and cotton. Cultivation and production of hybrid paddy seed is being demonstrated for the

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first time in this programme at Kannivadi. Preliminary analysis of the use of fertilizers at the seed village demo plot trials (Table 3.9) has shown that using VAT techniques it is possible to reduce fertilizer cost (64% in brinjal, 78 in tomato and 69 in bhendi) when compared to blanket recommendation based on crop requirement without soil testing. It is estimated that by following VAT techniques, a farmer would be able to save about Rs. 3,500 per hectare, depending upon the crop cultivated, soil status and the crop fertilizer requirement.

During the reporting period 610 trainee days were completed. Arrangements have also

been made to provide financial assistance to 20 farmers through the SHGs for undertaking seed production.

### *Pulse village module*

The cultivation of red gram under VAT method was demonstrated during the year. One acre was divided into 10 equal plots of 10 cents each for a detailed study of the impact of VAT with specific reference to nutrient management. The demonstration showed that the VAT method ensures substantial productivity, while reducing the input cost to a considerable extent (Table 3.10).

Table 3.9 : *Percentage of fertilizer saved through VAT technique*

Method	Fertilizer saved in crops		
	Brinjal	Toarnto	Bhendi
Conventional soil based application – random soil sampling	47	24	25
VAT based application – grid soil sampling	63	78	69

Table: 3.10 : *Comparison between conventional soil based application and VAT technique*

Method	Cost (Rs.)	Quantity of fertilizer saved (%)
Blanket recommendation	1,000	-
Conventional soil based	845	15.5
VAT based	606	39.4

Table: 3.11 : *Comparison of profit between the conventional cultivation practice and VAT technique*

Method	Yield (kg/ha)	Total Expenses (Rs.)	Total Income (Rs.)	Net Profit (Rs.)
Conventional cultivation	1,061	10,997	23,142	12,145
VAT technique	1,206	10,781	26,532	15,751

The average yield of red gram at the pulse village demonstration plot has been 1,275 kg/ha. Compared to the Tamil Nadu average it is greater (48%) and is comparable to the potential of SA1 variety of red gram released by TNAU. The use of fertilizer has been reduced by 39% for this crop. 20 farmers have been following the VAT method for cultivating Bengal gram. Each farmer had allotted 0.5 acres of land for practising VAT.

Table 3.11 shows that the productivity under VAT is higher than that of the conventional practices, without a major increase in expenses. The ratio between expense and income for normal practices is 1:2.10 while for VAT technique it is 1:2.46. The fertilizer applied has also been reduced by about 20% for urea and single super phosphate when compared to normal operations. This supports our earlier hypothesis that following the VAT method can reduce fertilizer application (without affecting the net profit of the farmer).

### ***Lysimeter experiment***

Lysimeter experiment was conducted to study the plant soil relationships, evapotranspiration rates and leaching losses. It also helps to estimate the nutrient and water requirements of different crop varieties during different seasons to effectively practise precision farming.

Experiments were conducted using manually operated lysimeters to study the exact quantity of nutrient (nitrogen (N)) and irrigation requirement for cultivation of Vaishali variety of Tomato during June –July. Three different levels of nitrogen and irrigation were followed. The amount of water applied was equal to the total crop water use since the previous irrigation and N applications were

based on the total crop requirement for N and applied according to field conditions through fertigation method. The drainage water was collected daily and analyzed for N at 15 days' interval. Yield and other growth components were monitored, measured and analyzed statistically.

The results showed that the application of irrigation at 25% higher than the crop water use gave higher fruit yield per plant compared to 25 % lower and 50 % higher levels. Although plant height, leaf area, flower production and leaching losses were higher in 25% higher irrigation levels, they were statistically nonsignificant compared to the other two treatments. Under the different N levels, 75% of the recommended amount gave higher fruit yield with reduced leaching losses than 25% and 50 % higher doses.

The interaction between different levels of N and irrigation indicated that the application of 25 % higher irrigation based on the effective crop water use and 25 % lower N than recommended amount, gave fruit yield with reduced leaching losses of nitrates. Based on the feedback from the trial, the second experiment would be designed for the next crop.

### ***Self-replication of SHGs and 'Kulumai' federation of Self Help Groups***

The self-replication of SHGs continued. At present 54 SHGs are functioning in the region with a total savings of Rs.3,88,329. Appreciating the efforts of the SHGs the local bank has helped them by providing Rs.1,40,000 as matching loan to enhance the ability of their internal crediting system. The repayment rate by the SHGs to the bank is more

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than 100%. The utility pattern of the loans received by the SHGs shows that of the 377 members, 150 have spent the money for agriculture and cattle rearing, 70 members for their children's education and 24 to start micro enterprises.

The Self Help Groups operating in Kannivadi region were brought under the same roof by forming a federation called *Kulumai*. The word '*Kulumai*' in Tamil stands for a traditional grain storage bin. The federation has three objectives:

- Capital mobilization through self savings and internal crediting and facilitating credit between SHGs
- Ecopreneurship development for livelihood strengthening of the rural poor
- Monitoring the activities of the SHGs

The lowest stratum of the structure of the federation consists of all SHGs. All the members of the SHGs form the general body of the federation. The SHGs of the same area were brought together as clusters. These clusters form the next layer in the structure. The leaders of the SHGs in the respective area are the members of the clusters. The apex body of the federation consists of 11 members representing the different clusters from different areas. Among the eleven, four are women.

Rules and norms for operating the federation were evolved through group discussions among the leaders of SHGs. A joint account was opened in the name of '*Kulumai*' at Canara Bank, Kannivadi.

All SHGs operating in the region are interconnected through a computer network. The details of SHGs are constantly being updated.

This would facilitate internal lending among the SHGs.

Local officials from Rural Development agencies and banking institutions have assessed the performance of SHGs. Based on the evaluation these groups were graded and selected for receiving a matching grant which could enhance their internal crediting capacity and provide financial support to start group based micro enterprises.

A series of dialogues was organized between SHG members, leaders and district government officials. An interactive session was also arranged at which the Chief General Manager, NABARD interacted with the SHG leaders and responded to their queries. A similar meeting was organized on 15 August, 2000 between the members of the SHGs and the department heads of Dindigul district and bank officials. The officials promised to extend maximum cooperation and support for replication of all successful ecopreneurship programmes to help the resource poor households in the region.

### ***New initiatives of grassroot institutions***

The progress in Kannivadi biovillage project is due to the initiatives taken by the local grass root institutions like RSGA and *Kulumai* federation with the support of MSSRF. Reddiarchatram Seed Growers Association has initiated a project on *Sustainable and value added agriculture* with the objective of supplying information and conducting training programmes to develop the capacity of labourers and farmers of Kannivadi region and extension staff from government departments and NGOs. Similarly *Kulumai* has taken up the responsibility jointly with MSSRF and IGNOU for community mobilization,



development of Learner-Centered materials and community learning. The programme would be implemented through SHGs managing village telecentres in two villages for information supply and educating illiterate adults and school dropouts in the villages.

### ***Capacity building and process documentation***

Capacity building is a process of constantly improving skills to meet the demand/requirement. Different methods like classroom training, field demonstration and exposure visits were organized regularly. 4,759 trainee days were covered during the year. Process documentation records the dynamics of the project and also facilitates the dynamics by critically looking into the thinking process of the programme. The processes of the projects at different stages like problem analysis, planning, developing monitoring and evaluation plans were regularly recorded and converted into process documentation reports. This exercise helped to refine the perspective and keep the plan flexible, providing scope for midcourse correction and improvement in the quality of planning and implementation. Other methods adopted to supply information to the farmers and farm labourers were preparing and distributing pamphlets, bit notices and manuals.

### **301.3.2 Pudukottai**

A project was launched in collaboration with Ohio State University, USA on "*Sustainable Management of Natural Resources for Food Security and Environment Quality*". This project aims at defending the gains of the green revolution in alluvial soils in Punjab, consolidating the gains in the vertisols soils

in Madhya Pradesh and initiating a new green revolution movement for rainfed agricultural systems particularly in alfisols soils in Tamil Nadu. Punjab Agricultural University (PAU), Ludhiana and Jawaharlal Nehru Krishi Vishwa Vidyalaya (JNKVV) Jabalpur are partners in this project. The objective of the project is to finetune the technologies for integrated management of natural resources as a strategy to achieve food security and enhance environment quality. The objectives are to be achieved through participatory research and demonstration and capacity building. The Project is managed by a steering committee and is being coordinated by MSSRF.

As a part of this project, a development project has been initiated at Annavaasal Block in Pudukottai district, Tamil Nadu. The project focuses on revitalizing the agricultural resources in the degraded alfisols soils particularly in *vialogam* series. This soil is characterized by shallow to moderate depth with acidic pH. It is highly eroded and the surface layer is rich in iron. Lack of organic matter and poor fertility have led to the decline of agriculture in this region.

The project began its activities by forming a network of various agencies involved in agriculture with the help of the Department of Agriculture and Tamil Nadu Agricultural University. A village has been identified for participatory research and demonstration. The objective of this project is to involve the villagers as resource persons in managing rainfed agriculture in degraded areas. Through a process of social mobilization, the villagers were brought together. Participatory Rural Appraisal was conducted and a plan of operation was jointly evolved with the

villagers. Two SHGs have been formed and the villagers were taken to Kannivadi for discussions.

Soil survey was also conducted and the quality of the soil at various levels has been assessed. At present a baseline survey is being conducted in the village. The visit of experts from Ohio State University has identified certain issues such as binding of iron with phosphorus in this region. Contour maps are being prepared for efficient soil and water management. The involvement of scientists and villagers in evolving a joint strategy to tackle the problems of rainfed agriculture in this region augurs well for the progress of the project in the coming years.

### **301.4 Chennai**

The laboratory at Chennai has been focusing primarily on biopesticide production and supporting the JRD Tata-Ecotechnology Centre's activities through research and regular training programmes.

#### **301.4.1 Biopesticide production**

One of its main areas of research is plant extract. During 1999-2000 four plant species being used as green manure by the local communities of Kolli Hills were selected. Initial work was concentrated on *Dodonaea viscosa*. Experiments were planned and executed to tap the insecticidal properties, if any, from these plants. After various treatments hexane extract was found to stimulate egg laying but arrest hatchability. Hence, hexane extract of *Dodonaea* was selected for further studies.

In 2000-2001, crude hexane extract was subjected to fractionation to narrow down the compounds with insecticidal property. In addition, three more plant species (*Clausena dentata*, *Cipadessa bacciferra* and *Melia dubia*) were included for tapping the potential properties.

*Efficacy of hexane fractions of Dodonaea viscosa on Helicoverpa armigera:* Crude hexane extract of *D. viscosa* was subjected to fractionation. Through Column chromatography 12 fractions were obtained using hexane and ethyl acetate solvent combination. These fractions were tested against adult moths to observe adult longevity, fecundity and hatchability. Among the different fractions tested, fraction 1 recorded a meagre 11.6 eggs in four days of oviposition. This was followed by fraction 8, which produced 42.3 eggs in 8.3 days. Among all the solvents, hexane was found to be the best with 19.6 egg production. All these treatments resulted in zero hatchability.

Trial TLC (Thin Layer Chromatography) was run to observe the chemical compound profile. In this study, fractions 2 to 10 displayed similar profiles whereas Fraction 1 and methanol fraction differed in mobility. Hence, fractions 2-10 were pooled together. The pooled fraction was subjected to further fractionation. It resulted in four fractions (Fr I-IV). Primary TLC was run for the four fractions and methanol fraction. None of them possessed similar chemical profiles. These four fractions were tested for adult longevity, total eggs laid and hatchability (Table 3.12).

The total eggs laid by the moths treated with fractions using chloroform and benzene combination showed that fraction 4 was

effective as it resulted in 832.6 eggs in its life span of 13 days. When hatchability was compared, fraction 1 was found to be superior with just 7.09 %.

*Effect on growth and development* : The resultant progenies from 12 fractions were maintained on normal diet and observed for pupation and moth emergence (Table 3.13).

Fourth instar of *H. armigera* larvae which hatched from different fractions (Fr4-C, Fr5(H)-C, Fr5(EA)-C, Fr9-C and MS-C) were transferred to normal diet and their growth and development status were analysed. Fr4

reflected the least pupation (13%) and the corresponding healthy moth emergence was nil. Compared to it, interesting results were also observed in MS-C treatment where 76% pupation resulted in 12% healthy moth emergence. Pupae from Control recorded the highest pupal weight (380.0 mg) and pupal size (3.07 cm) whereas it was least in MSC.

*Treatment on H. armigera adult* : Fresh leaves of *Cipadessa bacciferra*, *Dodonaea viscosa*, *Clausena dentata* and *Melia dubia* were shade dried and powdered. Serial solvent extractions were carried out using hexane,

Table 3.12 : *Bio-efficacy of hexane fractions of D.viscosa on H.armigera*

Treatment	Adult longevity (Days) *	Total eggs laid (No) *	% hatchability *
Control (C)	12.3	1,519.6	59.03 (50.58)
C + Fraction I	14.3	1,068.6	7.09 (15.17)
C + Fraction II	16.0	942.3	15.49 (23.04)
C + Fraction III	12.3	1,138.0	10.44 (18.59)
C + Fraction IV	13.0	832.6	24.11 (29.24)
C + Benzene Solvent	13.0	907.3	15.61 (22.95)
CD (P<0.05)	2.61	373.58	12.44

\* Mean of triplicate; Figures in parenthesis are arc sine transformed values.

Table 3.13 : *Bio-efficacy of hexane fractions of D.viscosa on growth and development of H. armigera*

Treatment	% Pupation*	Pupal weight (mg)*	Pupal length (cm)*	% Moth emergence*	
				Healthy*	Malformed/dead*
Control (C)	80.00(63.44)	380.00	3.07	100.00(90.00)	0.00 (0.57)
Fr4-C	13.33(21.14)	280.00	1.90	0.00 (0.57)	100.00(90.00)
r5(H)-C	73.33(59.21)	190.13	1.46	26.38 (30.62)	73.61 (59.37)
Fr5(EA)-C	46.66(43.07)	257.83	1.61	13.33 (13.45)	86.66 (76.92)
Fr9-C	60.00(51.14)	170.41	1.39	45.00 (41.93)	55.00 (48.07)
S-C	76.60(61.92)	167.03	1.39	12.03 (16.67)	87.66 (73.51)
CD (P<0.05)	12.78	32.52	0.16	23.56	23.82

\*Mean of triplicate; Fr-Fraction; H-Hexane; EA-Ethyl acetate; MS-Methanol solvent  
Figures in parenthesis are arc sine transformed values

acetone, petroleum ether, chloroform and water. Known quantity (2-ml/ day for four days) of 10% crude extracts were given with honey for adult moths (5pairs/replication). Three replications were maintained for each treatment. Adult longevity, fecundity and percentage hatchability data are presented in Table 3.14.

Different treatments exhibited variations in their activity. Adult moths survived for a long period (14 days) in petroleum ether solvent while survival was least (3 days) in acetone extract of *M. dubia*, chloroform and petroleum ether extracts of *D. viscosa* and chloroform extract of *C. dentata*.

Among the different extracts used, zero egg laying was observed in chloroform and petroleum ether extracts of *D. viscosa* and chloroform extract of *C. dentata*. This was followed by acetone extract of *M. dubia* (11.6 eggs). Highest egg laying was seen in water extract of *C. bacciferra* (1,597.0 eggs).

Zero hatchability was reflected in many treatments, the most effective being water extract of *C. dentata* and chloroform extract of *C. bacciferra*. These were followed by petroleum ether and hexane extracts of *M. dubia*, which showed 4.5 and 6.16% egg hatchability. Compared to control all the treatments proved better in discouraging hatchability, except petroleum ether extract of *C. bacciferra* which resulted in 54.5%.

*Effect on growth and development of larvae:* The resultant progenies (Table 3.14) from various treatments were cultured on a semi-synthetic diet. The fourth instar larvae were selected for study. Treatments were fixed as follows: diet, diet + extract, diet + solvent.

Percentage of pupation, pupal weight, pupal length and malformed/dead moths were recorded. The resultant progenies of *C. dentata* treated moths could not survive beyond the third instar and hence it was not included in the study. Hence, among the treatments, the percentage of pupation was minimum in chloroform and water extracts of *M. dubia* (5.5%). It was followed by 21.1% pupation in acetone and petroleum ether extracts of *C. bacciferra*. Pupal weight and length were less in almost all the treatments except normal diet. The percentage of malformed /dead moths was highest in chloroform extract of *M. dubia* and petroleum ether extract of *C. bacciferra* (100%) followed by hexane and water extracts of *M. dubia* (95.2 & 80.9% respectively).

*Treatment on second generation moths:* The resultant healthy moths from *C. bacciferra* and *M. dubia* were tested for egg laying and hatchability. The moths emerging from AS (Acetone solvent) treatment of *C. bacciferra* were fed with solvent along with honey solution (normal diet) while all other moths from the various treatments were given a normal diet. The adult longevity, total eggs laid and hatchability were noted.

The results obtained from second generation moths showed least egg laying in PE-N (Moths emerged from petroleum ether extract was given honey solution) of *M. dubia* and *C. bacciferra* (11.3 & 339.6).

*Repellent study on Tribolium castaneum (Red flour beetle) a stored product pest, which serves as a competitor in Corcyra production:* A simple experiment was conducted to find a suitable plant extract which would deter or inhibit the growth and multiplication of this beetle. Leaf powder of

Table 3.14 : *Efficacy of four botanicals on adult longevity, fecundity and egg hatchability of Helicoverpa armigera*

Treatment	Adult longevity (days)*				Total eggs laid (No)*				% hatchability*			
	Cb	Cd	Dv	Md	Cb	Cd	Dv	Md	Cb	Cd	Dv	Md
Control (C) 10% honey	10.0	7.3	713	713	713	713	901	1,058	85.90(68.06)	85.90(68.08)	50.01(45.02)	86.50 (67.51)
C+ Acetone extract	6.3	11.7	1,235	867	1,235	867	236	11	19.10(25.88)	18.95(25.97)	37.13(37.33)	0.00(0.57)
C+ Chloroform extract	10.3	3.0	926	0	926	0	0	637	0.00(0.57)	0.00(0.57)	0.00 (0.57)	12.30(20.53)
C+ Hexane extract	5.6	11.7	87	1,369	87	1,369	970	877	0.00(0.57)	23.22(28.97)	38.61(38.40)	6.16(14.3)
C+ Petroleum ether extract	9.6	11.0	640	781	640	781	0	672	54.50(47.63)	31.74(34.26)	0.00(0.57)	4.50(12.18)
C+ Water extract	12.0	11.7	1,597	298	1,597	298	395	1,406	35.60(36.60)	0.00(0.57)	26.82(31.15)	35.30(36.50)
C+ Acetone solvent	13.0	13.0	1,510	1,506	1,510	1,506	1,540	1,510	0.00(0.57)	0.00(0.57)	0.00 (0.57)	0.00(0.57)
C+ Chloroform solvent	13.0	13.0	740	735	740	735	760	740	0.00(0.57)	0.00(0.57)	0.00 (0.57)	0.00(0.57)
C+ Hexane solvent	5.0	5.0	17	21	17	21	18	17	0.00(0.57)	0.00(0.57)	0.00(0.57)	0.00 (0.57)
C+ Petroleum ether Solvent	14.0	14.0	1,219	1,229	1,219	1,229	1,247	1,219	0.00(0.57)	0.00(0.57)	0.00(0.57)	0.00(0.57)
CD(5%)	2.03	2.71	170	62	170	62	228	175	3.07	2.00	5.51	2.53

\*Mean of triplicate; Figures in parentheses are arc sine transformed values; C. b.-*Cipadessa baccifera*; C.d. -*Clausena dentata*; D.v.-*Dodonaea viscosa*; M.d.-*Melia dubia*

nine different plants of medicinal and indigenous value was mixed with wheat flour (20 gms of leaf powder for 100 gm of wheat flour) and was replicated thrice. 30 adult beetles were released per replication and the number of beetles, which emerged after 27 days of treatment were counted. The number of adult beetles was least when treated with *M. dubia* (74.3).

The experiments conducted so far indicate that these plant species are effective in inhibiting egg production, hatchability and retardation of growth and development of *H. armigera*. The results obtained encourage the use of these plant species as future biopesticides. Experiments are being undertaken in this direction.

### **301.4.2 Hatchery Activities**

*Breeding of freshwater prawn Macrobrachium rosenbergii* is being carried out in the hatchery at MSSRF, Chennai in order to formulate an appropriate production model involving research, demonstration and training. The project looks into various aspects such as the broodstock availability, seasons, fecundity and survival rate, water purity level analysis, procurement of seawater and freshwater and optimal physio-chemical parameters required for the breeding and rearing of freshwater prawn larvae and postlarvae. Emphasis is also being given to proximate analysis of the nutrient content of the supplementary feed given to the larvae and studies are being conducted to supplement the use of *Artemia salina* and nauplii (a brine shrimp) that occupy the primary food chain along with other phytoplankton and zooplanktons. Day to day observations were also made on the energy usage

level in order to arrive at an efficient production model for fresh water prawn.

Training programmes with different modules were conducted to benefit the end users and also to familiarize them with the breeding and management of fresh water prawn in a recirculatory type hatchery. Thirty rural women were given training in various aspects of breeding. Thirty Post-graduate students were given exposure to hatchery techniques and water quality analysis involved in fresh water prawn breeding and production.

Sixty thousand postlarvae were produced in the hatchery in one operation cycle and were sold to prawn farmers at Nellore (35,000), Department of State Fisheries, Pondicherry (1,000), IIFS project site at Chidambaram (5,000), Biocentre project at Pondicherry (2,000) and State Fisheries Department, Chennai (7,000). In the second operation cycle, mass mortality was observed and the cause has been studied using histopathology techniques. Results show that unregulated power supply may be a reason for the respiratory choke that has caused inflammation on the gill lamellae, while other water quality parameters and feeding regime showed no significant difference.

A pilot study was carried out to study the salinity tolerance level of the postlarvae of freshwater prawn with different salinity ranges and dissolved oxygen content of the culture medium under laboratory conditions for a period of 96 hours. The result of the study showed that the survival of the postlarvae of freshwater prawn is significant at freshwater and low saline water (> 3.8ppm), temperature (28°C – 30°C) and pH (8.0 – 8.5). The dissolved oxygen level was 4.3mg / L at low saline conditions (> 4 ppm).

*Backyard ornamental fish breeding* enterprise was started with the objective of providing supplementary income to rural landless dalit women's households. The production and profit achieved by them was comparatively low. Their feed samples were analysed for the carbohydrate, protein and lipid content. Based on the results that showed a low protein content, training was imparted on balanced feed formulation and preparation.

Based on the input details and marketing particulars collected systematically from the trainees, an analysis has been carried out in the form of stochastic sensitivity analysis. In this analysis, the biological factors are inherently varied as against the economic factors and each variable is made to be constant one at a time while others remain dependent in order to determine the chances of success of the project and survival of the fish.

The outcome of the study suggests that this type of project holds a cent percent chance of survival. The stability is because of the uniformly-spread yield throughout the year. The economic success depends not only on the investor's expected rate of return and the assumed level of biological and economic factors, but also on management capabilities, market conditions and above all, the willingness to take a risk.

*Aquarium fish were bred* inter specifically as a trial to produce parent-stock in the Chennai centre for distribution to the "All Women Fish Growers Association" that functions at Keelamanakudi. Diversification of species has been planned. Compatibility studies have been performed for different live-bearers species in aquarium tanks in the hatchery. Results showed that inter-specific breeding could be achieved only at 40% level in glass

aquaria, using induction. For the compatibility studies, in addition to *Poecilia reticulata* and *Xiphophorus helleri*, *Xiphorus maculatos*, *Carassius auratus* and *Pterophyllum scalare* could be used as live bearers. The balanced nutrient feed stabilised for the ornamental fish culture group has been transferred to another project site, Kannivadi to breed aquarium fish. *Trichogramma* wastes were used as feed ingredient and are being tested in the culture tanks of Keelamanakudi.

### **Sub Programme Area 302**

### **B V Rao Centre for Sustainable Food Security**

One of the main activities of the B V Rao Centre during the year was the preparation of the Food Insecurity Atlas of Rural India, undertaken jointly with World Food Program (WFP), a United Nations Organization. This innovative Atlas was released by Shri Atal Behari Vajpayee, the Hon'ble Prime Minister of India, on 24th April 2001 at New Delhi. The book release was followed by a two-day consultation on "Towards Hunger Free India", under the aegis of MSSRF, WFP and the Planning Commission, Government of India. A ten-point agenda for action was prepared at the end of the two-day consultation. Subsequently, a booklet titled 'Towards Hunger Free India', was released by Shri N Ravi, Editor, The Hindu, at a function held at MSSRF on 11<sup>th</sup> May 2001. It contains the speeches of the Prime Minister and other dignitaries who participated in the book release function and the ten-point agenda for action to make India hunger free.

Other activities under this programme area include the Hunger free Area Programme and the Pilot Project for elimination of micronutrient malnutrition in Tamil Nadu.

### **302.1 Food Insecurity Atlas of Rural India**

Issues relating to food insecurity at the level of every child, woman and man in the country were considered in an integrated and holistic manner in the preparation of the food insecurity atlas of rural India. The analysis deals with food availability (a function of home production and imports), food access (a function of purchasing power, sustainable livelihoods and employment opportunities) and food absorption in the body (a function of access to clean drinking water, environmental hygiene and primary health care).

The three time dimensions of food availability, namely present availability, potential availability and availability under unforeseen crisis-situations were taken into consideration.

- Present availability is based on current production across the states.
- Potential productivity is based on sustainability criteria like forest cover, soil degradation and ground water pollution and depletion. Biodiversity loss and climate change are other factors for which data is not currently available, but they could cause production instability in the future.
- Crisis in food availability is also caused by disasters such as drought, floods, cyclones and earthquakes.

Food access was considered from three angles : chronic problems of food access, transient problems of food access and problems of food access caused by gender and social discrimination.

- Chronic problems of food access and deficient calorie consumption are due to extreme poverty and the lack of assets, education, employment opportunities and rural infrastructure.
- Transient problems of food access are due to seasonal factors such as failure of monsoon or excess rains, changes in prices, etc., which cause crop loss and loss of livelihoods and entitlements, and are normally restricted to a single agricultural season.
- Problems of food access are associated with gender and social discrimination. Differentials in wages, literacy and access to health care and disparities in food distribution are common across the states. They are reflected in the highly skewed sex ratios and low female literacy rates.

Food absorption has been found to be affected by problems caused by deficient calorie intake, deficient micronutrient intake and incidence of disease.

- Inadequate absorption of calories leads to protein calorie malnutrition and associated problems of marasmus, kwashiorkor, stunting, underweight and wasting in children and low body mass index in adults.
- Inadequate absorption of micronutrients results in iron deficiency, anaemia, vitamin A deficiency, etc.



- Problems of absorption are often caused by disease and intestinal infection arising from the lack of safe drinking water and health care facilities.

All these aspects have been examined across the states with the help of the chosen indicators, placing each state in the order of severity of the problem. The analysis has revealed that non-food factors also play an important role in causing food insecurity.

It was noticed that the link between production and consumption is weakening. Production is being increasingly undertaken for the market and driven by the market and prices. The local food requirements of the people and the local demand for food are met by trade, wherever the livelihood access is good. Diversification of agriculture, particularly into horticultural crops as in Karnataka, Andhra Pradesh and Maharashtra, or diversification into livestock products as in Gujarat, Punjab, Haryana and Rajasthan, improves livelihood access. The link between production and consumption is mainly livelihood access. It should however be emphasized that farm families constitute the majority of our population. Their first priority in land use is to meet their home needs, next comes the market.

Environmental degradation has important implications for sustainable food production and availability. States that produce large amounts of food grains today will have to protect their environment from degradation. The states of Punjab and Haryana particularly, are exploiting natural resources at a very fast pace. Other states such as Assam and Bihar have vast potential to produce more by utilizing the natural resources to greater levels.

Moreover, the introduction of leguminous crops into the cropping systems has to be considered more seriously, at least wherever it is possible, to make them profitable. Forest management and conservation are important in the states of Orissa, Assam and Madhya Pradesh, which have a large forest area. There is a danger of forest depletion in these states with forests being destroyed for crop and animal production, if people are not provided with alternate employment.

The analysis has brought out some important aspects of food consumption of the lower income groups in terms of depth and spread of hunger. The spread of hunger is given by the percentage of population consuming less than 1,890 Kcal per consumer unit per day and the depth of hunger is given by the calorie consumption of the lowest ten percent of the population per consumer unit per day. It is observed that the spread and depth of hunger are more in the areas with deficit production and the areas with a large number of people dependent on casual employment as in Kerala, Tamil Nadu, Gujarat and Maharashtra. Other factors that contribute to the depth of hunger appear to be the lack of non-agricultural employment opportunities and low wages to labour as in the case of Madhya Pradesh and Bihar. Transitory food insecurity due to drought adds to the problems, as in the case of Gujarat.

Another important finding is that the states with access to more land and less dependence on casual labour are protected from hunger. The depth and spread of hunger are very little in the states of Rajasthan and Uttar Pradesh in normal years. Fewer landless has not helped Kerala, since the number dependent upon casual labour is high and the land base

is too small. Yet another important factor, which probably helps to reduce the depth and spread of hunger, seems to be government transfers. West Bengal is a case in point. The calorie consumption of the lowest ten percent in West Bengal is as good as that of Punjab, Haryana, Rajasthan and Uttar Pradesh, despite the existence of a larger number of landless families and those dependent upon labour income. Probably better targeting of the rural programmes such as IRDP, that reach the landless more effectively, better wages, and more importantly, a smaller deficit in production over requirement have helped West Bengal.

Gender discrimination in access to food, health care, literacy, livelihoods and wages, is of great concern. The sex ratio is becoming increasingly adverse to women. Women and girl children often suffer greater nutritional deprivation. Except in Kerala, the average life span of women is low in all the states. These trends are opposite to global trends and point to the need for viewing a household as not being a homogenous unit. Therefore strategies for hunger elimination should be based on individuals and not households.

Rural health infrastructure plays an important role in reducing the infant and child mortality rate and improving life expectancies and nutrition status, even if the livelihood access is not so good and calorie consumption is low. Government programmes such as the Mid-day Meal Programme, Integrated Child Development Services and other programmes such as universal immunization etc., bring better nutrition status to the population.

The composite Food Insecurity Map of India (*on the cover of the Annual Report*) that takes into account nineteen indicators, is a blend of the three aspects of food availability, food access and food absorption. The map reveals the following facts: Bihar is most food insecure and Punjab is the most food secure state. There are some states in shades of red, implying that they are food insecure states. There are some states in shades of green, indicating the food secure states. There are others in yellow, which fall in a category between the other two. All of them have some positive aspects and some negative aspects of food availability, food access and nutrition status.

Barring Gujarat, all the states in the shade of red, Madhya Pradesh, Uttar Pradesh, Rajasthan and Orissa, have much in common. They have high levels of poverty and a not so healthy rural population. An interesting feature is that their poor health status and lower life expectancies do not seem to be an outcome of low calorie consumption. Physical access to food is better in these states. Poverty and lack of health care appear to be the problems. Despite a low level of poverty, Gujarat is the odd one out that falls in this category, due to the food availability and health problems of its rural poor.

Himachal Pradesh appears to be as food secure as Punjab in every respect. Tamil Nadu and Kerala deserve special mention. Kerala is a food deficit state and both Kerala and Tamil Nadu are poor in livelihood access. These states have become fairly food secure against many odds. They have better health care, better infrastructure and better nutritional status of their rural population.

The States of Andhra Pradesh, Assam, Maharashtra, West Bengal, Karnataka and Haryana fall under the third typology or the middle category. Each one of them has achieved food security in some respects though not in all respects. Andhra Pradesh and Karnataka have diversified their agriculture and reduced rural poverty, but have not been able to achieve the nutritional status of Tamil Nadu. West Bengal deserves special mention in this category. In spite of rural poverty, the spread and depth of hunger are negligible in West Bengal. The calorie consumption of the lowest ten percent of the population is as high as that of Punjab. Haryana is far behind Punjab in many respects. The agricultural prosperity has not trickled down as in Punjab to the lower strata. Haryana has good rural infrastructure but poor health infrastructure, exposing the rural population to health problems.

The study clearly points to the need for policy and programme interventions, for environmental conservation and improvement of livelihood access, food access and the nutritional status of the people. The recommended ten-point Action Plan consists of the following:

- Identification of vulnerable individuals
- Information empowerment
- Eliminating Protein Calorie Malnutrition and energy deprivation
- Eliminating hidden hunger caused by micronutrient deficiencies
- Special attention to women and children
- Drinking water and environmental hygiene

- Enhancing purchasing power through sustainable livelihoods
- Special strengthening of food based safety nets
- Linking disaster mitigation with development
- Greater market access to farm products

### ***State Level Reports of Food Insecurity***

The Food Insecurity Atlas of Rural India depicts the position of the different states at the macro level. District level studies are needed to further explore and understand the problems within a state at a micro level, before undertaking programmes for implementation.

Towards this end, Food Insecurity Reports of the states of Orissa, Rajasthan and Madhya Pradesh are under preparation. The reports follow the methodology adopted in the preparation of the Food Insecurity Atlas of Rural India.

In this connection, a programme launching the Community Food and Water Security System was held in Bhopal, Madhya Pradesh, on 16 October 2000, World Food Day. It was attended by Shri Digvijay Singh, the Hon'ble Chief Minister of the state. A report on the food insecurity situation of Madhya Pradesh was presented on the occasion.

Following this, MSSRF and WFP have entered into an agreement for preparing detailed Food Insecurity Reports of Madhya Pradesh and Rajasthan. Detailed discussions have been carried out with the respective government officials, academia and NGOs of Rajasthan and Madhya Pradesh, on choice of indicators and assessment of the food insecurity status of the districts.

WFP and MSSRF have also entered into an agreement for preparing a Food Insecurity and Vulnerability Profile of Orissa based on Community Level Assessment of four districts of the state, through primary survey. A Food Insecurity Report of the state is also under preparation. It is also proposed that a study of the food insecurity situation in the state of Gujarat be undertaken. It is expected that the state level reports will be completed in 2001-2002.

WFP and MSSRF signed a broad Letter of Understanding in November 2000 for long-term co-operation. Preparation of The Food Insecurity Atlas of Urban India is the next task on the agenda.

### **302.2 Hunger Free Area Programme**

The implementation of the seven-point action plan of Hunger free Area Programme has been continuing since 1997-98, in association with Gandhigram Rural University. The following activities were undertaken:

- PRA based studies on the socio-economic status of the households in four hamlets of Kovilur Panchayat in Vedasandur Block of Tamil Nadu have been completed.
- A detailed profile of ultra poor families (270) has been prepared and documented.
- All the poor and ultra poor families have been provided with "Entitlement Cards".
- A series of awareness generation programmes on government schemes, nutrition, reproductive and child health, organised under the project, have increased the level of awareness among the people.
- A number of training programmes on leadership development and income-generating farm and non-farm activities, have helped in building up the capacity of the men and women in poor households.
- Regular supply of fresh vegetables through kitchen gardens established in ten schools, has improved the health status of the school-going children.
- Periodic medical check-up and the maintenance of a health card for each child have helped in assessing the health status of the children.
- Organisation of all the poor and ultra poor households into SHGs and training them in managing the groups and micro enterprises have instilled a great deal of confidence in them and marginally improved their socio-economic status.
- Training programmes have been organised in order to enable the people to tap maximum returns from the existing resources.
- Installation of smokeless chullas, construction of toilets, soak pit, supply of protected water supply and imparting of health education have resulted in better absorption and retention of food and improved their health status.
- Better coordination has been established among the local level formal and informal organisations for convergence of

different schemes as it would facilitate better reach of the schemes to the poor.

In a nutshell, the project has motivated the people to combat hunger and ill health through group-based, self-help efforts.

### 302.3 Pilot Project for Elimination of Micronutrient Malnutrition in Tamil Nadu

The overall aim of this FAO funded project is a practical, community-based contribution to the policy of the Government of Tamil Nadu to improve the nutritional status of the ultra poor population, with special focus on the elimination and prevention of micronutrient malnutrition. The Government of Tamil Nadu undertook the preliminary work connected with the project. As a TRC for this project, MSSRF has developed the framework for the conduct of the baseline survey. The fieldwork entrusted to the Gandhigram Rural

University, consisted of developing two different types of schedules, one on background information, income expenditure pattern, general health status, immunisation, health and sanitation, household food consumption etc., and the second schedule on particulars of family members in a household and their health status. The work was in progress during the year under report.

The baseline survey covered 809 households with a population of 4,366. Participatory Rural Appraisal was used in the conduct of baseline survey. Besides food habits and other socio-economic details of the selected households, anthropometric measurements were used in the baseline study to identify the malnourished segment within the households selected. Biochemical and clinical parameters revealed the extent of micronutrient deficiency in the area of study. Tables 3.15 and 3.16 give the nutrition overview.

Table 3.15 : *Nutrition Overview (Percentage)*

Age	Stunting	Under Weight	Anaemia	Vitamin A	Iodine
0-4	62.3	40.6	52.5	5.12	21.21
5-9	50.7	45.1	76.2	1.33	20.0
10-14	47.8	41.0	70.2	5.12	19.23
14-18	40.6	45.2	65.0	2.22	26.66
Total	50.6	42.9	65.98	3.45	21.78

Table 3.16 : *Nutrition Overview (Percentage)*

Age	BMI	Anaemia	Vitamin A	Iodine
19-25	66.28	37.5	3.94	19.48
26-40	67.10	33.0	2.32	29.00
>40	65.4	22.0	3.96	22.36
Total	66.2	30.83	3.41	23.61

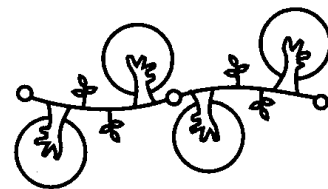
BMI - Body Mass Index

### **302.4 National Land and Water Care Movement**

Based on the recommendations of the New Delhi Declaration on land resource management for food, employment and economic security, the Consultative Group on Land and Water Care Movement became operational in March 2001. The objectives of this consultative group are to promote convergence and synergy among all similar ongoing programmes of the central/state governments, with social organizations, bilateral and multilateral donor/ partners and to maximize the impact of available technical and financial resources for this movement.

The National Land and Water Care Movement was launched by Shri M Venkaiah Naidu, Hon'ble Minister for Rural Development, Govt. of India on 26 April, 2001 at New Delhi. A Consultative Group on Land and Water Care (CLAW) has been set up under the chairmanship of Dr M S Swaminathan. Similar state level bodies of co-ordination committees (SLCC) to implement developmental projects for fostering a community-centred Food and Water Security System in the States of Orissa, Tamil Nadu, Andhra Pradesh, Madhya Pradesh, Maharashtra, Gujarat, Assam, Meghalaya and Uttaranchal are being setup and various activities are being drawn up.

## Programme Area 400



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# Reaching the Unreached

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**T**he findings reported in the publication "The Unborn Girl Child" regarding female foeticide have received confirmation from the preliminary results of Census 2001. Work on capacity building and mainstreaming of gender considerations in the curricula of Agricultural Universities made good progress. The gender dimension of wild foods management was studied in Wayanad. 'Voicing Silence' took a step forward in its work with the community of women performing artists. The play 'Medai Pesudu' ('The Stage Speaks') was also performed during the National Theatre Festival in New Delhi.

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**Sub Programme Area 401**

**Project ACCESS**

Research, capacity building and development and dissemination of resource materials related to ECCD (Early Childhood Care and Development) and child care services have been the areas of focus in Project Operation Resource Support, sponsored by the Bernard Van Leer Foundation, now in its third and concluding year.

**401.1. Research**

Of the three main research studies planned for the project period, the last two were completed, as well as a case study and a scan of references to infancy in Tamil folklore and

literature, details of which are given in Table 4.1.

***The unborn girl child***

Project ACCESS, a member of the CASSA (Campaign against Sex Selective Abortion) network, had agreed to undertake a case study on the use of sex ratio at birth as a tool for identifying the prevalence of female foeticide. This was based on the rationale that while the biological sex ratio at birth (number of female babies born for every thousand males) was of the order of 951, a ratio less than this would suggest the practice of female foeticide in a given population.

The final analysis included information about live births in Chennai hospitals for the last ten years, live births in a private hospital in Chennai and from a Government hospital in

Table 4.1 : *Research studies*

Title / Month of publication	Author	Distribution status
<i>The Unborn Girl Child - A case study on sex ratio at birth as an indicator of female foeticide. November 2000</i>	M Buvaneshwari	100 copies distributed
<i>Costing Child Care Services - A proposed cost framework and sample analysis with ICDS as a model in Tamil Nadu. January 2001</i>	T R L Narayanan and J Jayanthi Rani Christina	Submitted to Secretary, Social Welfare, Government of Tamil Nadu. Approval awaited for dissemination.
<i>Maternal Care and Infant Growth – child care practices of mothers and the growth and development of infants in urban slums. January 2001</i>	Rama Narayanan	Not for circulation yet
<i>Depiction of infants in Tamil folklore and literature. January 2001</i>	L S Saraswathy	Messages are under preparation



Salem for the current and previous years. This case study has brought to light the fact that the sex ratio at birth in Chennai in general has been fluctuating over the past ten years. Sex ratio at birth was found to be lower than the biological sex ratio in the Chennai data. Sex-selective abortions appear to cut across the rich-poor, rural-urban boundaries. The sex ratio at birth is much lower in the private hospitals than in the government hospitals and very low in Salem. The case study points to a methodology for studying the phenomenon of female foeticide.

### ***Costing child care services***

In this study a costing framework was developed to include the various types of expenditure that are likely to be incurred by any ECE programme. To do this, available data on costs and expenditures in Integrated Child Development Services (ICDS) was collected and analysed, and a draft report prepared in two sections. The first section introduces the framework and its rationale, while the second includes a sample analysis according to the framework using the available ICDS data. The draft report was circulated to a wide group of professionals both within and outside the Government for their critical comments. After careful scrutiny, comments and suggestions were incorporated and the final report was submitted to the Government of Tamil Nadu. Approval is awaited for wider dissemination. The framework is expected to be of interest to academics, practitioners and policy makers as a useful tool for measuring costs of child care services at both the government and non-government levels.

### ***Maternal care and infant growth***

This study attempted to identify and document the child care practices of mothers or primary

care givers with specific reference to feeding, health care and interaction with the infant. The relationship of these practices to growth and development has also been broadly studied. Three hundred and sixty-two mother-infant dyads from thirteen slums within Chennai Corporation limits were chosen for the study. Mothers were interviewed and their responses were recorded with the help of a field-tested questionnaire. Several important findings emerged from this study. To mention just a few, eighty-two percent of the mothers were breast-feeding; there was relatively low use of the bottle, and a clear preference for other devices over the bottle, as well as timely initiation of supplementary feeding in most cases. The study further points to the high degree of malnutrition which sets in progressively during infancy, resulting in nearly two thirds of the infants being underweight at twelve months of age. To understand the relationship between child care practices and infant growth, other issues such as the quantity and quality of supplementary foods, adult-child interaction while feeding and the home environment in which the child is growing need to be studied.

### ***Depiction of infants in Tamil folklore and literature***

In view of the mandate of the Operation Resource Support (ORS) project to focus on the period of 0 - 2 years, it had been decided to develop a set of messages on certain specific aspects of infancy, based on three research studies conducted earlier. A need was felt to undertake an analysis of various Tamil cultural forms for insights into child care practices in infancy in order to refine messages already developed and to identify any conflicts in the messages already

shortlisted. With the help of a consultant, folk forms like lullabies, songs, stories, poems, proverbs etc. that dealt with the period of infancy were identified from various printed sources and analysed. The report has thrown light on some of the cultural perceptions regarding the various developmental stages of the infancy, the recognition of the importance of this period as elucidated in literature, the value attached to this period and some cultural practices undertaken for the well-being of the infant. Based on this study, a series of radio programmes and articles in the popular press are being planned.

***Dissemination of research findings***

The study *Quality Matters ! Understanding the relationship between early childhood education and learning competencies of children* was completed at the beginning of this year. 135 copies of the study and more than 700 copies of the synopsis in English and Tamil have been distributed. As part of the process of developing a coordinated strategy involving various stakeholders for improving the quality of ECE, a series of presentations was made on the findings of the study across the country in leading centres of research, training and planning (Table 4.2).

Table 4.2 : ***Dissemination of research findings on quality in ECE***

<b>Month</b>	<b>Host Institution</b>	<b>Location</b>
August-September 2000	Tenth European Early Childhood Education Research Association (EECERA) Conference	London, U.K
September 2000	Department of Education, Alagappa University	Karaikudi
October 2000	Department of Home Science Gandhigram Rural Institute (Deemed University)	Gandhigram
October 2000	Secretary Department of Women and Child Development, Ministry of Human Resources Development	New Delhi
November 2000	Department of Child Development Lady Irwin College	New Delhi
November 2000	Secretary, Social Welfare Government of Tamil Nadu	Chennai
November 2000	Department of Home Science Avinashilingam Institute for Home Science & Higher Education for Women	Coimbatore
March 2001	Department of HDFS, M S University Baroda and IAPE Baroda	Baroda
March 2001	Maharashtra FORCES and IAPE, Mumbai	Mumbai
April 2001	District Programme Nutrition Officers (DPNO) and World Bank assisted ICDS III staff	Chennai

Preparation has begun for a national workshop to be held in August 2001 in which policy makers, practitioners, trainers and leading international experts will participate. The workshop will discuss the use of the tool for four main purposes - training, research, monitoring and evaluation and accreditation, as strategies to improve the quality of ECE. 100 copies of the report of the action-research study "Panchayati Raj and Child Care Services" have been distributed.

### **401.2 Capacity Building**

The two main activities taken up under Capacity Building were the concluding phase of the Trainers' Training Network and a communication workshop for NGOs working on reproductive health.

#### ***Trainers' network***

The ECE Trainers' Network was launched in January 1998, as a support for the group of trainers engaged in developing and conducting self-financed in-service skills training courses for ECE workers in the private and voluntary sector. Regular meetings have been held twice a year for the last three years and the concluding meeting in the series was held in October 2000 to discuss the future and sustainability of the network and its mode of operation. The network, launched by TN-FORCES, has been functioning with the technical support of ACCESS. Its main achievement has been the conceptual development and practical implementation of a variety of Extended in-service Skill Development courses for ECCE teachers, tailored to suit the needs of varied groups. A well-established core group of ten members drawn from 6

institutions formed the network. In a participatory process of evaluation, it was found that these members have developed both personally and professionally, have a strong professional commitment to training, have become skilled designers of courses and have developed several innovative training strategies capable of enduring in the present hostile climate. At a meeting held in October 2000, the trainers discussed the future course of training programmes, their own roles, financial and organizational aspects of the network and areas in which they needed to further develop their own skills such as advocacy, communication and human resource mobilization. The group has drawn up a plan to sustain the network and the training courses.

#### ***Communication workshop for NGOs***

A request was made by TNVHA (Tamil Nadu Voluntary Health Association) to conduct a training programme in communication for some of its member NGOs who were implementing a project in Reproductive and Child Health in four districts of Tamil Nadu. While the NGOs were well-trained in the technical aspects of the issue, they had expressed a desire to learn more about understanding attitudes, and strategies to be adopted in communication, since attitudinal changes were necessary in the long run to bring about a change in behaviour. A three day workshop was organized in July 2000 in which thirty-four people, representing twelve institutions, participated.

The workshop began with an elicitation of expectations and field problems faced by the participants. During the three days the sessions dealt with various aspects such as

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understanding one's own attitudes and those of others, identifying individuals and groups who had to be reached, identifying situations for communication and taking messages to different groups in various situations. The participants were also exposed to prevailing folk and literary forms of communication such as puppetry, rudiments of theatre, debate and poetry. A session on poster making helped them to make posters on specific themes using simple inexpensive materials such as newspapers, colour papers and pens. In the followed up exercise carried out by

TNVHA a month after the workshop, participants reported using many of the strategies learnt in the workshop and identified specific forms of communication suitable to their areas in which they needed more in-depth training.

### 401.3 Resource Materials

Several new resource materials connected with training, capacity building and orientation were developed during the year. Table 4.3 gives the details.

Table 4.3 : *Resource materials developed*

Month	Title	Content
<b>Manuals / Tools</b>		
Aug 2000	<i>Media Uravugal</i> — Tamil (English translation available)	Guide to NGOs working with media on child rights issues
Oct 2000	TECERS Tool English/Tamil	Measures quality of ECE in a cultural context
Dec 2000	<i>Thai Sey Urimai-Oru Paarvai</i> — Tamil [with a special four - page supplement for Panchayat leaders] (English translation available)	Information on laws/schemes relating to child care and questions/ suggestions for leaders
<b>Video</b>		
August 2000	<i>Penungal Oor Pillaigalai</i> Tamil	Documentation of the action research on "Panchayati Raj and Child Care Services"
November 2000	Balwadi — Why? What? How? Tamil/ English	Tool for awareness creation and community monitoring of child care services
Feb 2001	<i>Enga Patta Kelunga</i> [Picturisation of three songs] Tamil	Burden on the Pre-school child and playway methods in ECE
<b>Diskette</b>		
November 2000	Survival of the girl child information base. English	Review of print materials available on the issue of girl child survival

In the past, of all the resource materials, the tools and manuals have been the most in demand. This year also about 750 copies of earlier manuals / tools have been disseminated.

The manual *Media Uravugal* was an outcome of the media workshop held in December 1998 following a request by participants for a guide to work with the media, to advocate their issues. Though published in August 2000 after considerable delay, the demand for it has been high and within a short span of time more than 650 copies have been distributed. The possibility of finding a publisher to reprint the manual, as the first set of copies will soon be exhausted, is being explored.

The first edition of the manual *Thai Sey Urimai - Oru Paarvai* was brought out in April 1999 with a four-page centre pull-out aimed at MLAs. Based on its utility, the Director of Rural Development, Tamil Nadu requested Project ACCESS to prepare a special four-page supplement aimed at Panchayat leaders. UNICEF has reprinted 15,000 copies of the manual with this new supplement for distribution to all Panchayat leaders throughout the state.

The TECERS tool, an outcome of the research study *Quality Matters!* can be used for purposes of research, training, monitoring, evaluation, accreditation and for the improvement of quality of ECE as a whole. The process of advocacy of the tool has already started and nearly 100 copies of both the English and Tamil versions have been distributed.

TN-FORCES had expressed a need for simple user-friendly materials for use in meetings, workshops, public hearings and campaigns for the purpose of orienting the public to-

wards the proper functioning of government-run child care centres and creating an awareness about quality in ECE. The same need was also felt while working with Panchayat leaders and Ward members during the action-research on their involvement in child care services. The video *Balwadi - Why? What? How?* has been developed as a response to this need. It is a simple visual tool for creating an awareness about what a good child care centre should be, to encourage easy monitoring by parents, self-help groups, community leaders and functionaries in other departments. It has been shown at several meetings, including one with the Project Officers of Tamil Nadu Women's Development Corporation who are supervising over one lakh self-help groups in the State and who plan to utilise it in educating their members to become involved in monitoring child care centres in their areas. 15 copies have already been requested. The video is regularly used in all advocacy meetings.

Two audio cassettes, *Enga Paatta Kelunga* and *Thayum Seyum*, the first on the burden on the pre-school child and the latter on mother and infant care, were produced in 1997. Though widely distributed, no way could be found to monitor their use or measure their impact. At the same time, it was found that the earlier spots on Burden on the Pre-school Child found in *Messages That Move* had been used to saturation point. Hence it was decided to produce fresh spots to keep up the Burden on the Preschool Child campaign, give it a new life and emphasise the importance of the playway method. For this purpose, three songs from the audio cassette were chosen and picturised, using the wealth of raw footage available with Project

ACCESS, without any additional shooting. The songs are intended to be telecast as "fillers" as well as used for advocacy in meetings.

There is a continuing but infrequent demand for the video and audio training materials developed earlier. A total of 26 copies of different videos and 30 copies of the two audio cassettes were disseminated this year.

In the two - day international short films competition organised by the Mumbai International Film Festival (MIFF) in 2000, the video spot *Enna Pannikittirunde* was selected for screening and shortlisted for the award in the documentary category.

A catalogue of the printed materials, audio and video products developed over the past ten years including both the COTA (Children on the Agenda) and ORS project periods is being developed. A documentation/information centre on all resources developed by ACCESS and other agencies related to Early Childhood Education and the Girl Child is being organised.

### **401.4 Other Activities**

#### ***Collaboration with TN – FORCES***

As a founder member of TN - FORCES, efforts in working with the network through attendance at all core committee meetings, planning of activities and provision of technical support for various activities have been consistent. A major initiative this year related to the situation of nursery school teachers. ACCESS helped in developing a set of demands to be presented to the Advisory Committee set up by the Government of Tamil Nadu for raising the minimum wages of nursery teachers on par with that of primary teachers, recruiting trained

teachers and running training schools or providing grants to private establishments to run training courses. ACCESS and Vidya Vikasini, as network members jointly organised a meeting with school managements in Coimbatore to discuss these issues and advocate support for training and proper remuneration for nursery school teachers. A list of demands was also submitted to the Ambattur Industrial Estate Manufacturers Association, including items like expanding the common crèche programme at Ambattur Estate, providing quality child care services in the crèches and developing a corpus fund for providing good facilities to benefit the maximum number of children. In a series of meetings with NGOs, a proposal was developed to increase the grants given by the State and Central Social Welfare Boards to NGOs to run crèches and submitted to the Central and State Boards and the Tamil Nadu Government. In February, ACCESS also represented TN-FORCES at a meeting with the Labour Commissioner and other officers regarding implementation of the welfare provisions of the Construction Labour Act and submitted a note on the same.

The most significant event this year was the Convention and Rally held in December 2000 along with the AGM, to which full participation, support and solidarity was extended. A ten-point charter of demands in support of vulnerable working women and children was developed and presented to all political parties during the recent election campaign.

As part of the trainers' network, ACCESS was directly involved in the three extended

in-service courses conducted by IAPE (Neyveli), Vidya Vikasini (Coimbatore) and ICCW- TN (Chennai). In a two-day exercise in February, 2001 the members of the network were helped to develop proposals for training courses for the next year, to be submitted to donor agencies for possible funding, in accordance with the decision taken to this effect earlier.

### ***Participation in CASSA network***

ACCESS has been a member of the CASSA network (Campaign Against Sex Selective Abortions) ever since its inception in December 1998 and has extended continued support by participating in all the activities carried out by the network. Following the dharna and rally during the month of May 2000, a delegation from the campaign met the Director, Medical Services, Joint Secretary, Health Department and the Health Minister and presented a memorandum to the Chief Minister of Tamil Nadu. CASSA lobbied with the political parties and members of the Legislative Assembly for effective implementation of the PNMT (Pre-Natal Diagnostic Techniques) Act, specified policies and programmes to eliminate female foeticide and demanded adequate budget allocation for enforcement of the PNMT Act.

The contribution of ACCESS in the network has been in the area of data gathering and support. Besides a review of available literature on the issue of declining sex ratio, available on diskette, ACCESS took up a case-study of the at-birth sex ratio from available data.

### ***Policy related activities and events***

Participation in discussions on policy and programme for ECD at various fora, national and international, official and voluntary, was regular throughout the year as reported in Table 4.4. As a founder-member of FORCES, Project ACCESS has been active in debating and guiding the formulation of the FORCES stand at its meetings, including the annual Policy Committee Meeting held in January 2001 at Puri. Since "maternity entitlements" was taken up as the major theme for this year's work by FORCES, key presentations on this theme were made, both at the seminar organised by FORCES on this topic in February 2001 and at the consultation held later, sponsored by the National Commission for Labour. Links were established with PLAN International, a leading NGO donor in the field of ECD, by participating as a lead speaker in both sub-national and regional level meetings. The workshop on ECD organised by UNICEF provided an opportunity to correct the increasing tendency on the part of the Government to equate ECD with ICDS, by emphasizing once more the focus on the *Rights of the Child* and the policies needed to meet the State's obligations towards the young child.

In June 2001, Project ACCESS completes ten years of work. A consolidated documentation of the achievements and impact of the project in the last ten years is being prepared. Project ACCESS is being scaled down and will in the future function as an information and resource centre on ECCD.

Table 4.4 : *Participation in policy-related events*

<b>Events</b>	<b>Partner</b>	<b>Place</b>	<b>Date</b>	<b>Theme</b>
International Conference on Early Childhood Care for Survival, Growth and Development	UNICEF	New Delhi	October 2000	Rights of the child
Workshop on Early Childhood Care and Development	PLAN International Central Zone	Bangalore	December 2000	Policy and programme for ECD
FORCES Fifth Policy Committee Meeting	FORCES	Puri	January 2001	Agenda for FORCES
Workshop on Maternity Entitlements for Women in the Unorganised Sector	FORCES	New Delhi	February 2001	Maternity entitlements
Workshop on Women Workers: An Agenda for the Future	National Commission on Labour	New Delhi	March 2001	Maternity entitlements
Regional Workshop on Early Childhood Care and Development - Looking for New Opportunities	PLAN International	Yogyakarta - Indonesia	April 2001	Policies and approaches to ECD

### **Sub Programme Area 402**

#### **Uttara Devi Resource Centre for Gender and Development**

The Centre continued to work towards its objectives of making significant though small contributions externally and internalising the gender dimension within the Foundation.

#### **402.1 Core Activities**

The activities continued to focus on education and research.

#### ***Engendering Agricultural Curriculum***

Continuing the initiative of the previous year in organising a brainstorming workshop, several agricultural Universities were invited to collaborate in taking the next step towards engendering the curriculum. The lead was taken by Kerala Agricultural University (KAU) at Thrissoor, which had already set up its own Centre for the Study of Gender Concerns in Agriculture (CSGCA). A series of meetings led to an MOU between the two institutions for the promotion of gender dimensions in the activities related to agricultural research, teaching and extension. The first outcome was the planning and design of a joint workshop for the Faculty of KAU on Gender Analysis in Agriculture.



The three-day workshop was held in November 2000 at Thrissur. There were 31 participants from all the campuses and several major disciplines. The objectives of the workshop were :

- To orient the Faculty of Kerala Agricultural University towards concepts of gender analysis
- To introduce theoretical frameworks for gender analysis
- To discuss practical applications of gender analysis to teaching, research and extension activities in the University

The Resource Persons and facilitators for the workshop were Ranjani K Murthy and Josephine, gender specialists, with the support of Mina Swaminathan, Hon Director, GENDEAVOUR. The keynote address at the inaugural function was by Dr M S Swaminathan, Chairman of MSSRF. In the first working session, definitions of major concepts in gender analysis emerged from a set of introductory activities. Later, frameworks and tools for gender analysis and gender impact assessment were introduced and discussed intensively, using a variety of methods like case-studies, brainstorming, video content analysis, assignments, group work and games. On the third day, action plans were drawn up to take the work forward in the areas of extension, teaching, training and research. A major decision was to begin with gender orientation in the field work component of the agricultural curriculum at the undergraduate level, known as RAWE (Rural Agricultural Work Experience) and of similar exercises in the veterinary, dairy, fisheries, forestry and other courses and later to consider

the development of a *core unit on gender studies* at both UG and PG levels. It was agreed that potential gender impact assessment should be taken up in all extension projects, and a beginning should be made by developing appropriate indicators for this purpose. It was also felt that smaller groups should be set up, across campuses and disciplines, to take up follow-up activities in connection with extension, teaching, training and research respectively. The report of the workshop, the first ever of its kind in any agricultural University in the country, is being widely circulated.

As one of the follow-up activities, a three-day meeting was held in Thrissoor in March 2001 for Faculty interested in working on strengthening the gender dimension in RAWE and similar fieldwork components at the UG level. The Resource Persons for this meeting were Edith Van Walsum, gender specialist, Mina Swaminathan, Hon Director, GENDEAVOUR and Dr K N S Nair, till recently Vice-Chancellor of KAU. On the first day, feedback was received from a group of 22 former and current students from various disciplines about the shortcomings they perceived in the present curricula, with specific reference to gender concerns, as this was considered to be a valuable input when restructuring the curriculum. During the next two days, the guidelines and schedules for students in the fieldwork exercises were carefully analysed and suggestions were made on how the gender component could be introduced or strengthened. Qualitative methods and tools for gender analysis were studied and tested out in the field directly by the Faculty. These exercises have to be further developed and refined and are

expected to be introduced into the curriculum in the coming year.

GENDEAVOUR has been invited by the NCRWA (National Research Centre for Women in Agriculture) at Bhuvanesar to conduct a six-day orientation on gender analysis for the Faculty of Agricultural Universities and other research and extension institutions affiliated to the ICAR (Indian Council of Agricultural Research). This decision was taken by the Director of NCWRA, Dr Hema Pandey, who participated in the KAU workshop as an observer and gave a Guest Lecture on the role of the NCRWA and felt that such initiatives were essential for ICAR institutions to prepare themselves to implement the new National Policy on Agriculture with its strong emphasis on empowerment of women. The workshop is to be held in September 2001 and preliminary steps for design and planning are being taken. The foundation having been laid for engendering the curriculum at KAU, the module and procedures developed there can be applied in other Universities / training situations.

### ***Research studies***

The study undertaken last year by Dr Shubh-Kumar Range, Visiting Fellow, on "Development and Change in Local Institutions : Implications for Gender Roles in Kolli Hills" has been completed. The first draft of the report has been reviewed and the publication will be taken up as soon as the final report is received from the author.

### ***Wild foods management study***

A pilot study on Wild Foods Management in Wayanad District of Kerala was undertaken by Dr Hemal Kanvinde, specialist in Ecology,

with the support of the staff at the Community Agrobiodiversity Centre at Wayanad, with a view to developing a methodology for such studies. The specific objectives were :

- To identify wild food species, (managed and semi-domesticated) their growth habits and human consumption
- To document the gender-based linkages, particularly women's roles, at the interface of these plants for domestic food consumption, species exploitation and management, cultivation and marketing as well as the critical role women play in sustaining rural households
- To study the changing status of different species and the relationship of species rarity to management (including protection and propagation), access / gathering rights and use value

A two-step methodology was tested. To begin with, information was gathered from families through semi-structured interviews and by accompanying them on gathering trips. In the next stage, the information was validated with the help of "knowledgeable" men and women in the community. This procedure not only generated information but also led to an understanding of local nomenclature systems.

Focusing on three tribal communities namely, Kuruchiyars, Panniyars and Kattunayakars and one group of non-tribal residents of Wayanad district, the study highlighted gender roles and responsibilities in wild foods collection, processing and management in the four communities. Differences in management and decision-making, and in the knowledge base about plants and animals were found to be related to differences in food habits. This pilot survey revealed that wild edible foods

contribute a great deal to the diet of certain communities of Wayanad.

Further research is needed on the effects of changing cropping patterns on the use of wild edibles and on gender roles and responsibilities, on the efficiency of managed and wild areas to produce wild edible food species and on varying dietary patterns, food habits and nutrition levels. Such studies would throw light on the critical links between food and nutrition security, eco-system degradation and biodiversity conservation. The draft report is in the process of being critiqued by an inter-disciplinary group ranging from anthropologists to botanists, and the final report will be enriched by the feedback received.

### ***Resource materials***

Work was begun with the help of Ms Meera Sundarajan, gender specialist, on putting together, in a systematic way, an inventory of resource and instructional materials which would be useful for training and orientation on gender concepts, tools and approaches and which could be used both for staff training and for external training courses. An important contribution is a collection of case studies, gathered mostly from experiences, anecdotes and research findings of the staff in MSSRF projects, but also including cases drawn from literature which have proved useful for training purposes. The inventory has also made a start with readings, video films, manuals and handbooks available in the library and is expected to grow in the coming year.

To carry this effort further, a Resource Persons Network, starting with ten distinguished

specialists, has been formed to develop courses and instructional and resource material at various levels on gender issues in agriculture and related areas. At its first meeting, held on 6 and 7 April, 2001, the group suggested that the term "gender" be understood and used along with the concept of "equity", while the term "agriculture" should include not only allied disciplines like forestry, fisheries, dairy and veterinary sciences, but should be broadened in scope to refer also to rural development, rural livelihoods, environment and natural resource management. A suitable composite name should be found to sum up this cluster of ideas.

The group developed a tentative outline, content and methodology for a one-week orientation to these concepts, issues, tools and perspectives for Faculty from agricultural Universities and other ICAR institutions, as well as Government functionaries from concerned Departments and others engaged in rural development. This outline can be fine-tuned to meet the needs of each specific group of participants and will be adapted, to begin with, for use at the NCWRA-sponsored workshop in September 2001.

The group has also drawn up long-term plans for the development of course modules at different levels and for sharing and developing a basket of resource and instructional materials in seven categories. These materials, added to the small inventory already available at GENDEAVOUR, will form a Resource Bank for teachers, trainers, researchers and extension workers at all levels.

## **402.2 Internalisation of Gender Dimensions**

Several strategies contributed to the process of internalisation.

### ***Gender concerns forum***

The Gender Concerns Forum provides opportunities for sharing and discussing gender concerns to strengthen the internalisation process. The Forum met thrice during the year. In early August 2000, the Forum met to review the decisions taken at its earlier meeting, report on the action taken, identify bottlenecks and problems and suggest solutions. In late August, a special meeting was held at the request of the staff working in Biotechnology and related fields, to discuss issues relating to gender and biological sciences. A discussion paper was prepared for the meeting, based on queries frequently raised about the relevance of gender issues for researchers in Life Sciences. These included issues such as theoretical questions and concerns raised world-wide by feminist scientists, choice of research topics, relationship with indigenous knowledge systems, gender issues in institutions and the interactive relationship between research findings and field realities. This discussion, which was facilitated by Dr Sumi Krishna, gender specialist, opened up many more questions than it started with and led to an appreciation of the need for more such interactions to clarify issues and help people resolve problems in their daily work. A detailed report is available.

The third meeting was held in March 2001, at the time of the Annual Review and was attended by about 75 members. It began with a workshop, led by seven in-house facilitators,

on introduction and clarification of the concepts of Practical and Strategic Needs of Women and their applications to ongoing work and goals of the Foundation. In a series of small group exercises, participants first identified such needs among the communities they worked with and then attempted to suggest applications for these concepts in relation to their own project activities. The latter part of the exercise could only be briefly dealt with due to lack of time. It was also realised that in developing strategies, attention had to be paid to several linked issues, such as women's participation at different levels in both the private and public domains, gender roles and relations, clarity on service provision, meeting threats and seeking allies among stakeholders and understanding men's gender roles and constraints.

Three presentations were made by members on their experiences in the field on gender concerns. These papers, background material and a brief report of the meeting are available.

The Forum acted throughout the year as a means of sharing information, especially with regard to resource materials, new additions to the library, training opportunities, resource persons, guidelines, tools and checklists related to gender impact assessment and procedures for internalisation.

### ***Support for staff orientation / training***

GENDEAVOUR offered support to the following activities in gender orientation organised by projects of MSSRF at various times and locations, to meet their own perceived needs:

- *Process Documentation on Social and Gender Impact : Participatory Assess-*

ment. Coastal Wetlands Restoration Project, Kakinada, Kendrapara, Pichavaram and Muthupet. August - October 2000

- Retreat - Workshop on *Social Stratification and Process Documentation*. JRD Tata Ecotechnology Centre, Kolli Hills. February 2001
- Joint meeting of the staff of all the projects in Orissa for a discussion of *Gender-Related Issues and Problems*, Bhubhaneshwar. January 2001
- Publication of the report "Sowing Seeds for Social Change - Lessons in Gender and Social Relations from the Seed Village Project of MSSRF" by Ranjani K Murthy, JRD Tata Ecotechnology Centre, Chennai. January 2001.

It is noteworthy that though there were no full-time permanent staff throughout the year, so much could be achieved due to the rich contributions of several specialists - consultants.

### **Sub Programme Area 403**

#### **Voicing Silence**

This year, *Voicing Silence* took a step forward in its work with the community of women performing artists in the traditional popular genres of Tamil theatre, while maintaining its emphasis on gendered theatre / theatre from a feminist / gendered perspective. Continuing the relationship developed over the last few

years with a small group of women from the *isai natakam* or *novel* form, as it is known in Northern Tamil Nadu, *Voicing Silence* has initiated a move to empower them through theatre, by giving expression to their own voice within this form.

The objectives of this project are to empower them financially, professionally and personally by helping them to set up their own women's theatre group which can function, to begin with, during the "off-season" or winter months and thus help them to earn some extra income during this lean period. Professionally, it provides exposure and training and helps them to enhance both their skills and their repertoire by developing new plays, working with new directors and artists, learning new styles and skills, playing to new audiences, performing a diversity of roles, managing their own company and gaining greater visibility as artists, without threatening their regular performances or male colleagues. Personally and socially, it will help to enhance their self-confidence, self-esteem and social status both as women and as artists, as also their sense of identity and ability to cooperate as a group, and make a dent in the gender barrier in this male-dominated profession. Indeed, signs of both such professional and personal growth are already visible.

*Pavazhakkodi*, a play developed last year, was performed eight times during the year. With the successful launch of this innovative play, the group took the next step forward in deciding to set up their own autonomous company to function mostly during winter months and embarked on a new

production this year, also on a gendered theme. To begin with, a two-day workshop led by theatre person Ms A Mangai with support from Ms Mina Swaminathan, Hon Director, Voicing Silence, explored with them, through improvisations, the themes and women characters central to the Puranic and other stories which form the basis of their repertoire and tried to bring out the hidden dimensions of those women characters, seen from a new angle. Out of this churning, three characters were selected on whom to base the new play, looking at old stories from a new and feminist perspective, but casting them within the original form. Dr M S Gandhi Mary, teacher, playwright and writer, developed the play in an interactive process, including not only the artists and workshop leaders, but also others such as poet *Inquilaab* and *Aazhi E Vengadessin*, who later directed and designed the production. The entire process of developing the play, writing and refining the script and simultaneously rehearsing and polishing the production was spread over twenty days in December 2000. *Medai Pesudu*, or "The Stage Speaks" was thus born at the turn of the century and the dawn of a new year.

The three stories which make up this performance are drawn from the three main sources of traditional drama — the Ramayana, the Mahabharata and the Puranas. The dominant *rasa* in each is different, as is the style of playing, from the lyric and poetic in the first, the grand and stately

epic in the second and concluding with rib-tickling raunchy comedy in the last. The two narrators, the clown and the herald, hold the stories together, questioning and arguing, each in "his" way trying to take the play forward but in different directions, allowing the audience to examine both sides of the issue, while keeping up fast-paced witty dialogue and sarcastic humour to sustain audience interest. This form allowed scope for the expression of the performers' rich and varied talents, in both male and female roles and in different styles, within their own genre. The process also provided an opportunity for them to interact with several artists from contemporary theatre and other art forms, as well as to express themselves as women artists and not merely to perform as directed.

The play has been performed five times up to April 2001 (Table 4.5) and has been well received and reviewed. More invitations are being received but because of the difficulty of the women getting together as a group during the "season", not more than five or six more performances are expected in the rest of the year. By next year, when yet another production will be taken up, the group is expected to be fully launched and capable of catering to varied audiences.

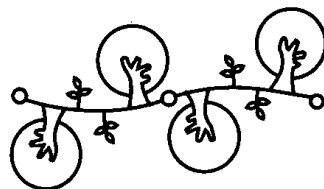
The project has been supported by The Hunger Project, an endowment from the Ford Foundation and a generous personal donation from Mrs Mary Mentz of Australia.

**Table 4.5 : Performances of Medai Pesudu\***

<b>Date</b>	<b>Place</b>	<b>Occasion</b>	<b>Sponsor</b>	<b>Audience</b>
27.12.2000	Chennai	Dress Rehearsal	MSSRF	Theatre and gender related groups
28.12.2000	Tiruvannamalai	Arangetram	Shantimalai Research and Development Trust	Women members of SHGs from nearby villages
31.12.2000	Chennai	Kalai Iravu	Murpokku Ezhuthalar Sangam (P.W.A.)	Members and general public
27.01.2001	Pondicherry	Makkal Kalai Vizha	Puduvai Manila Kalai Ilakia Perumanram	Members and general public
04.04.2001	Delhi	National Theatre Festival	National School of Drama	Critics and general public

\* The Stage Speaks

## Programme Area 500



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# Education, Communication, Training and Capacity Building

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*The 'Antyodaya' model of bridging the digital divide developed by MSSRF received widespread national and international appreciation. Content and connectivity received particular attention and the innovative connectivity procedures adopted led to MSSRF being chosen for the Motorola Gold Award 2000. The Hindu Media Resource Centre is enabling the printed, electronic and new media to become bridges between science and society. A wide range of training programmes, workshops, dialogues and consultations were organised. The annual interdisciplinary dialogue focused on the theme of "Information and Communication Technologies for Poverty Eradication".*

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**Sub Programme Area 501**

**Knowledge System for Sustainable Food Security**

It is of great concern that skin-colour based apartheid is being replaced by technological and economic apartheid. In the hope of bridging the divide, new Information & Communication Technologies (ICTs) are being harnessed at the Foundation in the last 3 years.

The purpose of this programme, funded by IDRC, is to test what ICTs can do to improve the lives of the poor. Phase I of the project came to an end in June 2000 and Phase II commenced in February 2001. During Phase I, many useful insights were gained, especially about the users of the knowledge centres (Table 5.1). The salient features of the project are:

- The hub and spokes model [the value addition centre at Villianur acting as the

hub and the village knowledge centres being the spokes]

- The bottom up process, placing emphasis on the community and being sensitive to the local information needs
- Community ownership of the equipment
- Emergence of a hybrid wired and wireless technology and solar-and-mains power
- Participation of rural women, with a view to bridging the gender divide
- Reaching the poorest of the poor
- Training volunteers in software skills
- Information dissemination through the local language.

These features led to the successful operation of five knowledge centres in rural Pondicherry. During the year, four more knowledge centres were established at Thirukanchipet (a Dalit village of mostly landless agricultural labourers), Pooranangkuppam, Kalitheerthalkuppam and Ariyur.

Table 5.1 : *Categories of users of knowledge centres in Pondicherry*

Village	Total no. of users	Men	Women	Children below 14 years	Dalits	Below Poverty Line	Illiterates
Veerampattinam	5,823	4,842	813	168	29	2,552	117
Kizhoor	7,425	5,226	862	1,337	100	2,694	179
Embalam	12,601	6,681	2,401	3,519	336	3,278	238
Pooranangkuppam	1,344	983	94	267	—	373	49
Thirukanchipet	1,693	1,379	102	212	1,455	1,400	58
Kalitheerthalkuppam	961	767	97	97	16	128	146
Ariyur	140	71	30	39	12	51	1
Pillayarkuppam	620	300	260	60	—	—	—

***New Technology for a better delivery system of information***

The ICT revolution creates access to networked information, which is generic in character. To be of use to the rural poor or in the development context in general, such information must be made locally relevant. Apart from sharing and networking routine information from the existing databases and downloading maps of wave heights from US Navy websites, efforts were made to increase actionable information. It is information with which people can take some decisions. Reporting terminal experiment is an example. It is a new technology, which is now being tested in collaboration with Space Application Centre. The hand-held reporting terminal is generally intended for military applications – for communication from the field to the command headquarters. Fishermen who carry the terminal into the sea for sending SOS messages or even general messages are now testing this in Veerampattinam. Contact with the SAC's Delhi office is made by pressing numbers 1 to 99 to convey different messages. The message is picked up by a satellite and is received on the ground in Delhi from where it is automatically faxed to a destination of our choice.

***Motorola Gold Award 2000***

During the year, Motorola recognised the use of the hybrid wired-wireless communication technology at the knowledge centres for its innovative use of two-way radio communication for the Motorola Gold Award 2000. There was no other recipient of the Gold Award for the year. The citation states: *"They embraced the technologies and basic communication system for supply of useful information in order to improve quality of life"*.

The end of Phase I is marked by the emergence of different models. In Veerampattinam the village knowledge centre is located in the village panchayat building and administered by the local panchayat; at Embalambam, the centre located in a Hindu temple premises is managed by the temple trustees and run by women self-help groups; at Kizhoor, the centre is located in the front room of a private home and is managed by the family members; and at Pillayarkuppam the knowledge centre is located at the Foundation's Biocentre, a training-cum-demonstration unit.

At Thirukanchipet and Ariyur, the knowledge centres are located in government buildings and managed by the local communities. The government is not charging rent for these buildings. At Pooranangkuppam, the knowledge centre is located in the premises of the local temple and is managed by the village panchayat and the temple trustees. At Kalitheerthalkuppam, the knowledge centre is located in a building especially constructed for the purpose by the local community and is managed by the village panchayat. This shows the independence of the villages and the need to work with diversity. This has also led to the understanding that there are replicable principles, not models.

Upon the successful completion of Phase I of the project, IDRC has generously approved Phase II as well. The main objective of Phase II is to extend research experiments in the existing village knowledge centres. It is increasingly felt that Phase II should concentrate on researching additional contents and deployment of new technologies to enhance the delivery system, rather than on opening more knowledge centres. In order to ensure sustainability, community online banking has been

introduced and the necessary software has been developed at the informatics laboratory.

Phase II will also concentrate on exchanging models and researching results with other telecentre programmes in different parts of the world. This will help in arriving at a more comprehensive and sustainable model. Initiatives will be taken on on-site consultations with policy makers towards research based advocacy to promote ICTs for rural development.

### ***Technical assistance in setting up knowledge centres in Kannivadi***

Having gained skills and expertise in managing the Pondicherry Knowledge Centres project, the staff assisted in setting up knowledge centres in Kannivadi. Technology stability, introduction of new technology and building a new website <http://www.oddanchatrammarket.com> have been achieved.

### **Sub Programme Area 502**

### ***The Hindu Media Resource Centre for Ecotechnology and Sustainable Development***

*The Hindu Media Resource Centre* is in its third year, having been set up in August 1998 with endowment support from Kasturi & Sons Ltd. The aim is to promote public understanding of science through media practitioners. The Centre adopts various strategies to reach printed, visual and web media practitioners and has been consistent in disseminating information about developments in ecotechnology and sustainable development. Table 5.2 describes the activities of the year.

### **502.1 Media Workshops**

The purpose of the media workshop series is to develop an interactive dialogue with media practitioners over a period of time as a *sustained campaign* on controversial scientific issues rather than achieve immediate press coverage. The national level media workshop on 'Media and Gene Revolution' was the third trend-setting workshop organised by the Centre within the last two years. Thirty-two media practitioners from all over the country participated in the workshop. The panelists were : Dr M S Swaminathan, Chairman, MSSRF, Dr Guy Sorman, Advisor to the President of France, Dr Calestous Juma, Director - Science, Technology and Innovation Programme, Harvard University, USA, Dr Swapan K Datta, Plant Biotechnologist, IRRI, Philippines, Dr Partha R Dasgupta, Head, New Technologies and Regulatory and Govt. Affairs, Novartis Seeds, New Delhi, Dr Gerard Barry, Rice Genome Initiatives, USA, Dr C S Prakash, Professor, Plant Molecular Genetics, Tuskegee University, USA, Dr Suman Sahai, President, Genecampaign, Ms Ranjana Smetacek, Director, Public Affairs, Mumbai. Mr N Ram, Editor, *The Front Line* moderated the workshop.

Media practitioners seemed more receptive towards technology than they were two years ago. While ready to support technology with adequate precaution, they were skeptical about what they called 'corporate generosity' and 'hidden costs' while discussing an announcement to make the rice genome sequencing free.

Discussing steps to control the digital divide, the participants also warned that countries

Table 5.2 : *Overview of Activities*

<b>Activities</b>	<b>Date</b>	<b>Details</b>
Media Workshop (504.1)	4 August, 2000	Media and the Gene Revolution –National Level Media workshop
Millennium Lectures (504.2)	24 November, 2000	H E Fawzi H Al Sultan, President, International Fund for Agricultural Development: <i>IFAD and Poverty Eradication</i>
	5 February, 2001	Mr Björn Stigson, President of the World Business Council for Sustainable Development: <i>Globalisation and corporate responsibility for environment and social development</i>
	19 February, 2001	Ms Maureen O’Neil, President, International Development Research Centre: <i>Programmes and Priorities of IDRC</i>
Public Fora (504.3)	10 January, 2001	Social and Ethical Dimensions of Genetic Modification
	19 January, 2001	ICTs and Poverty Eradication
Training (504.4) Land Technical Assistance	12 April, 2000	Training of Rural Reporters in Pondicherry to increase demand driven information
	17 May, 2001	
Proceedings	4 October, 2000	Report on Media and the Gene Revolution Workshop released and distributed to media practitioners
Building Databases	Throughout the year	Database of addresses of media practitioners Software platform completed for the Database of Media Referral Services
Technical Assistance	September 2000 to February 2001	Documentary film on Biovillage Project
	Ongoing activity	Media liaisoning

like India should not allow the spread of genetic divide. They also discussed the reasons for the hostility of European media towards GM technology, including anti-Americanism, hatred for MNCs and so on.

The workshop helped media practitioners to understand the need for and risks involved

in technology with special reference to developing nations. Their concerns were reflected in the national, regional and local press in the next six months.

### **502.2 Millennium Lectures**

Experts who have an excellent understanding of food security and poverty eradication

issues at the global and regional level are invited to deliver Millennium lectures. Three lectures were organised during the year:

*IFAD and Poverty Eradication:* H E Fawzi H Al Sultan emphasised the word (poverty) eradication, rather than 'reduction' or 'alleviation' to underline the need to address the root causes of poverty and work for sustainable solutions rather than aim for 'palliatives' that merely provide short-term relief.

"Today more than 1.2 billion human beings are condemned to lives of absolute poverty—three quarters of them living and working in rural areas. As we all know, there are no blueprints and no quick-fix solutions to poverty eradication. IFAD's motto is *Working for a World without Hunger*. It calls for wide-ranging partnerships of all stakeholders concerned *with*, and not *for* the poor".

*Globalization and corporate responsibility for environment and social development:* World Business Council for Sustainable Development is a coalition of some 150 leading international companies that are united by a shared commitment to the principles of sustainable development. WBCSD has 700 members in 20 national and regional business councils in developing countries. Mr Bjorn Stigson, President of the Council, emphasized the following points:

- Definition of key Business Assets has changed since the industrial revolution from land ownership to access to raw materials, to access to power in the form of hydro, steam, and electricity, to inventions and knowledge.
- Corporate Social Responsibility is very important. 53 of the 100 biggest

economies in the world are corporations; it is not strange that the broader role of corporations is being discussed.

- We live today in a tripartite world of Governments, Business and Civil Society. Governments have been weakened. At the same time the role and influence of business has increased to the point where it is challenged as too powerful.

*Programmes and Priorities of IDRC:* As IDRC looked at the rapidly evolving international context, it has concentrated on the following factors affecting policymaking in countries in the South.

Ms Maureen O'Neil focussed on the enormous challenges posed by the apparent paradox of globalisation and fragmentation, contrasting greater homogeneity with renewed affirmation of local identity and the importance of paying attention to governance issues, for IDRC believes that economic and social progress depends on the way in which decisions are taken locally, nationally and internationally, and on the effectiveness with which societal decisions or policies are implemented.

After an assessment of the changing context for research in the South, the Centre chose a flexible framework based within three broad areas:

- Social and Economic Equity
- Environment and Natural Resource Management and
- Information and Communications Technologies for Development.

### **Proceedings**

The Workshop Proceedings (No. 38) were prepared and sent to many media practitioners. The Proceedings have been distributed to (until March 2001) 1,301 recipients. They include 1,059 e-mails and 242 regular mail to journalists, editors, columnists, freelance writers, individuals and institutions.

### **Database of Contacts**

Various list servers, Associations of Journalists and leading e-journalist groups were approached to circulate the proceedings and the database of media contacts thus increased to a considerable level. As a result, the Centre is now in constant contact with the Asia Pacific Environment Journalists Forum, Indian Environment Journalists Association and South Asian Journalist Association.

### **502.3 Public Fora**

MSSRF takes advantage of the presence of leading scientists and development thinkers at the Foundation and organizes public fora at a common place accessible to the citizens of Chennai, targeting mainly the youth, students and media. Two such meetings were held during the year.

*Social and Ethical Dimensions of Genetic Modification:* The Centre organised a public forum in collaboration with the British Council Division, Chennai on Social and Ethical Dimensions of Genetic Modification. This meeting reflected the anxious mood of consumer organisations, farmers and trade union activists who were present at the meeting to find out what is going on.

*ICT and Poverty Alleviation:* Taking advantage of the presence of leading international

scientists and experts on ICT and other related areas, the Centre organized a public forum. The panelists were:

Dr Bruce Alberts, President, National Academy of Sciences, USA, Dr Stein W Bie, Director General, ISNAR, Netherlands, Dr Renald Lafond, IDRC, Canada, Dr Martin Lees, Rector, United Nations Peace University, Costa Rica, Dr Natarajan, Director, IIT Chennai, India, Dr Amrita Doss, Director, Institute of Career Studies, India. Prof M S Swaminathan was the moderator. Mr N Ram, Editor, *The Frontline*, welcomed the gathering. The forum highlighted the following key issues:

- The New Economy characterized by jobless growth can be sustained socially only by New Employment based on job-led growth. ICT is a powerful tool in spreading information on both new employment opportunities such as recycling of wastes (solid and liquid), adoption of renewable energy systems and various environmental enterprises, including bioremediation.
- An *Antyodaya* or bottom-up approach is essential for reaching the unreached. For this purpose, access, availability and affordability should receive attention. Transaction costs should be kept low. The low cost wireless technology developed by local scientists should be tried.
- In content creation, both the social and economic relevance of the information and timeliness of delivery have to be kept in view.

### **502.4 Training**

#### ***Training Rural Reporters***

The Centre in a joint exercise with Rural Knowledge Centres in Pondicherry,

conducted two training sessions on how to write short but informative *classifieds*. After identifying the potential candidates, 22 issues were identified as worth reporting to the knowledge centers on a daily basis so that the demand driven content input could be increased. The rural reporters were trained to write effectively in Tamil. They are now able to convey a message in 25 to 30 words.

### **Technical Assistance to other Projects**

The Centre also assisted in making a video documentary film on "Biovillage". It provided technical support in budgeting, scripting, liaisoning with the filmmaker and critiquing at every stage to make it a sensible development film. It also completed a content analysis report of the media coverage of Information Village Research Project.

### **Media Referral Services**

The centre has completed the software platform for media referral services. A student intern from Crescent Engineering College working for an MBA degree also contributed to its success. This database will soon be uploading the expert profiles of scientists and development workers in India. The main objective of this database is to provide an interface that will help media persons to interact with scientists. It is hoped that such easy access to scientists would increase the value of reports and insights.

### **Sub Programme Area 503**

#### **Design and Development of Databases and Provision of CD-ROM Services**

The Informatics Centre collects, collates and disseminates information to various users and

stakeholders. The centre is responsible for building a directory of experts in mangroves and a bibliography on work carried out in the Indian Ocean rim countries on mangroves, both of which form part of the Global Mangroves Information System. It also hosts one of the sub-distributed bio-informatics centres supported by the Department of Biotechnology, Government of India.

### **The mangrove database**

Mangroves play an important role in coastal ecosystems. Unfortunately, the rate of mangrove degradation in the Asia-Pacific region is the highest in the world, largely because of the inadequate appreciation and understanding of the multiple uses of mangrove wetlands. As one of the steps to address this issue, a mangrove database covering all aspects of mangrove wetlands of the Indian Ocean rim countries, including experts, is being developed. For the bibliography, information has been collected from *Mangrove Ecosystem Information Service*, *Aquatic Science and Fisheries Abstracts (ASFA)*, *AGRIS*, *CAB Abstracts* on CD-ROM and an earlier database compiled on mangroves in the Asia-Pacific and the Northern Indian Ocean Region. The search resulted in more than 14,000 entries. After elimination of duplicates and standardisation of data elements, 2,840 entries have been included in the database and key words provided for each entry. India is among the top ten countries in the number of publications on mangroves. The experts database consists of information on 576 scientists and professionals active in mangrove ecosystem research and management in the Indian Ocean region. India, Japan, Australia, China, Philippines, Thailand, Brazil,

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Indonesia, Malaysia and South Africa account for two-thirds of the mangrove experts.

### **Bioinformatics centre**

MSSRF hosts one of the 55 bioinformatics centres established by the Department of Biotechnology.

The Centre works in close cooperation with the genetic engineering group of the Foundation and field stations involved in biodiversity and has developed a software for the digital slide library using HTML and JavaScript.

A Multimedia Database on Plant Tissue Culture Techniques has been developed in collaboration with the National Chemical Laboratory, Pune, and the Tata Energy Research Institute, New Delhi. The database is available on CD-ROM and it includes a bibliography.

The Centre assists the Scientific Committee on Problems of the Environment (SCOPE) of the International Council of Science (ICSU) in converting all the books published by SCOPE during 1972-1998 into web-accessible form. 37 volumes running to about 15,000 pages are to be converted. Nine volumes have been completed and these are hosted on the ICSU's website. Work is in progress on the remaining books.

The list of books converted so far includes the following :

- *Biological Invasions: A Global Perspective*, edited by J.A. Drake, H.A. Mooney, F. di Castry, R.H. Groves, F. J. Kruger, M. Rejmánek and M. Williamson, 1989, John Wiley & Sons. SCOPE 37.
- *Ecosystem Experiments*, edited by Harold A. Mooney, Ernesto Medina, David W. Schindler, Ernst-Detlef Schulze and Brian H. Walker, 1991, John Wiley & Sons. SCOPE 45.
- *Environmental Impact Assessment: Principles and Procedures*, edited by R. E. Munn, Second edition 1989 reprint, John Wiley & Sons. SCOPE 5.
- *Functional Roles of Biodiversity: A Global Perspective*, edited by Harold A. Mooney, J. Hall Cushman, Ernesto Mediana, Osvaldo E. Sala and Ernst-Detlef Schulze, 1996, John Wiley & Sons. SCOPE 55.
- *Global Change: Effects on Coniferous Forests and Grasslands*, edited by A. I. Breymer, D. O. Hall, J. M. Melillo and G. I. Ågren, 1996, John Wiley & Sons. SCOPE 56.
- *Long-term Ecological Research: An International Perspective*, edited by Paul G. Risser, 1991, John Wiley & Sons. SCOPE 47.
- *Practitioner's Handbook on the Modelling of Dynamic Change in Ecosystems*, J. N. R. Jeffers, 1988, John Wiley & Sons. SCOPE 34.
- *Scales and Global Change: Spatial and Temporal Variability in Biospheric and Geospheric Processes*, edited by Thomas Rosswall, Robert G. Woodmansee and Paul G. Risser, 1988, John Wiley & Sons. SCOPE 35.
- *Sustainability Indicators: A Report on the Project on Indicators of Sustainable*



*Development*, edited by Bedrich Moldan, Suzanne Billharz and Robyn Matravers, 1997, John Wiley & Sons. SCOPE 58.

### **Provision of information**

Accessing information is essential to development. Unfortunately, scientists in developing countries do not have access to most journals and secondary services and are therefore handicapped. To redress this problem to some extent, MSSRF provides free access to CAB Abstracts on CD to faculty and students of academic and government research institutions. Searches were made for about 1,200 users this year. Most of them came in person, but a large number of outstation clients sent in their requests by post. An analysis of the users shows that they are from 10 universities, 40 colleges and 11 research institutes. Notable among the institutions are Bidan Chandra Krishi Viswa-vidyalaya, Mohanpur, WB, and Tamil Nadu Agricultural University, Coimbatore.

### **Sub Programme Area 504**

#### **Scientometrics / Literature Analysis Group**

Three studies have been completed for NISSAT-DSIR on mapping research in mathematics (based on data from *Mathsci*), agriculture (based on CAB Abstracts) and life sciences (based on *Biological Abstracts*) in India in 1998. These form part of a larger study on national mapping of scientific research. Our results are compared with those of our earlier studies for the period 1990-1994.

CAB Abstracts has indexed 11,855 papers from India, published in 1998. Of these, 4,855 are in the area of "plants of economic importance (general)", 1,808 are on "Animal science" and 910 are on "Soil sciences". More than 7,000 papers have come from academic institutions and more than 2,000 from ICAR laboratories. More than 78% of the papers have appeared in Indian journals and close to 80% of the papers have appeared in non-SCI journals. Chaudhary Charan Singh Haryana Agricultural University, Punjab Agricultural University and the Indian Agricultural Research Institute are the leading publishers of research papers.

Studies on mapping fish and aquaculture research in India and China have been completed, based on bibliographic data collected from six databases, viz. *Aquatic Science and Fisheries Abstracts*, *Biological Abstracts*, *CAB Abstracts*, *Science Citation Index (SCI)*, *Biochemistry and Biophysics Citation Index (BBCI)* and *Biotechnology Citation Index (BTCI)*.

The earlier study on mapping medical research in India [see *Current Science*, 72 (1997), 912-922 and *National Medical Journal of India*, 11 (1998), 27-34] has been extended to three specialities, viz. cardiovascular disease, tuberculosis and diabetes. These studies are based on data for ten years (1990-1999) from three databases, viz. *PubMed*, *Science Citation Index* and *Biochemistry and Biophysics Citation Index*. India and China lead the world in the incidence of diabetes and tuberculosis and yet their share of the world's published literature in these fields is meagre. Apart from analyzing the published literature for identifying distribution by

institution, institution type, journal, journal country and journal impact factor, the citations for each paper up to the end of 2000 from both SCI and BSCI have been included. Similar studies of mapping research in these three specialties have been carried out for the Peoples Republic of China and the data for the two countries have been compared. From bibliographic data of papers indexed in SCI and BSCI, the extent of international collaboration has been estimated and it has been found that 11% of Indian papers and 23% of Chinese papers on cardiovascular disease research, 7.4% of Indian papers and 45% of Chinese papers on tuberculosis and 19% of Indian papers and 36% of Chinese papers on diabetes are internationally coauthored. The findings will be published soon.

In view of the increasing role played by international collaboration in science, international collaboration involving India, China, Japan and Israel has been quantified through coauthorship analysis based on data collected from SCI 1998. Of the four countries Japan has recorded the lowest percent of internationally collaborated papers, albeit on a very large base of publications. India, China and Israel collaborate mainly with partners in G7 countries, especially the USA, whereas China and South Korea are among the top seven countries collaborating with Japan. In the recent past, China has overtaken India in both the number of papers published and in the percentage of internationally collaborated papers.

Work has commenced on mapping new biology research in India and the role of

public funding in life science research. New biology papers from India, seen from three databases, viz. BSCI, BTCL and Derwent's Biotechnology Abstracts, have been analysed for the publication years 1992 and 1995.

In view of the rising costs of journals and dwindling funds for libraries in India, we have been actively promoting the idea of setting up Open Archives for preprints and have been negotiating with the Department of Biotechnology to set up an archive at the Foundation. To gain wide acceptance of the idea, a two-day conference was convened in mid-September 2000. Among the participants were Prof P Balaram, Editor of *Current Science*, Stevan Harnad, Professor of Cognitive Sciences at the University of Southampton and a champion of the Open Archives idea, and Mr Alan Gilchrist, Editor of *Journal of Information Science*.

### **Sub Programme Area 505**

#### **Library and Information Services**

The Boothalingam Library serves the scientists, scholars and researchers of MSSRF. However, it is open to the academic community for reference. Nearly 2,000 external users visited our library during the year.

The Library houses about 15,000 documents, 125 professional core journals and more than 250 video cassettes. Agriculture, Biology, Environment, Forestry and Gender are the core subject areas that shape the collection. Alert service is regularly provided to all staff through the network. OPAC (Online

Public Access Catalog) is also made available for users.

Bibliographic information of all the documents is accessible through the campus-wide network. The library also functions as a storehouse of the Foundation's publications.

### **Sub Programme Area 506**

#### **Workshops and Conferences/ Training Programmes**

In keeping with the mandate of the Foundation, several International, national and local level workshops, conferences and training programmes were organised during the year. They served to design and finalise action-research programmes in collaboration with several partners. Besides, seminars were organised with speakers from within the Foundation and distinguished visitors, to provide an exposure to emerging concerns and topics in areas relevant to the Foundation's activities.

The Workshops /Conferences of national and international scope are presented in Table 5.3. While details of many of these are reported in the relevant programme areas from PA100-400, a few are reported in this section.

#### ***LEAD-MSSRF Workshop on Intellectual Property Rights and Human Wellbeing (2-5 August 2000)***

LEAD is committed to creating a global society based on mutual obligations and

responsibilities in which development patterns will satisfy the shared needs and aspirations of all peoples and respect the Earth's living systems and natural resources. A Workshop for the LEAD Fellows on *Intellectual Property Rights and Human Wellbeing* was held from 2- 5 August 2000. Prof Calestous Juma inaugurated the workshop and along with Ms Henson, Appollonio Victoria, ISNAR served as the key resource person. Participants included LEAD Fellows from eight countries.

The issues addressed concerned the formal and informal protection and rewarding systems inclusive of gender implications, safeguards in the Acts and Agreements to achieve this and the institutional, investment and delivery mechanisms available globally and locally to harness the benefits of modern S&T accomplishments for national and global public good.

The recommendations of the workshop suggested that in both the national and international contexts, the development of strong national policies for assignment and protection of IPRs are of absolute priority and include inputs from the grassroots levels (traditional or indigenous plus general public) as well as the regulatory, scientific and political perspectives.

Additionally, as nations differ in their ability or willingness to develop policy into a firm institutional context with associated enforcement mechanisms, inter-institutional cooperation becomes an imperative to ensure that concepts related to or affected by IPRs are not adversely influenced by any new IPR policy.

Table 5.3 : *Conferences/workshops*

<b>Title</b>	<b>Associate Sponsors</b>	<b>Date</b>	<b>SPA</b>
<i>ACCESS : Communication Workshop for NGOs</i>	—	July 2000	401
<i>Workshop for the LEAD Fellows on Intellectual Property Rights and Human Wellbeing</i>	LEAD Intl., USA	2-5 August 2000	501
<i>Workshop on Intellectual Property Rights and Food Security</i>	NISSAT	3-4 August 2000	501
<i>Workshop on Green Belting &amp; Eco-Development in Kudankulam</i>	DAE	28 August 2000	501
<i>Conference on Advances in Information Science &amp; Communication</i>	Current Science Association; IIT, Madras; L&T Ltd., Chennai	16 September 2000	506
<i>Workshop on Biovillage Programme: Extending the Biovillage Concept to all the Villages of Pondicherry</i>	—	25 November 2000	501
<i>Conference on Management of Alien Invasive Species</i>	CABI Bioscience, UK	2-5 December 2000	501
<i>Tenth Inter-disciplinary Dialogue in the series New Technologies - Reaching the Unreached- Information and Communication Technologies for Poverty Eradication</i>	CAPART, ISRO, Ford Foundation	18- 20 January 2001	501
<i>Project Design Workshop on Enhancing the Contribution of Neglected and Underutilized Species to Food Security and to Incomes of the Rural Poor</i>	IPGRI-IFAD	23 -25 January 2001	501

Efforts in development aid should focus on the inequity and differences in bargaining power of developed and less developed countries and work toward national capacity building as opposed to the imposition of policies developed elsewhere. A clear national policy

on IPRs is a fundamental prerequisite for the implementation of any international agreement or convention.

Proceedings and conclusions of the workshop were to be shared with other LEAD Fellows and their inputs sought. It was also suggested

that Fellows in their individual countries and spheres of influence should seek ways to have a voice in the discussions and become active contributors to the knowledge reservoir and subsequent policy development.

***NISSAT - MSSRF Workshop on Intellectual Property Rights and Food Security (3- 4 August 2000)***

Intellectual Property Rights (IPR) have in recent years become increasingly relevant in diverse policy areas including trade, health, culture and heritage, investment, environment, food security and scientific and technological progress. The two-day workshop on "Intellectual Property Rights and Food Security", organised by MSSRF was sponsored by the National Information System for Science and Technology (NISSAT), Department of Scientific and Industrial Research (DSIR). Dr G Thyagarajan, Scientific Secretary, COSTED, inaugurated the workshop.

The focus of the workshop was awareness about the challenges posed by biological inventions and the implications of the TRIPS Agreement Article 27.3 (b) that permits exceptions from patentability for plants, animals and biological processes and includes the requirement for a *sui generis* system of protection for plant varieties or use of patents or both. The key issues, their scope, review options, the relationship between the review and other international obligations, notably those under the Convocation of Biological Diversity and International Undertaking on Plant Genetic Resources were dealt with.

The participants in the workshop included Mr N R Krishnan, Former Secretary to the Govt. of India, Dr M D Nair, IPR Consultant, Dr P Ganguli, Hindustan Lever Ltd., Mumbai;

Dr Pushpangadhan, Director, NBRI and other scientists, technologists, managers of R&D institutions and industries and policy makers dealing with issues relating to Intellectual Property and Patent Information.

***Workshop on Green Belting & Eco-development in Kudankulam (28 August 2000)***

A research project on ecodevelopment is being conducted in Kudankulam since 1998 in partnership with a number of government and non-government organizations. In order to discuss the progress made and to prioritise future action plans in the area, a two-day workshop on *Green-belting and Ecodevelopment in Kudankulam* was organized at the Manonmanian Sunderanar University, Tirunelveli. Mr V K Chaturvedi, Chairman and Managing Director of NPCIL inaugurated the workshop. This workshop was attended by representatives from the Department of Atomic Energy, Mumbai; Nuclear Power Corporation of India Limited, Mumbai; Space Application Centre, Ahmedabad; National Bureau of Soil Survey and Landuse Planning, Nagpur; Central Tuber Crop Research Institute, Trivandrum; Indian Rare Earths Limited, Manavalkuruchi; Forest, Agriculture and Groundwater departments of the State Government, NGOs in the area, Panchayat leaders and members of the self help groups at Kudankulam. The participants also visited the green-belt and demo-plot developed by MSSRF at Kudankulam.

The technical presentations dealt with the progress made in mapping the soil types and available water resources in Kudankulam. Practical difficulties faced during the implementation of the project were also discussed in detail. These discussions provided options

for the application of frontier technologies in the area of agriculture, fisheries, forestry and water management. The broad recommendations of the workshop included (a) developing demonstration sites for different soil types in the region, (b) developing self-help groups for management of scarce water resources in the region and (c) development of a genetic garden for fruit crops in the region. These recommendations have already been translated into action.

***Workshop on Biovillage Programme: Extending the Biovillage Concept to all the Villages of Pondicherry (25 November 2000)***

His Excellency Mr Fawzi H Al-Sultan, President, International Fund for Agricultural Development (IFAD), Rome, visited the Biocentre at Pillayarkuppam and the Information Village Programme on 25<sup>th</sup> November 2000. During this visit he evinced keen interest in the Biovillage Programme of MSSRF. He addressed nearly 400 members of various Self Help Groups (SHGs) in the Biovillage Programme and complimented the villagers for coming together and taking development initiatives. He described the role of IFAD in encouraging the Self Help Group movement all over the developing world. He appreciated the blending of micro enterprises with the Self Help Group movement and felt that it would help in strengthening the rural economy. Later he attended a meeting presided over by Her Excellency the Lt Governor of Pondicherry, Dr Rajani Rai. During this meeting a presentation was made by MSSRF on extending the concept of Biovillage to all the villages in Pondicherry. His Excellency Mr Fawzi H Al-Sultan appreciated these efforts of MSSRF in taking steps for replicating the concepts of Biovillage. Her Excel-

lency, the Lt Governor of Pondicherry thanked MSSRF for providing a framework for the Biovillage programme in Pondicherry

Mr Mark Malloch Brown, Administrator, United Nations Development Programme (UNDP), New York visited the Biocentre on 15<sup>th</sup> February, 2001 and held discussions with the staff and representatives of various Self Help Groups in the Biovillage Programme. He discussed issues such as the financial delivery mechanism and the impact of the project on the rural poor. He appreciated the efforts of the Programme, particularly the efforts such as linking modern information and communication technology with rural development programmes. Later he met the Governor and the Chief Minister of Pondicherry and discussed the possibility of replicating the Biovillage concept in all the villages of Pondicherry. He later held a Press Conference in which he appreciated the efforts of the Biovillage programme "*in helping the poor to help themselves*". In the afternoon, he visited the MSSRF office at Chennai and discussed the various issues in connection with the Gulf of Mannar Biosphere Reserve Project.

***CABI Bioscience, UK - MSSRF Conference on Management of Alien Invasive Species (2-5 December 2000)***

The Barwale Chair coordinated the Conference on Management of Alien Invasive Species in collaboration with CABI Bioscience, United Kingdom from 2-5 December 2000. Alien species occur outside their normal geographical distribution and are a major threat to biological diversity, next only to habitat destruction. This problem has intensified with increasing global trade,

international travel, global climate changes and changing land use patterns and warrants appropriate containment policies and procedures. These aggressive invaders include weeds, fish and mammals. *Lantana camara* (Lantana), *Chromolaena odorata* (Siam weed), *Eichhornia crassipes* (Water hyacinth), *Salvinia* sp., *Achatina fulica* (Giant African Snail), are some of the notable invaders that have colonised the Indian sub-continent. The Convention on Biological Diversity (CBD), Article 8(h) calls for the prevention, control or eradication of alien species, which threaten ecosystems, habitats or species. In spite of the magnitude of the problem, there are serious gaps in research. Experimental studies on the processes and mechanisms of biological invasions need to be initiated to understand their effects on biodiversity and food security. This is essential to evolve a systematic approach to the management of alien invasive species on public and private lands. Several participants from national and regional research institutes, universities and governmental agencies participated in the deliberations and evolved a set of recommendations. An interim proceeding of the conference is being compiled.

### ***Tenth Inter-disciplinary Dialogue in the series "New Technologies for Reaching the Unreached"- Information and Communication Technologies for Poverty Eradication (18-20 January 2001)***

Since its establishment in 1990, MSSRF has been organising an annual inter-disciplinary dialogue under the generic title "New Technologies: Reaching the Unreached". This year the workshop was inaugurated by

Prof Bruce Alberts, President, US National Academy of Sciences. Participants included Dr Adel -el-Beltagy, DG, International Centre for Agricultural Research in the Dry Areas, Syria, Prof M Anandkrishnan, Advisor to Chief Minister of TamilNadu (IT) and distinguished international and national scientists, policy makers and technologists. The dialogue on the theme "Information and Communication Technologies (ICTs) for Poverty Eradication" considered issues such as the role of ICTs in bridging the rich-poor divide; the role that science academies, national and local governments, bilateral and multilateral donors, UN agencies, private business, industry and the corporate sector could play in bridging the digital divide; and the design of a low transaction-cost, user-controlled, driven and managed system. In addition, for India, the Dialogue will assist in drawing up an Agenda 2007 to mobilise ICT for ending chronic hunger and promoting a Community Food and Water Security system.

The following emerged as the major recommendations of the workshop:

- ICT, if properly used, is an important means for improving the conditions of the poor in every country. IT should have a social agenda.
- There is a need for reform in freedom of and access to information. IT can be a tool for providing better access and information.
- Policy makers, while evaluating every IT policy with regard to its impact on the common man, should make Governments include a section on ICT for the poor in overall IT policy.

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- There is a need for incentives to encourage local entrepreneurship.
- A comparative assessment should be made of incentives and policies adopted in different countries to encourage the growth of ICT.
- It is necessary to develop a Convention on IT, similar to the Biodiversity Convention, which will set the Agenda for the next decade.

### ***Project Design Workshop on Enhancing the Contribution of Neglected and Underutilised Species to Food Security and to Incomes of the Rural Poor (23-25 January 2001)***

The Barwale Chair coordinated the IFAD Project Design Workshop on enhancing the contribution of neglected species to food security and to the incomes of the rural poor. The workshop was supported by the International Plant Genetic Resources Institute (IPGRI), Rome, International Fund for Agricultural Development (IFAD), Rome and the International Development Research Centre (Food Links Initiative), Canada.

The food security basket of the world is extremely narrow, with six crops providing more than ninety percent of the world's food supply, although there are a large number of neglected and underutilized species that can make important contributions to the nutritional and livelihood security of large populations living in the semi-arid and marginal environments. Unfortunately, not much attention has been paid to such research and extension. The workshop was aimed at developing a project that would address the problem of reviving the use of some of the underutilized crops.

The workshop was attended by researchers from both governmental and non-governmental organisations from India, Nepal, Bangladesh and representatives from IPGRI and IFAD. Par the varieties. A Nutritious Millets Initiative (NMI) designed to create an economic stake in conservation of millets by linking conservation, cultivation, consumption and commercialisation in a mutually reinforcing manner will be started by the MSSRF in Kolli Hills. Well-defined workshops for senior policy makers would also be organised to ensure sustainability and spread the experiences gained by the project.

### ***Convocation for Members of the Community Agro-biodiversity Conservation Corps (2 May 2001)***

The project "Agrobiodiversity Conservation Corps (ACC)", funded by the Royal Embassy of the Netherlands, attempted a novel approach to contextualise agrobiodiversity issues among the local population by training 212 rural and tribal youth in selected agrobiodiversity hotspots over a period of five years. This project supports biotech activities and sums up the expectations of the proposed Biodiversity Bill. The volunteers will act as catalysts in carrying the message of agrobiodiversity to the people.

At the conclusion of the project in April 2001, a Convocation for members of the ACC was held at MSSRF. His Excellency Mr P F C Koch, the Ambassador of the Netherlands to India graced the occasion with his presence. Prof P C Kesavan, Executive Director, welcomed the gathering and described how through the ages, rural and tribal youth (men and women) have played a significant role in the conservation and enhancement of local



agrobiodiversity. Dr S John Joseph gave a brief resume of the projects implemented in the five sites over the last five years. The Ambassador delivered the convocation address and distributed certificates to the participants. He released a monograph on "Agrobiodiversity Conservation Corps: Catalysts of a Community Agrobiodiversity Conservation Movement" and expressed his satisfaction over the achievements of the project. Delivering the Presidential Address, Prof M S Swaminathan said that the ACC volunteers engaged themselves in field

activities to revitalize the conservation traditions of rural and tribal families. Conservation of biodiversity would be meaningless without strengthening the livelihoods of rural and tribal families.

Some of the major training programmes held under the different Programme Areas are listed in Table 5.4, the details of which are available under the sections indicated. This year too the JRD Tata Ecotechnology Centre held training programmes as indicated in Table 5.5

**Table 5.4 : Major training programmes**

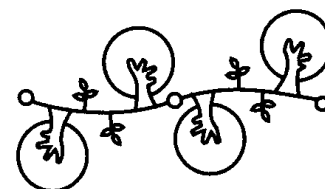
<b>Programme Area</b>	<b>Area of Training</b>	<b>Site/Location</b>	<b>Participants</b>
<b>Coastal Wetlands</b>			
SPA 101	Conservation methods, alternative livelihoods	Project sites in 3 states	Rural Families
SPA 101	Pisciculture, animal husbandry, agri horticulture	West Bengal	Forest Protection Council members
SPA 101	GIS	Andhra	Forest Staff
<b>Biodiversity</b>			
SPA 201	Conservation methods	Project sites	Self help groups
SPA 201	Agro biodiversity	Project sites	Rural youth
<b>Ecotechnology</b>			
SPA 301	Minor millets and pineapple production and marketing	Project sites	Rural families
SPA 301	Precision farming	Project sites	Rural families
SPA 301	Low cost greenhouses, ecoaquaculture	Project sites	Rural families
<b>Biovillages</b>			
SPA 301	Integrated Intensive Farming System	Project sites	Rural families
SPA 301	Self help groups and rural entrepreneurship	Project sites	Rural families

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Table 5.5 : *Training programmes held at the JRD Tata Ecotechnology Centre*

Programme	Trainee days		
	Women	Men	Total
Minor millets and pineapple production and marketing	2,294	1,682	3,976
Integrated Intensive Farming System	227	221	448
Ecoaquaculture	386	82	468
Ecopreneurship and micro enterprises	1,572	150	1,722
Precision farming	610	930	1,540
Self help groups and rural entrepreneurs	775	490	1,265
PRA, monitoring and evaluation and developing micro plans	282	210	492
Training for field officers and Government officials	2	68	70
Biovillages, Pondicherry			2,423
<b>Total</b>			<b>12,381</b>

## Programme Area 600



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# Special Projects

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*Special projects were undertaken in the areas of sustainable management of important global ecosystems and the assessment of gaps in gender, science and technology. A programme titled "Opportunity in Calamity" was initiated in the super-cyclone ravaged villages of coastal Orissa and the earthquake devastated areas of the Kutchh region of Gujarat.*

<b>601</b>	Preparation of Expert Report on Policy Issues and Responses .....	152
<b>602</b>	Assessment of Resources, Best Practices and Gaps in Gender, Science and Technology .....	152
<b>603</b>	Opportunity in Calamity.....	153

### **Sub Programme Area 601**

#### **Preparation of Expert Report on Policy Issues and Responses**

An Expert Report on Policy Issues and Responses to changes in the five ecosystem types dealt with in the World Resource Report 2000 - 2001 from the perspective of a developing country is being prepared.

#### **Background and objective**

The World Resources Report 2000 – 2001 on “*People and Ecosystem: Fraying Web of Life*”, which is a collaborative effort of the United Nations Development Programme (UNDP), the United Nations Environment Programme (UNEP), the World Bank and the World Resources Institute, presents the results of the Pilot Analysis of Global Ecosystems (PAGE) undertaken in 1999. This report, undertaken in September 2000, documents the condition on a global scale, of the five ecosystem types at the beginning of the 21<sup>st</sup> century: agro-ecosystems, coastal areas, forests, freshwater systems and grasslands. The PAGE will be the foundation of a millennium ecosystem assessment.

Results of the Pilot Analysis show that these five ecosystem types have undergone adverse changes that have been induced by anthropogenic activities. The changes, which threaten the ability of these systems to provide goods and services on a sustainable basis, have elicited many policy and other responses throughout the world. Decision 20/1 of UNEP’s Governing Council 20 Session requested an Expert Committee Report on

Policy Issues and Responses to Changes in these five ecosystem types. This Expert Report will be on a global scale, but will also include regional and sub-regional issues and responses, where noteworthy. Particular emphasis on analysis and assessment of policy impact and effectiveness as well as discussion of policy types and instruments have been sought.

A Memorandum of Understanding was signed between MSSRF and UNEP in February 2001 and the Report is under preparation.

### **Sub Programme Area 602**

#### **Assessment of Resources, Best Practices and Gaps in Gender, Science and Technology**

A resource group of scientists and technologists from the Asia Pacific region came together in Chennai, India to deliberate on “Women in Science and Technology, Science and Technology for Women” from 17-19 December, 1996. The *Chennai Declaration* and a 10-point Agenda for Action were drawn up as a result. Following this, the First Regional Advisory Group Meeting on Assessment of Resources, Best Practices and Gaps in Gender, Science and Technology in the Asia-Pacific Region, held in the Philippines from 5-7 September, 2000, decided to undertake this study in continuation of the Chennai meet. The study is sponsored by UNESCO-UNDP, Asia Pacific Region.

This project intends to build on what was started in Chennai and implement some of the action points which were raised. The

result of this national and regional scanning is expected to serve as a baseline information or a "well documented knowledge base" as to what has been achieved as well as the gaps in addressing the needs of the poor women and other gender issues in S&T, particularly in the fields of biotechnology, green health, information technology, renewable energy and water. The countries where this exercise is being conducted are Mongolia, Korea, China, Philippines, Vietnam, Thailand, Indonesia, India, Nepal, Pacific-Fiji, Samoa and Kiribati.

The Foundation was invited to be the National Focal Point for this three month exercise as the organizer of the Chennai Declaration meet and also due to its active involvement in the existing network on gender-sensitive issues and institutional capacity to carry out the project. The activity was initiated on 1<sup>st</sup> March 2001 with the scanning material developed by the Regional Advisory Members.

Data is being collected from Ministries, concerned Departments and line Agencies including funding agencies, universities, NGOs and CSOs. Government mandates, memos, resolutions, ordinances, reports and other policies, as well as certain grassroot initiatives promoting women's (including rural women) access to scientific knowledge and technological innovation in the above-mentioned areas are being sourced.

The organizations/institutions/individuals have been identified and primary and secondary data is being collected through their response to a questionnaire and

interviews with key informants. Based on the analysis the country report is expected to be ready by October 2001. The regional findings, based on the National reports, is expected to be ready for dissemination through a Regional Workshop in the early part of 2002.

### **Sub Programme Area 603**

#### **Opportunity in Calamity**

MSSRF has initiated sustainable development activities in regions struck by major disasters. The main objective of the initiatives is not only to mitigate the immediate problems but also to evolve a long-term strategy which would help the community to cope with disaster and adopt appropriate rehabilitation measures. It has initiated the Biovillage programme in the cyclone affected coastal areas of Orissa. The Programme focuses on empowering the rural communities to play a major role in strengthening the community-based rehabilitation programmes and capacity building in disaster management and rehabilitation programmes. The communities have been encouraged to design their own disaster management structures such as cyclone shelter buildings. In the village of Gayaspur, the villagers have designed the cyclone shelter in consultation with local architects. They have also managed to get a plot of land from the Government to construct the cyclone shelter building. They have initiated a Grain Bank which would help them in the event of calamities. Similar efforts have been taken in Mallikapur, another coastal village where a school building is being

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developed as a multi-purpose cyclone shelter. Self Help Groups are being formed to initiate micro-enterprises and efforts are being taken to introduce the modern information and communication technology.

In the Kutch region of Gujarat which was affected by severe earthquakes, MSSRF has been working closely with the Gujarat Agricultural University (GAU) and Vikram

Sarabhai Centre for Development Interaction (VIKSAT), a leading Non-Governmental Organisation of Gujarat, with the support of *Friends of MSSRF*, in strengthening efforts to initiate micro-enterprises for villagers affected by the disaster.

Networking with various NGOs is found to be an effective strategy to reach disaster-affected areas.

## **Publications**

### **Books/Monographs/Manuals**

Eganathan, P. and C. Srinivasa Rao. 2001. *Manual on Vegetative and Micropropagation in Mangroves*. Manual no.2. MSSRF, Chennai. 34pp.

Jnani. 2000. *Media Uravugal* (Tamil). Manual no.1. MSSRF, Chennai. 67pp.

Kanvinde, Hemal and Gita Gopalkrishnan. 2000. *Gender Dimensions in Biodiversity Management and Food Security: Policy and Programme Strategies for Asia*. Proceedings no.37. MSSRF, Chennai. 39pp.

M. S. Swaminathan Research Foundation. 2000. *A Social Vision for Science: The History of the M. S. Swaminathan Research Foundation, Chennai - (1990-2000)*. MSSRF, Chennai. 22pp.

M. S. Swaminathan Research Foundation. 2000. *Quality Matters: Understanding the Relationship Between Quality of Early Childhood Education and Learning Competencies of Children: An Exploratory Study in Tamilnadu*. Research Report no.4. MSSRF, Chennai. 57pp.

M. S. Swaminathan Research Foundation. 2001. *Agrobiodiversity Corps: Catalysts of a Community Agrobiodiversity Movement*. Monograph no.9. MSSRF, Chennai. 24pp.

M. S. Swaminathan Research Foundation and the United Nations World Food Programme. 2001. *Food Insecurity Atlas of Rural India*. MSSRF, Chennai. 162pp.

Planning Commission, Government of India, MSSRF and the UNWFP. 2001. *National consultation on Towards Hunger Free India*. MSSRF, WFP and UNWFP Chennai. 26pp.

Shanmugavelan, Murali. 2000. *Media and the Gene Revolution*. Proceedings no.38. *The Hindu Media Resource Centre for Ecotechnology and Sustainable Development*, MSSRF, Chennai. 25pp.

### **Reports/Theses**

Bhuvanewari, M. 2000. *The Unborn Girl Child: A Case Study on Sex Ratio at Birth as an Indicator of Female Foeticide*. Working Paper no.7. MSSRF, Chennai. 19pp.

Christina, A. 2000. *Panchayati Raj and Child Care Services: An Action-Research Study*. Working Paper no.6. MSSRF, Chennai. 22pp.

Jayashree M, 2001. *Gender and Biodiversity Correlates of Food Security : A Case Study of Kolli Hills, Tamil Nadu*. Thesis submitted to the University of Madras in partial fulfilment of requirements for the degree of Doctor of Philosophy.

John Joseph, S. 2001. *Early and Current Forest and Biodiversity History*. Report presented to the National Biodiversity Strategy and Action Plan to Tamil Nadu Nodal Agency. Southern Forest College, Coimbatore.

Latha, R. 2000. *Studies on Propagation, Genetic Relationship and Characterization of Salinity Tolerance in *Porteresia coarctata* (Roxb.) Tateoka, a Wild*

*Relative of Rice*. Thesis submitted to the University of Madras in partial fulfilment of requirements for the degree of Doctor of Philosophy.

Senthilkumar, P. 2000. *Cloning, Characterization and Expression of Vacuolar H<sup>+</sup>-ATPase Subunit c from the Mangrove Species *Porteresia coarctata* (Roxb.) Tateoka*. Thesis submitted to the University of Madras in partial fulfilment of requirements for the degree of Doctor of Philosophy.

M. S. Swaminathan Research Foundation. 2000. *Biovillage-Oriented Development Plan for the Union Territory of Pondicherry*. MSSRF, Chennai.

M. S. Swaminathan Research Foundation. 2000. *The Biovillage Experience: A Tool kit for Developing Biovillages: A Human Centered Paradigm for Sustainable Agricultural and Rural Development*. MSSRF, Chennai.

Swaminathan, M. S. and S. Rajagopalan. 2000. *Elimination of Micronutrient Malnutrition in Tamil Nadu*. Baseline Survey Report of Pennagaram Block, Dharmapuri District. FAO Project of MSSRF, Chennai and Gandhigram Rural Institute, Gandhigram.

### **Articles in Journals/Books**

Arunachalam, S. and M. Jinandra Doss. 2000. Mapping International Collaboration in Science in Asia through Coauthorship Analysis. *Current Science*. 79(5): 621-628.

Arunachalam, S. 2000. Information and Knowledge in the Age of Electronic

Communication: A Developing Country Perspective. *Debates on Issues of our Common Future*. Wilhelm Krull (ed). Velbruck Wissenschaft, Germany. 231-252.

Arunachalam, S. 2000. International Collaboration in Science: The Case of India and China. *The Web of Knowledge: A Festschrift in Honor of Eugene Garfield*. Blaise Cronin and Helen B Atkins (eds.). Medford, New Jersey. 215-231.

Arunachalam, S. and S. Senthilkumaran. 2001. Assessment of Impact of Information Technology on Rural Areas of India. *APWIN*. 3: 132-140.

Arunachalam, V. 2001. The Science Behind Tradition. *Current Science*. 80(10): 1272-1275.

Arunachalam, V. 2000. Paradigms of Participatory Enhancement of Rice Productivity: Suggestions based on a Case Study in India. *Current Science*. 79(3): 369-372.

Arunachalam, V. 2000. Participatory Conservation: A Means of Encouraging Community Biodiversity. *Plant Genetic Resources Newsletter*. 122: 1-6.

Arunachalam, V. 2000. Participatory Paths to Conserving and Utilizing Plant Biodiversity in India. *Biodiversity*. 1(4): 9-20.

Balaji, V. and K. Balasubramanian. 2000. Information Village. *Students' Britannica India*. Dale Hoiberg and Indu Ramchandani (eds). Encyclopaedia Britannica (India), New Delhi. 313-319.



- Balaji, V., K. G. Rajamohan, R. Rajasekara Pandey and S. Senthilkumaran. 2000. Toward a Knowledge System for Sustainable Food Security: The Information Village Experiment in Pondicherry. *On The Internet*. 6(2): 32-37.
- Chelliah, S. 2001. Mangrove Forests: A Threatened Ecosystem. *Yojana*. 45: 30-31.
- Cheriyann, V. D., C. J. Kurien, Birajalaxmi Das, E. N. Ramachandran, C. V. Karuppasamy, M. V. Thampi, K. P. George, P. C. Kesavan, P. K. M. Koya and P. S. Chauhan. 1999. Genetic Monitoring of the Human Population from High-Level Natural Radiation Areas of Kerala on the Southwest Coast of India. II. Incidence of Numerical and Structural Chromosomal Aberrations in the Lymphocytes of Newborns. *Radiation Research*. 152: S154-S158.
- Devasagayam, T. P. A. and P. C. Kesavan. 2000. Radiation Hormesis: Issues of the Decade. *Advances in Medical Physics*. M. M. Rehani (ed). Jeypee Brothers, New Delhi. 280-287.
- Eganathan, P., C. S. Rao and Ajith Anand. 2000. Vegetative Propagation of Three Mangrove Tree Species by Cuttings and Air Layering. *Wetlands Ecology and Management*. 8: 281-286.
- Eganathan, P., C. S. Rao, Ajith Anand and P. Balakrishna. 2000. Propagation of *Rhizophora* Species through Viviparous Hypocotyl Cuttings and Air Layering. *The Indian Forester*. 126(11): 1222-1230.
- Jayashree, B. and S. Arunachalam. 2000. Mapping Fish Research in India. *Current Science*. 79(5): 613-620.
- Jayashree, B., T. P. A. Devasagayam and P. C. Kesavan. 2001. Low Dose Radiobiology: Mechanistic Considerations. *Current Science*. 80(4): 515-523.
- John Joseph, S. 2001. A Refreshing Experience to Foresters. *TANTEA Silver Jubilee Souvenir*. TANTEA, Coonoor. (in press).
- John Joseph, S. 2001. The Role of Bioenergy of Forests in Greenhouse Gas Mitigation (Implications of Kyoto Protocol). *TANTEA Silver Jubilee Souvenir*. TANTEA, Coonoor. (in press).
- Kamat, J. P., K. K. Boloor, T. P. A. Devasagayam, B. Jayashree and P. C. Kesavan. 2000. Differential Modification by Caffeine of Oxygen-dependent and Independent Effects of Gamma-irradiation on Rat Liver Mitochondria. *International Journal of Radiation Biology*. 76(9): 1281-1288.
- Kumar, S. S., T. P. A. Devasagayam, B. Jayashree and P. C. Kesavan. 2001. Mechanism of Protection against Radiation-induced DNA Damage in Plasmid pBR322 by Caffeine. *International Journal of Radiation Biology*. (in press).
- Lakshmi M., P. Senthilkumar, M. Parani, M. N. Jithesh and A. Parida. 2000. PCR-RFLP Analysis of Chloroplast Gene Regions in *Cajanus* (Leguminosae) and Allied Genera. *Euphytica* 116(3): 243-250.
- Lakshmi M., M. Parani, P. Senthilkumar and A. Parida. 2000. Mitochondrial DNA Variation and Species Relationships in Mangrove Rhizophoraceae. *Wetland Ecology and Conservation*. (in press).

## Annual Report 2000-2001

- Narayan, L. R. A. 2000. Remote Sensing for Crop Yield Predictions. *The Hindu Survey of Indian Agriculture*. 193-195.
- Parani M., K. Rajesh, M. Lakshmi and A. Parida. 2000. PCR-RFLP Markers for Seven Minor Millet Species. *Genome*. 44: 494-499.
- Ravikumar, M. V. 2000. Bitten by a Common Krait (*Bungarus caeruleus*). *Cobra*. 40: 11-13.
- Ravikumar, M. V. 2000. Occurrence of Black Torrent Toad *Ansonia ornate* in Sugandhagiri Hills, Wayanad, Kerala. *Cobra*. 41: 10-11.
- Saleena, Lilly M., P. Loganathan, R. Sunita and Sudha Nair. 2001. Genetic Diversity of *Bradyrhizobium* Strains Isolated from *Arachis hypogea*. *Canadian Journal of Microbiology*. 47: 118-122.
- Saleena, Lilly M., P. Loganathan, Sunita Rangarajan and Sudha Nair 2001. Genetic Diversity of *Bradyrhizobium* strains isolated from blackgram and cowpea. *Journal of Biology and Fertility of Soils*. (in press)
- Selvam, V., S. Chelliah and T. Ravishankar. 2001. Mangroves: An Unique Ecosystem. *Kisan World*. 28(6): 42-46.
- Shaleesha, A. and V. Amalan Stanley. 2000. Involvement of Rural Women in Aquaculture: An Innovative Approach. *NAGA, The ICLARM Quarterly*. 23(3): 13-17.
- Shaleesha, A., and V. Amalan Stanley. 2000. Managing Fresh Water Prawn Aquaculture. *SAIC Newsletter*. 10(3): 10.
- Shaleesha, A., V. Amalan Stanley, C. Nagaraja and S. Rajakani. 2000. An Illustrative Module for Rural Women in Aquaculture – Backyard Ornamental Fish Breeding and Marketing. *Indian Farming*. 14(7): 9-13.
- Shanmugavelan, Murali. 2001. Knowledge – An Aid to End Aid. *Sustainable Development International*. April: 187-189.
- Shukla, L. I., V. Natarajan, T. P. A. Devasagayam, M. D. Sastry and P. C. Kesavan. 2000. In-vivo EPR Studies on Irradiated Seeds: Identification of Hydrated Electrons and Nitrogen-centered Radicals. *Journal of Biosciences*. 24(Supplement 1): 195.
- Sunita Rangarajan, P. Loganathan, Lilly. M. Saleena and Sudha Nair 2001. Diversity of pseudomonads isolated from three different plant rhizopores. *Journal of Applied Microbiology*. (in press)
- Swaminathan, Mina. 2000. Worker, Mother or Both: Maternity and Child Care Services for Women in the Unorganised Sector. *The Unorganised Sector: Work Security and Social Protection*. Renana Jhabvala and R. K. A. Subrahmanya (eds). Sage, New Delhi. 122-138.
- Swaminathan, M. S. 2000. Agriculture in India: Fifty Years of Progress. *Students' Britannica India*. Dale Hoiberg and Indu Ramchandani (eds). Encyclopaedia Britannica (India), New Delhi. 243-256.
- Swaminathan, M. S. 2000. Freedom from Want. *The Franklin Delano Roosevelt Four Freedoms Awards*. William J. vanden Heuvel, et al (eds). Roosevelt Study Center, Middelburg. 31-33.

- Swaminathan, M. S. 2000. Key to Population Stabilisation and HR Development. *Yojana*. 44(8): 7-14.
- Swaminathan, M. S. 2000. Natural Resources Management for an Evergreen Revolution. *The Hindu Survey of Indian Agriculture*. 9-15.
- Swaminathan, M. S. 2000. Towards an Ethical and Equitable Human Order. *Biolog Newsletter*. 2(1): 6-7.
- Swaminathan, M. S. 2001. A Century of Menedlian Breeding : Impact on Wheat. *Wheat in a Global Environment: Proceedings of the 6th International Wheat Conference*. (eds) Z. Bedo and L. Lang. Kluwer Academic, Dordrecht. 5-21.
- Swaminathan, M. S. 2001. Agriculture on Spaceship Earth. *Coromandel Lectures: Platform for a Common Present and Future for Humankind*. Coromandel Fertilisers, Secunderabad. 37-65.
- Swaminathan, M. S. 2001. Antyodaya, Conserving Indigenous Knowledge and Bridging Global Divides. *Indigenous Knowledge Development Monitor*. 9(1): 36.
- Swaminathan, M. S. 2001. Biotechnology and Food Security. *Akshaya Vikas: Sustainable Development*. Eknath Ranade, P. Parameswaran and K. P. Shivkumar (eds). Vivekananda Kendra Prakashan Trust, Chennai. 208-212.
- Swaminathan, M. S. 2001. Dr. Karan Singh and Human Security. *The Earth Has No Corners: Felicitation Volume on the 70<sup>th</sup> Birthday of Dr. Karan Singh*. K. L. Nandan. Shipra (ed), Delhi. 235-244.
- Swaminathan, M. S. 2001. Techno-Centric Agriculture: Towards A Green Future. *Chemical Engineering World*. 36(3): 32-36.
- Thatoi, H. N., P. K. Mishra, A. Ouseph, J. R. Mohanty and L. N. Acharjyo. 2000. Rooting of Stem Cuttings of *Cerbera manghas* (L) and *Merope angulata* (Kurta) Swingle through Application of Growth Regulators: A Tool for Conservation of Endangered Mangroves. *Indian Forester*. 126(9): 985-992.
- Thatoi, H. N., P. K. Mishra, A. Ouseph, J. R. Mohanty and L. N. Acharjyo. 2001. Vegetative Propagation by Stem Cuttings with Auxius of Four Mangrove and Associate Species of Bhitarkanika, India. *Jour. Trop. Forest Sci*. 13(1): 223-227.

**Presentations in Conferences/Symposia**

- Arivudai Nambi, V. 2001. Agroecosystem Management Strategies in Rainfed Subsistence System: Case Study of Javadi Hills, Tamilnadu. *Workshop on Tropical Soil Biology and Fertility (TSBF) Group*. Jawaharlal Nehru University, New Delhi. February 21-23.
- Arivudai Nambi, V. 2001. Eastern Ghats in Tamil Nadu: Some Biodiversity Issues. *National Biodiversity Strategy and Action Plan (NBSAP) for Eastern Ghats in Tamil Nadu*. Department of Plant Science, Bharathidasan University, Tiruchirappalli. March 5.
- Arunachalam, S. 2000. Reaching the Unreached: Making Science Relevant to the People's Needs - An Indian Experience. *Sixth International Conference on Science Indicators*. Leiden, The Netherlands. May 24-27.

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- Arunachalam, S. 2000. Introductory Statement. *Workshop and Global Dialogue on the Role of the Village in the 21<sup>st</sup> Century*. ZEF, Bonn, Expo 2000, Hanover. August 15-17.
- Arunachalam, S. 2000. Improving the Visibility of Science in the Developing World. *International Crop Science Congress: Workshop on Strengthening Information and Communication*. Hamburg, Germany. August 17-20.
- Arunachalam, S. 2000. Implications of the Open Archives Initiative on Science and Scholarship in the Developing World. *Tenth International Conference of Science Editors*. Rio de Janeiro, Brazil. August 27-30.
- Arunachalam, S. 2000. Mapping International Collaboration in Science in Asia. *Second Berlin Workshop on Scientometrics and Informetrics*. Berlin, Germany. September 1-4.
- Arunachalam, S. 2000. Implications of New Information and Communication Technologies on Science and Scholarship in the Developing World. *International Conference on Asia-Pacific and the Global Order*. ICSSR, New Delhi. October 2-4.
- Arunachalam, S. 2000. Bridging the Digital Divide: Innovative Use of ICTs in Rural Development. *Wellcome Trust*. London. October 10.
- Arunachalam, S. 2000. Doing Research in the Developing World: Can New Technologies Help Achieve Information Equity? *SLA Global Conference*. Brighton, UK. October 16-19.
- Arunachalam, S. 2000. West Learns from the East for a Change: The Case of Ethnobotany and Drug Development. *International Conference on Knowledge and East-West Transitions*. National Institute of Advanced Studies, Bangalore. December 11-14.
- Arunachalam, S. 2001. Reaching the Unreached: Using ICTs in Development. *International Conference on Information Security: Managerial and Technological Challenges*. Forum Engelberg Asian Platform and MDI, New Delhi. February 12-13.
- Arunachalam, S. and S. Gunasekaran. 2001. Mapping Tuberculosis Research in India and China: The Extent of Mismatch between Burden of Disease and Research. *Workshop on Emerging Trends in Science and Technology Indicators: Aspects of Collaboration*. NISTADS, New Delhi. February 20-23.
- Arunachalam, V. 2000. Participatory Improvement of Rice Crop with Tribal Farmers in India. *International Symposium on Participatory Plant Breeding and Participatory Plant Genetic Resource Enhancement*. Systemwide Program on Participatory Research and Gender Analysis (SWPRGA), Pokhara, Nepal. May 1-5.
- Arunachalam, V. 2000. The Evolving Potential of Plant Breeding. *3rd N. Parthasarathy Endowment Lecture*. Madras Science Foundation, Chennai. August 30.
- Arunachalam, V. 2000. Structuring the Present for a Sustainable Future. *International Symposium on Sustainable Futures*. Madurai Kamaraj University, Madurai. December 18-19.

- Arunachalam, V. 2001. Contract Farming, Conservation Farming and/or Environment and Ecofriendly Agriculture? *National Seminar on Environmental Ethics and Sustainability*. Lady Doak College, Madurai. February 21-23.
- Balasubramanian, K. 2000. Conservation and Development: Learning from a Development Project. *Conference on Capitalization of Experiences in Sustainable Natural Resource Management and Biodiversity: Learning from Practice, Summary of the Findings*. Centre for Development and Environment and Swiss Agency for Development and Cooperation, Berne, Switzerland. September 28.
- Balasubramanian, K., R. Rajasekarapandy, C. Madhumathi, S. Sudarkodi and Vishwanath Palled. 2001. Netting the Knowledge and Fishing the Benefits. *National Workshop on Strategies for Applying ICT for Rural Development*. Tamil Nadu Veterinary and Animal Sciences University and Cornell University, Ithaca, New York, USA. May 17-18.
- Eganathan, P., C. S. Rao, H. M. Sankararamasubramanian and P. C. Kesavan. 2001. Clonal Propagation and Artificial Regeneration of *Rhizophora* Species: A Case Study of Establishment of Mangrove Genetic Resource Conservation Centre (MGRCC) in Pichavaram Mangroves, India. *Golden Jubilee Symposium on Biotechnological Innovations in Conservation and Analysis of Plant Diversity*. University of Delhi, Delhi. February 7-9.
- John Joseph, S. 2001. Man and Environment. *Workshop on Environment*. NEWS, Kolkatta. February 17.
- John Joseph, S. 2001. Man and Environment: Issues and Problems. *Workshop on Environmental Issues*. Department of Applied Research, Gandhigram Rural Institute, Gandhigram. April 27-28.
- Lakshmi, M. 2001. Potential Use of Biotechnology for Food Security and Poverty Alleviation. *International Workshop on Agricultural Biotechnology for the Poor*. Asian Development Bank and Australian Center for International Agricultural Research, Manila. January 15-17.
- Parida, A. 2000. Empowerment: Key to Sustainable Development. *Workshop on Uniting Science and Participation in Research*. CGIAR-PRGA, Nairobi, Kenya. November 5-10.
- Parida, A. 2000. Prospects of Vitamin-A Rice in Developing Countries. *Consultation on Development and Popularization of Vitamin-A Rice*. Swiss Agency for Development and Cooperation, New Delhi. October 30-31.
- Parida, A. 2000. Issues and Perspectives of GMOs in Developing Countries. *Invited Lecture*. Nutrition Society of India, Hyderabad. December 1-2.
- Parida, A. 2001. Steering Committee Meeting. ICSU panel on GMOs. Manchester. February 21-24.
- Radha, R. and M. S. S. Mohan. 2000. Major Essential Oil Components of Two Species of *Syzygium-S. travancoricum* and *S. tamilnadensis*. *Centennial Conference on Spices and Aromatic Plants*. Calicut, Kerala. September 20 -23.

- Rao, C. S., Radha Rajagopalan, P. Eganathan, H. M. Sankararamasubramanian, Latha Rangan and P. C. Kesavan. 2001. Strategies and Modern Tools for the Conservation of Medicinal Plants. *National Symposium on Medicinal Plants-2001*. Department of Botany, St. Joseph's College, Tiruchirapalli. February 5-6.
- Ravishankar, T. and R. Ramasubramanian. 2001. Status of Mangrove Ecosystem along the Coastal Zone of Andhra Pradesh. *Awareness Workshop on Biotechnology-based Programmes for Women and Rural Development*. Department of Biotechnology, New Delhi and SPICAM, Kakinada. January 29-30.
- Rengalakshmi, R. and V. Arunachalam. 2000. Genetic Improvement Initiatives Leading to Intensive Conservation including Genetic Integrity in Little Millet in India. *International Symposium on Scientific Basis for Participatory Improvement and Conservation of Crop Genetic Resources*. Oaxtepec, Morelos, Mexico. October 8-14.
- Senthilkumaran, S. 2000. ICT for Development: MSSRF – A Case Study. *The UNIMAS Symposium on Rural Development with Information and Communication Technologies*. Kuching, Malaysia. November 22-26.
- Senthilkumaran, S. 2001. Knowledge Centres in South India. *Integrating Modern and Traditional Information and Communication Technologies for Community Development*. Kothmale, Sri Lanka. January 22-27.
- Senthilkumaran, S. 2001. Models for Replication, Information and Communication Technology in the Union Territory of Pondicherry. *Meeting of the IT Secretaries of Northeastern States*. Ministry of Information Technology, New Delhi. February 22.
- Shanmugavelan, Murali. 2001. The Role of Information Technology in Development: Information Village Research Project Experience. *13<sup>th</sup> Kerala Science Congress*. Thirissor. January 31.
- Shanmugavelan, Murali. 2001. Information Empowerment and Democracy. *International Conference on Media for Democracy*, Worldview International Foundation, Colombo, Srilanka. May 31.
- Participation in Training Programmes/ Workshops**
- Arivudai Nambi, V. 2001. *Working Group on Traditional Seeds: State Level Workshop on Sustainable Agriculture*. Bharathiya Kisan Sangh, Trichy. January 25-26.
- Arunachalam, S. 2000. UNITEs Workshop on Spreading IT Skills through Voluntary Action. UN Volunteers, Bonn. August 21-23.
- Arunachalam, S. 2000. *Policy Dialogue on the Power of Ideas: Building Tomorrow's Global Knowledge Economies*. World Bank, UNESCO and DSE, Expo 2000, Hanover. September 5-8.
- Arunachalam, S. 2000. *International IT Conference on Crafting Knowledge Society in the 21<sup>st</sup> Century*. Thiru-vananthapuram, Kerala. November 23-25.

- Arunachalam, S. 2000. *Workshop on Using Information Technology organised for Coffee Board Officials*. MANAGE (Hyderabad), Mysore. December 18.
- Arunachalam, S. 2001. *Second ICSU-UNESCO Conference on Electronic Publishing*. Paris. February 19-23.
- Arunachalam, S. 2001. *World Bank – British Council Policy Forum on Using Knowledge for Development*. Wilton Park, West Sussex, UK. March 19-24.
- Arunachalam, V. 2000. *CGIAR Workshop on Genetic Resources Management in Ecosystems*. Bogor, Indonesia. June 27-29.
- Balasubramanian, K. 2000. *Regional Symposium on Sustainable Development in Desert Societies*. Islamic Republic of Iran and the United Nations Development Programme, Yazd, Iran. May 16-18.
- Balasubramanian, K. 2000. *Workshop on Poverty, Gender and Water in South Asia*. International Water Institute and Gujarat Institute of Development Research. Taj Residency Ummed, Ahmedabad. August 10-11.
- Balasubramanian, K. 2000. *14CCEM Parallel Symposium for the 14<sup>th</sup> Conference of Commonwealth Ministers of Education*. Halifax, Nova Scotia, Canada. November 26-29.
- Balasubramanian, S. 2001. *Workshop on Cell and Developmental Biology*. National Centre for Biological Sciences, Bangalore. January 9-13.
- Geetha Rani, M. 2000. *Launching Workshop of National Agricultural Technology Project on Collection, Documentation and Validation of Indigenous Technical Knowledge*. Indian Council of Agricultural Research, Jabalpur. July 15.
- Geetha Rani, M. 2001. *Zonal Technical Co-ordination Committee Meeting under National Agricultural Technology Project on Plant Biodiversity*. Thiruvananthapuram. February 6-8.
- Geetha Rani, M. 2001. *Orientation Training-cum-Workshop under Human Resources Development (Mission Mode) on National Agricultural Technology Project on Plant Biodiversity*. New Delhi. February 27-March 1.
- Geetha Rani, M. 2001. *Workshop on Conservation and Management of Traditional Cultivars*. Thiruvannamalai. March 23.
- Geetha Rani, M. 2001. *First Regional Level Nattu Vaidyar Convention*. Covenant Centre for Development. Madurai. April 15.
- Geetha Rani, M. 2001. *Third National Workshop on National Agricultural Technology Project on Plant Biodiversity*. New Delhi. April 18-20.
- Gopalakrishnan, A. 2000. *International Conference on the Chao Phraya Delta: Historical Development, Dynamics and Challenges of Thailand's Rice Bowl*. Kasertsart University, Bangkok, Thailand. December 12-15.
- Loganathan, P. 2000. *UNESCO Biotechnology Action Council Fellowship*. Alfred University, USA. October 1 – December 19.

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- ✓ Nair, Sudha. 2000. *First Regional Advisory Group Meeting on Gender Equity through Science and Technology in the Asia Pacific Region*. Manila, Philippines. 5-7 September.
- Nair, Sudha. 2000. *Science Partnership Committee*. Centres Week of CGIAR, Washington, USA. October 20-27.
- ✓ Nair, Sudha. 2001. *Regional Workshop on Gender Equity through Science and Technology in the Asia Pacific Region*. Jakarta/Yogyakarta, Indonesia. April 4-8.
- Nair, Sudha. 2001. *Science Partnership Committee*. CGIAR, Paris. May 4-5.
- Navamuniyammal, M. 2000. *Workshop on Application of Remote Sensing and GIS in Wasteland Development and Monitoring*. Anna University, Chennai. August 1.
- Navamuniyammal, M. 2000. *Workshop on Satellite Data Products and Sensor*. Anna University, Chennai. August 2.
- Navamuniyammal, M. 2001. *Eleventh User Interaction Meet*. National Remote Sensing Agency (NRSA), Hyderabad. January 30-31.
- Navamuniyammal, M. 2001. *UNESCO Regional Training Programme on Applied Geologic Remote Sensing*. Anna University, Chennai. March 7-21.
- Parani, M. 2000. *Workshop on Microarray Technology*. Indian Institute of Sciences, Bangalore. February 19-22.
- Parani, M. 2000. *UNESCO-BAC Fellow*. International Rice Research Institute, Philippines. April 1-June 30.
- Sankaramurthy, S. 2000. *National Committee Meeting on Mangroves and Coral Reefs*. Ministry of Environment and Forests, New Delhi. August 30.
- Subbiah, Vijay R. 2001. *Workshop on Designing and Developing Instructional New Media Materials*. Common Wealth of Learning, Pune. April 16-May 2.
- Subhashini, H. D. 2000. *13<sup>th</sup> International Conference on International Federation of Organic Agriculture Movement*. FIBL, Basel, Switzerland. August 29-September 3.

## **Awards/Honours**

- Arunachalam, V. 2001. *Vasvik Award in Agricultural Science and Technology for Rationalizing Genetic Concepts in Plant Breeding*. VASVIK, Mumbai.
- Lakshmi, M. 2001. *Young National Women Bioscientist Award for the year 2000*. Ministry of Science and Technology, Government of India.
- Swaminathan, M. S. 2000. *Indira Gandhi Prize for Peace, Disarmament and Development*. Indira Gandhi Memorial Trust.
- Swaminathan, M. S. 2000. *Millennium Alumnus Award*. Tamil Nadu Agricultural University, Coimbatore.
- Swaminathan, M. S. 2001. *Millennium Scientist Award*. The Indian Science Congress Association.



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M.S. Swaminathan Research Foundation (MSSRF) was registered in 1988 as a non-profit Trust, recognised by the Government of India, Department of Scientific and Industrial Research, New Delhi, and by the Director General of Income Tax Exemptions, for the purpose of exemption of contributions from Income Tax under Section 80G and section 35 (1) (ii) of Income Tax Act, 1961, read with Rule 6 of Income Tax Rules, 1962. The Ministry of Home Affairs, Government of India, has recognised the Foundation for receiving funds from sources abroad under the provisions of Foreign Contribution (Regulation) Act, 1976.

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*Assistant Manager - Accounts*

Ms. R. Malathy  
*Senior Secretary*

Ms. T. Vijayasulochana  
*Senior Administrative Assistant*

Mr. M. Rajakumaran  
*Administrative Assistant*

Mr. R. Baskar  
*Accounts Assistant*

Ms. R. Jayashree  
*Accounts Assistant*

Mr. N. Sundaram  
*Accounts Assistant*

Ms. B. Gayathri\*  
*Accounts Assistant*

Ms. G. Padmavathy  
*Receptionist cum Telephone operator*

### **Programme Area 100 : Coastal Systems Research Coastal Wetlands Project**

Mr. S. Sankaramurthy\*  
*Project Director*

Prof. S. Chelliah  
*Project Director*

Mr. R. Ramesh Babu\*  
*Training Coordinator*

Ms. M. Navamuniyammal  
*Project Associate, Remote Sensing*

Mr. S. Krishnakumar  
*Research Assistant*

Ms. S. Geetha  
*Project Assistant*

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## **Annual Report 2000-2001**

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Mr. G. Suresh Kumar  
*Technical Assistant*

Ms. Seyda Habi Banu Begum  
*Administrative Assistant*

Mr. S. Radhakrishnan  
*Office Attendant*

### **Tamil Nadu**

Mr. K. K. Ravichandran  
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Dr. V. M. Karunakaran  
*Site Manager*

Mr. K. G. Mani  
*Site Manager*

Ms. G. Jeyalakshmi  
*Research Associate*

Mr. J. Raju\*  
*Research Fellow*

Ms. Evanjulin Jessie Beaula  
*Social Worker*

Mr. R. Gunalan  
*Social Worker*

Mr. T. E. Krishnan  
*Driver*

### **Andhra Pradesh**

Dr. T. Ravishankar  
*State Project Coordinator*

Dr. Dorai Sridhar  
*Site Manager*

Dr. R. Ramasubramanian  
*Site Manager*

Mr. Maqbool Mohhidin Jeelani  
*Agronomist*

Dr. Mohammed Maqbool  
*Agronomist*

Mr. D. Ramakrishna  
*Hydrologist*

Mr. Nune Srinivasa Rao  
*Social Worker*

Mr. Md. Najeebullah Shariff  
*Social Worker*

Mr. P. Chandrasekhar  
*Technical Assistant*

Mr. N. Veerabadra Rao  
*Computer operator cum Accounts Assistant*

Mr. B. Murali Krishna  
*Driver*

Mr. Venkateswara Rao\*  
*Driver*

### **Orissa**

Mr. Prafulla Kumar Mishra\*  
*State Project Coordinator*

Dr. H. N. Thatoi  
*State Project Coordinator*

Mr. Arabinda Sahoo  
*Agriculture Specialist*

Mr. Subodh Ranjan Das\*  
*Agriculture Specialist*

Mr. Gopal Chandra Mohapatra  
*Mangrove Biologist*

Mr. Narendra Kumar Behera  
*Mangrove Biologist*

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Mr Bisuddha Nanda Mishra  
*Social Scientist*

Mr. Sathyashree Nayak  
*Social Scientist*

Mr. Rabi Narayan Nayak  
*Social Worker*

Mr. Srinibas Panda  
*Social Worker*

Mr. Susanta Kumar Nayak\*  
*Social Worker*

Mr. Nirakar Behera  
*Field Attendant*

Ms. Yoshaswini Sahoo\*  
*Administrative Assistant*

Mr. Pradeep Kumar Nayak  
*Administrative Assistant*

Mr. Rabindra Kumar Mallick  
*Driver*

**Nuclear and Biotechnological Tools for Coastal Systems Research**

Dr. M. Lakshmi  
*Research Associate*

Dr. M. Parani  
*Research Associate*

Dr. Ravi Kumar Gupta  
*Research Associate*

Mr. P. V. David  
*Project Associate*

Mr. M. Nageswaran  
*Project Associate*

Ms. Lilly M. Saleena  
*Senior Research Fellow*

Mr. R. Kalaimani  
*Field Assistant*

Mr. J. Chelladurai  
*Field Assistant*

Mr. P. Muthukumar  
*Electrician*

**Bioresources Board**

Ms. R. Latha  
*Research Associate*

Mr. K. R. Sivaprakash  
*Junior Research Fellow*

**DAE - Homi Bhabha Chair**

Dr. Jayashree Balaji\*  
*Research Associate*

Ms. C. Rama Devi  
*Secretary*

**Promotion of Alternative Livelihoods for the Poor in the Biosphere of Gulf of Mannar**

Dr. V. Selvam  
*Director*

Dr. S. Babu  
*Mariculture Specialist*

Mr. M. Selvakku  
*Mariculture Specialist*

**Programme Area 200 : Biodiversity and Biotechnology**

**Molecular Mapping and Genetic Enhancement**

Dr. Ajay Kumar Parida  
*Principal Scientist*

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## **Annual Report 2000-2001**

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Dr. S. Rajalakshmi  
*Research Associate*

Mr. P. Senthilkumar\*  
*Research Associate*

Dr. Nimi Pandit  
*Research Associate*

Mr. M. N. Jithesh  
*Senior Research Fellow*

Mr. R. Prashanth  
*Junior Research Fellow*

Ms. Preeti Angela Mehta  
*Junior Research Fellow*

Mr. K. Rajesh\*  
*Junior Research Fellow*

Mr. M. Kadirvelu  
*Technical Assistant*

### **Biomonitoring**

Dr. Sudha Nair  
*Principal Scientist*

Dr. G. N. Hariharan  
*Senior Scientist*

Mr. P. Loganathan  
*Senior Research Fellow*

Mr. P. Balaji  
*Senior Research Fellow*

Ms. R. Sunita  
*Senior Research Fellow*

Mr. K. Ravikannan  
*Technical Assistant*

### **Bioprospecting, Biopartnership and Micropropagation**

Dr. C. Srinivasa Rao  
*Research Associate*

Mr. P. Eganathan  
*Senior Research Fellow*

Mr. H. M. Sankararamasubramanian  
*Junior Research Fellow*

Ms. R. Radha  
*CSIR Senior Research Fellow*

Mr. M. M. Saravanan  
*Technical Assistant*

Mr. P. Shunmugam  
*Technical Assistant*

Mr. E. Thiruvengadam  
*Electrician*

### **Biodiversity Conservation, Integrated Natural Resources Management and Poverty Eradication**

Dr. Arivudai Nambi  
*Principal Coordinator*

Ms. M. Geetha Rani  
*Gene Bank Manager*

### **Chidambaram**

Mr. R. Rajakumar  
*Junior Research Fellow*

### **Tiruvannamalai**

Mr. P. Murugan  
*Junior Research Fellow*

### **Community Agrobiodiversity Centre, Kalpetta, Kerala**

Dr. N. Anilkumar  
*Site Coordinator*

Mr. K. Madhusudanan  
*Project Associate*

---

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## The Foundation Staff

Mr. G. Girigan  
*Community Organiser*

Mr. V. Balakrishnan  
*Junior Research Fellow*

Mr. Rajesh Jacob\*  
*Junior Research Fellow*

Ms. Pratiba Joy\*  
*Junior Research Fellow*

Mr. M. K. Rateesh Narayanan  
*Junior Research Fellow*

Mr. K. Selvaraj  
*Junior Research Fellow*

Mr. T. Manojkumar  
*Technical Assistant*

Ms. Elsy Mathew  
*Technical Assistant*

Ms. Shyja  
*Computer and Library Assistant*

Mr. K. F. Thomas  
*Farm Manager*

Mr. P. A. Rasheed  
*Field Assistant*

### **Agrobiodiversity Programme, Orissa**

Mr. Bibhu Prasad Mohanty  
*Site coordinator*

Mr. Debasis Pati\*  
*Agriculture Specialist*

Mr. Trilochan Ray  
*Community Organiser*

Mr. Amarendranath Dey\*  
*Forestry Expert*

Ms. Rashmi Nayak\*  
*Project Associate*

Mr. Susanta Sekhar Chaudhury  
*Project Associate*

Mr. Kailash Chandra Agarwal  
*Administrative Assistant*

### **Summit Foundation - Simlipal Biosphere Reserve**

Dr. T. R. Vinod  
*Project Coordinator*

Mr. M. V. Ravikumar  
*Project Associate*

Mr. Tusar Ranjan Nayak  
*Social Worker*

### **Summit Foundation - Gene bank**

Mr. Saujanendra Swain  
*Project Associate*

Mr. Simanta Mohanty  
*Project Associate*

Mr. Jyothi Ranjan Mohanty  
*Technical Assistant*

Ms. Sasmita Dash  
*Technical Assistant - Field*

### **BR Barwale Chair in Biodiversity**

Ms. G. Anuradha  
*Project Associate*

### **Programme Area 300 : Ecotechnology and Food Security**

#### **JRD Tata Ecotechnology Centre**

Dr. K. Balasubramanian  
*Director*

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\* Left During the year

## **Annual Report 2000-2001**

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Dr. H. D. Subashini  
*Project Coordinator*

Dr. P. Thamizholi  
*Project Coordinator*

Dr. Vijay R. Subbiah  
*Project Coordinator*

Mr. Vishwanath M. Palled  
*Associate Coordinator - National Network on  
Biovillages and Community Banking*

Mr. S. Malarvannan  
*Project Associate*

Ms. R. Rengalakshmi  
*Project Associate*

Ms. A. Shaleesha  
*Project Associate*

Ms. Shilpa Patel\*  
*Project Associate*

Mr. S. Balasubramanian\*  
*Project Assistant*

Mr. C. Nagaraja  
*Technical Assistant*

Mr. S. Sekar  
*Technical Assistant*

Ms. D. Rojarani  
*Accounts Assistant*

Mr. S. Karthik  
*Lab Assistant*

Mr. S. Mohan  
*Office Attendant*

Mr. S. Gopalakrishnan  
*Driver*

### **Chidambaram**

Mr. A. Vedamoorthy  
*Project Associate*

Mr. E. Selvaganapathy  
*Field Assistant*

### **Kannivadi**

Mr. S. Bose  
*Site Coordinator*

Mr. M. Ganesan  
*Project Associate*

Mr. S. Murugesan  
*Project Associate*

Mr. S. Murugakani  
*Project Assistant*

Mr. B. Selvamukilan  
*Project Assistant*

### **Karaikal**

Mr. A. Gopalakrishnan  
*Project Associate*

Ms. S. Sudarkodi  
*Project Associate*

Mr. S. Rajakani  
*Technical Assistant*

### **Kolli Hills**

Dr. D. Dhanapal  
*Site Coordinator*

Mr. G. Alagukannan  
*Project Associate*

Mr. E. D. Israel Oliver King  
*Project Associate*

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**Biovillages Programme, Pondicherry**

Dr. M. S. S. Mohan\*

*National Project Coordinator*

Dr. R. S. Shantha Kumar Hopper\*

*Consultant*

Dr. A. R. Thiagarajane\*

*Biocentre Manager*

Mr. K. Johnson

*Coordinator - Biocentre and Biovillage Programme*

Mr. J. S. Balaji\*

*Project Associate*

Mr. D. Manimaran\*

*Project Associate*

Mr. A. Nirmal Rajkumar\*

*Project Associate*

Mr. S. Ramesh\*

*Project Associate*

Mr. D. Rosario

*Project Associate*

Ms. J. Sasikala

*Project Associate*

Mr. K. Vengadessan\*

*Project Associate*

Ms. B. Vijayalakshmi

*Project Associate*

Mr. S. Anand

*Field Assistant*

Mr. A. Govindarasu

*Field Assistant*

Mr. P. Kumaran

*Field Assistant*

Mr. T. Kumaran\*

*Field Assistant*

Ms. G. Meenakshi

*Field Assistant*

Mr. S. Saravanane\*

*Field Assistant*

Mr. K. Srinivasan\*

*Field Assistant*

Mr. V. Tirumal\*

*Field Assistant*

Mr. M. Babu

*Driver*

**Biovillages - Orissa**

Mr. Dibakar Sahoo

*Project Coordinator*

Ms. K. Anuradha\*

*Social Worker*

Ms. Gitishree Nayak

*Social Worker*

Mr. R. Jeeva

*Field Assistant*

**Sustainable Management of Natural Resources for  
Food Security (MSSRF - OSU - PAU - JNKVV  
Collaborative Project)**

Dr. S. P. Palaniappan

*Coordinator*

Mr. R. Balasubramanian

*Project Associate*

**Dr. B. V. Rao Centre for Sustainable Food Security**

Dr. Swarna Sadashiva Vepa

*Ramakrishna Bajaj Fellow*

Ms. R. V. Bhavani

*Principal Scientist*

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## **Annual Report 2000-2001**

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Dr. Saroja Raman  
*Project Leader*

Dr. S. Subramaniam  
*National Research Coordinator*

Ms. Suparna Mitra  
*Project Associate*

Ms. Rose Mary J. Vadakel  
*Project Associate*

Mr. B. Ananda Kumar  
*Technical Assistant*

Mr. M. K. Satishkumar  
*Secretary*

Mr. A. Sakthivelan  
*Secretary*

Mr. K. Sundervadivelu  
*Secretary*

Mr. C. Sivaraj  
*Electrical Supervisor*

Mr. S. Sridharan\*  
*Senior Research Assistant*

### **Programme Area 400 : Reaching the Unreached**

Ms. Mina Swaminathan  
*Hon. Director*  
*Project ACCESS & Uttara Devi Resource Centre for Gender and Development*

#### **Project ACCESS**

Ms. Rama Narayanan\*  
*Fellow & Project Incharge*

Ms. A. Christina  
*Project Coordinator*

Ms. M. Bhuvanewari\*  
*Project Associate*

Ms. Jayanthi Rani Christiana\*  
*Project Associate*

Ms. V. Vijaya\*  
*Project Associate*

Ms. K. Sheela  
*Senior Secretary*

Ms. J. Boomadevi  
*Secretary*

Mr. U. Imran\*  
*Secretary*

### **Uttara Devi Resource Centre for Gender and Development**

Ms. Saraswathy B. Nayar\*  
*Programme Associate*

Ms. J. Latha  
*Programme Assistant*

### **Programme Area 500 : Education, Communication, Training and Capacity Building**

#### **Informatics Centre, Library Services and "The Hindu" Media Resource Centre**

Dr. V. Balaji\*  
*Director*

Mr. S. Senthilkumaran  
*Associate Director, Informatics*

Mr. Murali Shanmugavelavan  
*Project Associate*

Ms. Sylvia Snehalatha  
*Manager - Library Services*

---

\* Left During the year

Ms. Anita Vasanth  
*Project Associate - Communication*

Mr. S. Gunasekaran  
*Project Associate*

Mr. M. Madhan  
*Assistant Librarian*

Ms. Annie Jennifer\*  
*Senior Programmer*

Mr. R. Chendil Kumar\*  
*Senior Programmer*

Mr. S. Gilbert Samson  
*Technical Assistant*

Ms. K. Umarani  
*Technical Assistant*

Mr. M. Manikandan  
*Technical Assistant*

Mr. K. Rameswaran  
*Technical Assistant*

Mr. R. Rajamanikkam  
*Technical Assistant*

Mr. S. Selvam\*  
*Technical Assistant*

Mr. P. Sivakumar  
*Technical Assistant*

Mr. S. I. Rino  
*Technical Assistant*

Mr. P. Vijayakumar  
*Technical Assistant*

Mr. M. Kuppusamy  
*Library Assistant - CDROM*

Mr. B. Sivakumar  
*Electrical Assistant*

**Information Villages Programme, Pondicherry**

Mr. K. G. Rajmohan  
*Administrative Coordinator*

Mr. R. Rajasekarapandy  
*Project Associate*

Mr. J. Gobu  
*Project Associate*

Ms. M. Vijayapoorani\*  
*Technical Assistant*

Ms. P. Pakkialatchumy  
*Technical Assistant*

**Distinguished Fellows**

Dr. L. N. Acharjyo

Dr. V. Arunachalam

Dr. S. John Joseph

Prof. Joseph Hulse

Dr. L. R. A. Narayanan

Dr. S. Rajagopalan

Dr. K. V. Raman\*

Dr. S. D. Sharma

Prof. Subbiah Arunachalam

**Scientists from other institutions**

Dr. M. Kaliyamurthy  
*Senior Scientist on deputation from CIFA,  
Bhubhaneshwar*

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**Donation and Shipping of Computers**

American Chamber of Commerce  
Krishen Mehta, Japan

Larry Hunter

## Sources of Project Support

### Programme Area 100 : Coastal Systems Research

#### *National*

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Government of India

Ministry of Rural Development  
Government of India

#### *International*

India-Canada Environment Facility  
New Delhi

UNDP-Global Environment Facility  
New Delhi

### Programme Area 200 : Biodiversity and Biotechnology

#### *National*

Department of Biotechnology  
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Department of Agriculture  
Government of Tamilnadu

National Bioresources Development Board  
New Delhi

Indian Institute of Remote Sensing, Dehradun

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Cooperation (SDC), New Delhi

The Ministry of Foreign Affairs  
The Netherlands

The Summit Foundation, USA

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#### *National*

Department of Biotechnology  
Government of India

Council for Advancement of People's  
Action and Rural Technology, New Delhi

Hindustan Lever Limited  
Mumbai

National Bank of Agriculture and Rural  
Development, Mumbai

Sahyadri Trust, New Delhi

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The Hunger Project - India  
Mumbai

United Nations Development Programme  
New Delhi

International Development Research Centre  
Canada

Volkart Stiftung  
Winterthur

World Food Programme, Regional Office for  
South Asia, New Delhi



## Sources of Project Support

National Bureau of Plant Genetic Resources  
(Indian Council of Agricultural Research)  
New Delhi

Sir Dorabji Tata Trust, Mumbai

Food & Agriculture Organisation of the U.N.  
New Delhi

FAO Representative in India & Bhutan  
New Delhi

Ramon Magsaysay Award Foundation  
Manila, Phillipines

### **Programme Area 400: Reaching the Unreached**

#### ***National***

Department of Science & Technology  
New Delhi

#### ***International***

The Hunger Project - India

Bernard van Leer Foundation  
The Netherlands

### **Programme Area 500 : Education, Communication, Training and Capacity Building**

#### ***National***

Department of Science & Technology  
New Delhi

Planning Commission, Government of India  
New Delhi

Department of Space, Government of India  
Bangalore

Ministry of Agriculture, Government of India  
Government of Pondicherry

State Bank of India, Local Head Office  
Chennai

Department of Biotechnology, New Delhi

NISSAT - DSIR, New Delhi

Indian Council of Agricultural Research  
New Delhi

#### ***International***

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Canada

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Winterthur, Germany

International Society for Mangrove  
Ecosystems, Japan

UNIFEM, New Delhi

World Food Prize Foundation, USA

International Rice Research Institute  
Philippines

Scientific Committee on problems of the  
Environment, France

Lead International Inc.  
United Kingdom

## Annual Report 2000-2001

Council of Scientific & Industrial Research  
New Delhi

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Karaikudi

The Institute of Mathematical Sciences  
Chennai

Indian Institute of Technology, Chennai

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Asian-South Pacific Bureau of Adult  
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Structural Engineering Research Centre,  
Chennai

International Plant Genetic Resources Institute  
Malaysia

Food & Agriculture Organisation of the U.N.  
Regional Office, Bangkok

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#### ***National***

Sir Dorabji Tata Trust, Mumbai

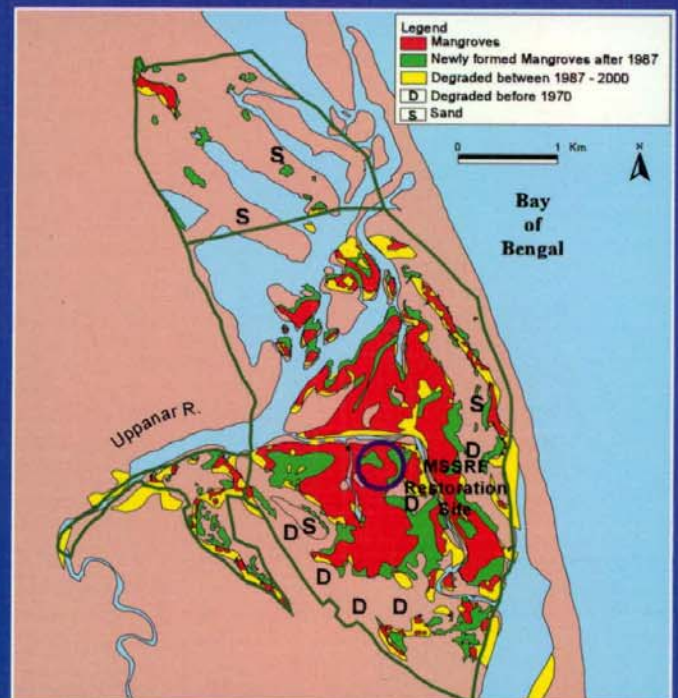
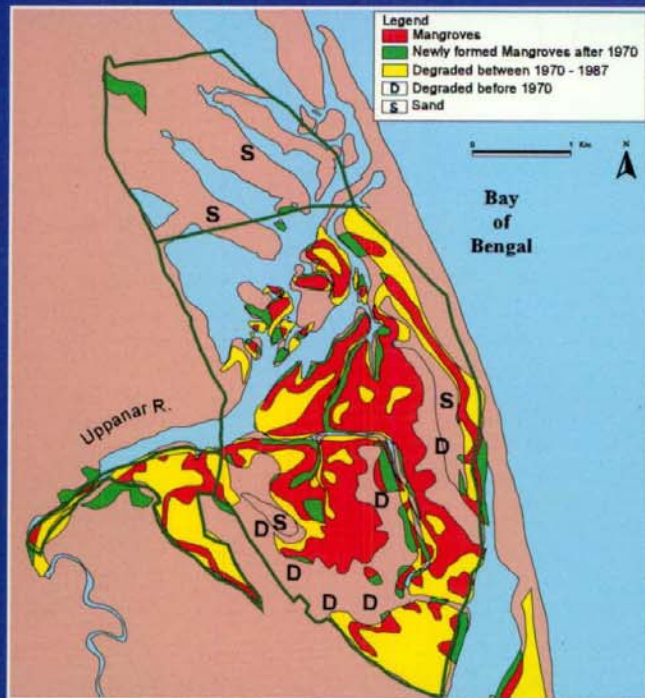
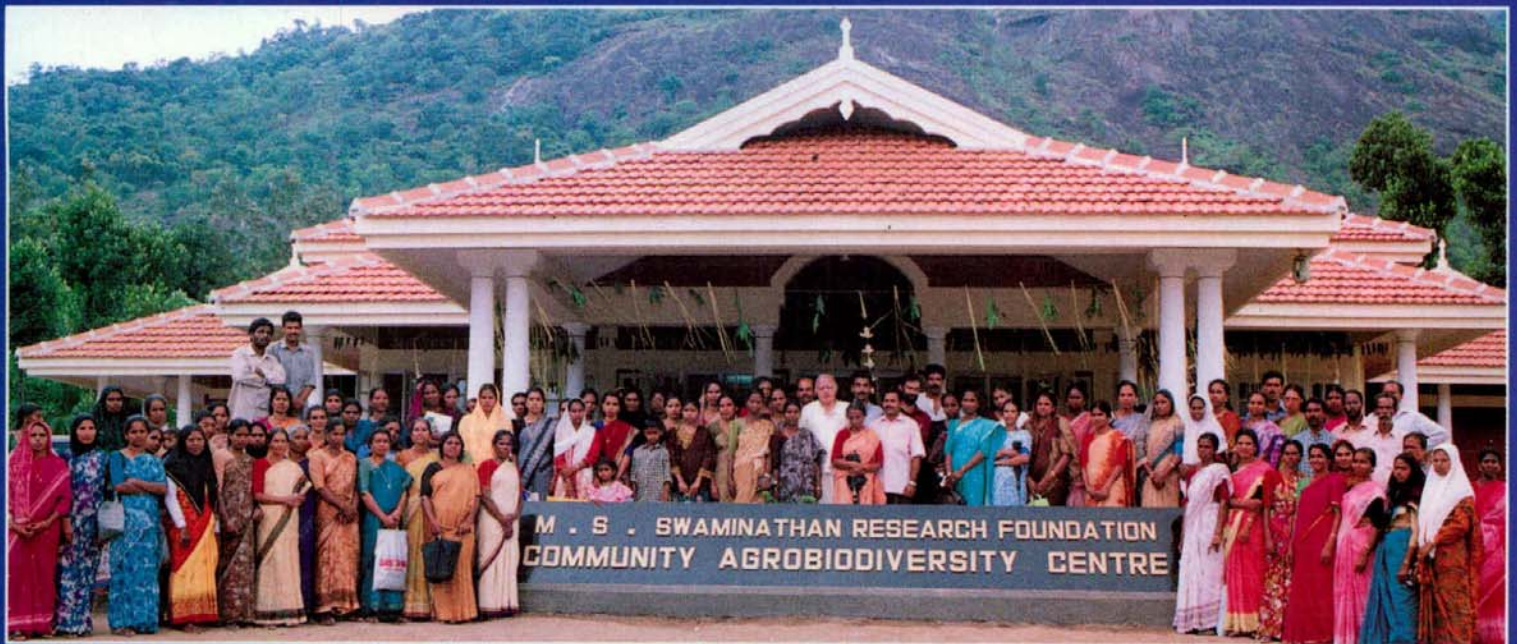
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#### ***International***

United Nations Educational Scientific and  
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Address:  
 M. S. Swaminathan  
 Research Foundation  
 III Cross Road  
 Institutional Area  
 Taramani  
 Chennai-600 113. India.