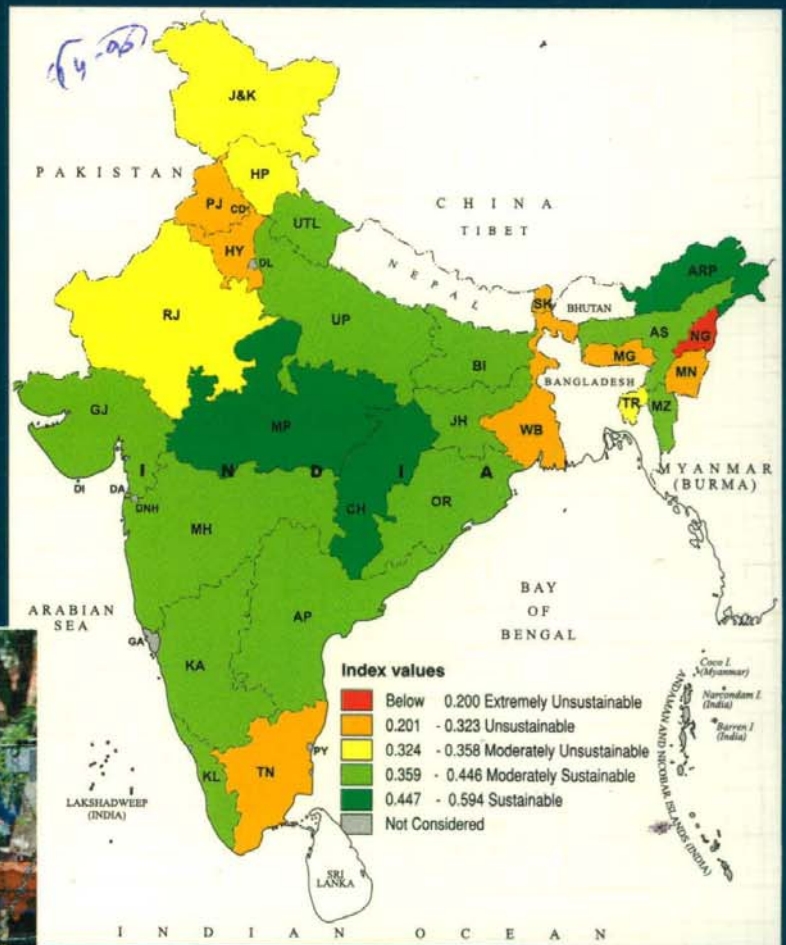


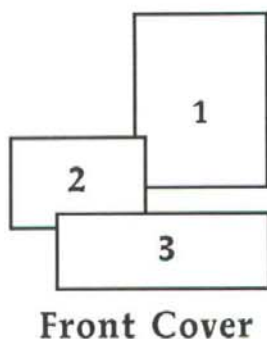
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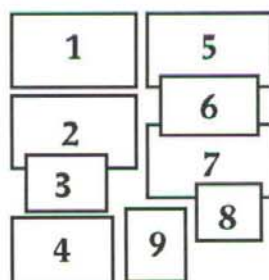
**THIRTEENTH
ANNUAL REPORT**

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





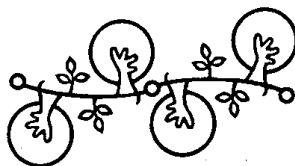
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Thirteenth Annual Report

2002-2003



M.S. Swaminathan Research Foundation

*Centre for Research on Sustainable Agricultural
and Rural Development
Chennai, India*

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Cover Design : The Frontline, Chennai

Printed at : AMM Screens

Citation : Thirteenth Annual Report: 2002-2003

M S Swaminathan Research Foundation, Chennai 600 113

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Chairman's Introduction

"It is a wonder that we do not look hard enough to see solutions to all the challenges in our path. You have worked for the solutions and shared them with all who are ready to learn"

- *Dr Speciosa Wandira Kazibwe, Vice President of Uganda, remarks during her visit to MSSRF on 5th March, 2003.*

The above observations capture the spirit behind MSSRF's work during the period covered by this Report, as well as the previous ones. I would like to cite five examples to describe briefly how every challenging problem has also an affordable and implementable solution. The examples are:

- Hunger-free India: Agenda 2007
- Revitalization of the conservation traditions of rural and tribal families
- Achieving a paradigm shift from jobless to job-led economic growth through a new deal for the self-employed
- Creating instruments for a Knowledge Revolution in rural India
- Spreading the message through documentation, media and communication

Hunger-free India: Countdown from August, 2007

In the last two Reports of MSSRF, detailed information has been provided on the extent of food insecurity prevalent in rural and urban India. Both the Rural and Urban Food Insecurity Atlases,

prepared jointly with the UN World Food Programme (WFP), have now become important guides for public policy and action at the local, state and national levels. A third Atlas, describing the status of sustainability of food security in the different states of the country, will be released later this year. Based on such detailed analyses of the major components of food security, two national consultations were held jointly with WFP at New Delhi, to prepare a road map to achieve the goal of a hunger-free India by 15th August 2007, which marks the 60th anniversary of India's independence. An International Consultation on *Peace, Freedom from Hunger and Sustainable Development: The Ethical Dimensions* was also held at MSSRF, with support from International Fund for Agricultural Development (IFAD), in December 2002, for developing strategies for converting the concept of food as a basic human right into reality. The road map deals with methods of overcoming poverty-induced endemic hunger (mostly under-nutrition), micro-nutrient deficiencies termed 'hidden hunger', and transient hunger resulting from drought, floods and cyclones.

During the last few years, the Government of India has introduced many schemes such as Sampoorna Gramin Rozgar Yojana, Antyodaya Anna Yojana, and Annapoorna, as well as restructured the Integrated Child Development Services and universal noon meal programmes for children and school students. The MSSRF-WFP strategy involves –

- Bringing about convergence and synergy among all ongoing programmes based on a whole life cycle approach and involving grassroot democratic institutions in implementation
- Enlarging the concept of *Food for Work* in order to make this programme a powerful instrument for social capital development through the inclusion of a wide range of skilled work in such programmes
- Setting up a *National Food Security Trust* with an initial grain allocation of 10 million tonnes for the purpose of providing food grains to local bodies and civil society organizations for carrying out location-specific and felt-need based developmental work. This will provide the much needed flexibility in the operation of *Food for Work* programmes.

The major aim of such a Trust should be to provide small allocations of food grains for addressing important tasks in the major hunger and hydrologic "hot spots" of our country. Such *Food for Work* programmes could be administered by credible local agencies. This programme will take care of the residual requirements after the efficient implementation of other ongoing projects. Such a *Food Security Trust* could facilitate the setting up of *Community Food Banks* in remote areas, often inaccessible during monsoon seasons.

The use of grains as cash has twin advantages in our country. First, it stimulates increased agricultural production, since our farmers will produce more if our consumption capacity is enhanced. Second, it will provide immediate

relief to those suffering from poverty-related protein-energy malnutrition. The hunger-free India strategy also involves the setting up of Consultative Groups for *Food and Nutrition Security* at various levels, ranging from local to national, to bring together all the stakeholders including multilateral and bilateral donors, for working together on the countdown to the 15th August, 2007 programme. Such Consultative Groups could help to optimise the benefits from the available financial and human resources and fill critical gaps in ongoing efforts.

Revitalization of the conservation traditions of rural and tribal families

A multi-pronged strategy has been adopted for achieving the goal of promoting *in situ* on-farm conservation of agrobiodiversity with generous support from the Swiss Agency for Development and Cooperation (SDC) and IFAD. The components of this strategy are –

- Linking traditional and underutilized crops with markets in order to create an economic stake in conservation
- Improving the productivity of traditional food crops through participatory breeding and selection
- Developing draft rules relating to the implementation of the Protection of Plant Varieties and Farmers' Rights (PPVFR) Act - 2001 and the Biodiversity (BD) Act - 2002, which will enable gender-specific recognition and reward of traditional knowledge and conservation efforts; and methods of recognising gender-sensitive

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community contributions to genetic conservation

- Fostering an integrated programme of establishing *Community Banks* (Gene, Seed, Water and Food Banks) in order to link conservation and consumption in a mutually reinforcing manner.

The work done by a tribal community in the Koraput region of Orissa in harnessing the power of partnership within the community as well as between the local and scientific communities won the *Equator Initiative Award* of the United Nations Development Programme (UNDP) and the UN Fund for Partnership at the World Summit on Sustainable Development (WSSD) held at Johannesburg in August-September 2002. The award, given in recognition of their initiative in organizing village level Gene, Seed, Water and Food Banks, was received by Smt Komala Pujari on behalf of the tribal families. The prize amount of Rs 15 lakhs has been kept as a corpus and the annual interest will be used for purposes to be decided by the community.

Progress was also made in generating an economic stake in the conservation of traditional genetic strains of crops. For example, in rice, well-planned efforts were launched by local communities to conserve, multiply and market cultivars like *Njavara* in Wayanad district of Kerala and *Kalajeera* in Koraput district of Orissa, which have medicinal properties.

Steps are being taken to spread genetic and legal literacy among rural and tribal families through the organization of *Genome Clubs*. The clubs are designed to empower elected members of grassroot democratic institutions

on the one hand and school children on the other with knowledge on all aspects of biodiversity conservation, sustainable use and equitable sharing of benefits. With support from the National Bioresources Development Board (NBDB), a Summer Course was organized for school children on various aspects of genetic resources conservation and enhancement.

Achieving a paradigm shift from jobless to job-led economic growth through a new deal for the self-employed

With the support of the Global Environment Facility (GEF) and the Lemelson Foundation, the *Ecology of Hope Initiative* was launched at WSSD in Johannesburg, for stimulating job-led economic growth, based on environmental or eco-enterprises. A database containing 750 concrete examples of successful eco-enterprises from different parts of the world was released on that occasion. This database is also available in MSSRF website (www.mssrf.org). The underlying principle is *Good Ecology is Good Business*. New eco-enterprises relating to the biological software essential for an ever-green revolution in our farms (*i.e.*, improving productivity in perpetuity without associated ecological harm) were initiated through local self-help groups (SHGs) of women and men in biovillages in Pondicherry, Tamil Nadu, Kerala and Orissa. The Poomani Women's SHG of Kannivadi, Dindigul district of Tamil Nadu, won the *Youth Innovators Award* at the Youth Employment Summit (YES) held in Alexandria, Egypt in September 2002, in recognition of their work in the mass production of *Trichogramma* parasitoid for biological control

of pests. MSSRF also developed basic ground rules for ensuring that the SHGs organized for undertaking micro credit supported micro enterprises are economically, environmentally and socially sustainable. A primary prerequisite for achieving sustainability is linking products with markets. Therefore, the *Sustainable Self-Help Groups* (SSHGs) fostered by MSSRF are all market-driven. Opportunities for assured and remunerative marketing will ultimately decide the fate of SHGs. Both on-farm and non-farm enterprises were promoted in order to derive the maximum advantage from the available opportunities for job-led economic growth. The SSHG movement is being supported by *Friends of MSSRF, Tokyo*.

An integral part of this movement is farming systems intensification, diversification and value-addition. There is an urgent need for achieving a reduction in production costs without any adverse impact on yield. For launching a productivity, quality and value-addition revolution in agriculture, MSSRF in association with NABARD, has set up a Precision Farming Research and Training Centre in Dindigul district of Tamil Nadu. The work is being extended to Orissa. In the Union Budget for 2003-04, the Finance Minister has provided funds for spreading the Precision Farming Movement. Technical assistance is being rendered to Indian Space Research Organization (ISRO) for setting up a precision farming research, demonstration and training centre in Mahboobnagar District of Andhra Pradesh. Such institutions are important for enhancing India's agricultural competitiveness under conditions of increasing globalisation of trade and economies.

Creating instruments for a knowledge revolution in rural India

MSSRF's experience in bridging the digital divide in rural India has provided some basic guidelines, such as the following, to bridge social, gender, genetic and technological divides:

- Connectivity and content should receive concurrent attention.
- Constraints must be removed on the basis of a malady-remedy analysis; for example, wired and wireless technologies could be used where telephone connections are not adequate or satisfactory. Similarly, solar power can be harnessed where the supply of power is irregular. The approach should be based on the principle that there is an implementable solution for every problem.
- The information provided should be demand-driven and should be relevant to the day-to-day life and work of rural women and men.
- The Knowledge Centres (KCs) should operate on the principle of social inclusion, thereby presenting a win-win situation for all. Women with limited education should be accorded priority in training to operate the centres, since this is an effective method of enhancing the self-esteem and social prestige of women living in poverty.
- The programmes designed to empower rural families with new knowledge and skills should be designed on the *antyodaya* model, where the empowerment starts with the poorest and most underprivileged women and men.

- The local population should have a sense of ownership of the KC. It should be client-managed and controlled, so that the information provided is demand and user driven.
- The local population should be willing to make contributions towards the expenses of the KC, so that the long-term economic sustainability of the programme is ensured. Contributions in cash or kind generate a sense of ownership and pride.

To be effective, the following linkages will have to be developed:

Lab to lab: This will involve organizing a consortium of scientific institutions and data providers.

Lab to land or lab to people: This will involve symbiotic linkages between the providers of information and the users, so that the information disseminated is relevant to the life and work of rural families.

Land or people to lab: There is considerable traditional knowledge and wisdom among rural and tribal families concerning the sustainable management of natural resources, particularly water and biodiversity. Therefore, the technical experts should not only learn from traditional knowledge and experience, but also take steps to conserve dying wisdom and dying crops for posterity.

Land to land or people to people: There is much scope for lateral learning among rural families. Such learning has high credibility because the knowledge coming from fellow rural women

or men would have been subjected to an impact analysis from the point of view of its economic and social relevance to the population.

Rural Knowledge Centres based on an integrated application of new communication technologies, like the internet and cable TV as well as conventional ones like community radio and the local language press, can become effective instruments for harnessing the power of partnership among professionals, political leaders and public policy makers, the general public and rural families. Such partnerships alone can help to bridge the growing gap between scientific know-how and field level do-how.

Based on the above "learning" by MSSRF scientists, the application of ICT techniques to meet the food and water security as well as livelihood needs of the rural families is being intensified and extended through a Virtual Academy for food security and Rural Prosperity (VARP) with support from the Tata Social Welfare Trust, *Friends of MSSRF* and a wide range of data generators (Figure 1 - inside back cover). Agriculture, comprising crop and animal husbandry, fisheries, forestry, agro-processing and agribusiness, is the backbone of the livelihood security system of rural areas, where 70% of India's population live. A considerable proportion of this population have no assets like land, livestock, fish pond or any commercially viable skill. The poor are also often illiterate, a majority of them being women. Therefore the Virtual Academy will place particular emphasis on fostering sustainable livelihood options for men and women, both in the farm and non-farm sectors. The emphasis will be on promoting

job-led economic growth in villages. In addition, the five foundations of sustainable development identified at WSSD, viz, water, energy, health, agriculture and biodiversity and ecosystem management, (WEHAB), will receive particular attention. Rural and tribal women and men, who constitute the Knowledge Management Corps, will be the Fellows of VARP.

Spreading the message through documentation, media and communication

The project for Action for Child Care and Education Services (ACCESS) supported by the Bernard Van Leer Foundation came to an end last year. The work done during the last 10 years under this project has been compiled in a book titled *As the Salt in the Sea*. Project ACCESS has been an exciting adventure in confronting one of the most critical concerns of our country, namely an understanding of the issues relating to care of the child and social recognition of the psychological, physical and institutional support needed by the mother. This project shaped MSSRF's earlier initiatives such as DACCS (Development of Alternative Child Care Strategies), COTA (Children on the Agenda) and ORS (Operation Resource Support). The work of project ACCESS will continue in a variety of ways, particularly from the view point of MSSRF, through the Uttara Devi Resource Centre (UDRC) for Gender and Development.

Project ACCESS has brought out powerfully the message of child care as a woman's issue. When a woman says, "I quit working because I need to take care of my child", society accepts it as the natural instinct of a mother. This is obviously not enough. There is need for

involvement by the father and family, society and state, if children are to be born for happiness and not just for existence. Lamenting the gender divide in his own way, Mahatma Gandhi said in 1920, "Man is born of woman; he is flesh of her flesh and bone of her bone. Come to your own and deliver your message again. Let us tear down the *purdah* with one mighty effort". The book *As the Salt in the Sea* is a powerful reminder of that message.

The Hindu Media Resource Centre (THMRC) is proving to be an important bridge between science and society. Among the many activities undertaken by the Centre during the year, particular mention must be made of the Millennium Lecture delivered by Dr Lennart Båge, President of the International Fund for Agricultural Development (IFAD). He stressed the importance of working towards a poverty-free world where every child, woman and man will have an opportunity for a healthy and productive life. Another important initiative was the organization of a media discussion on the Heritage of Watson and Crick, to commemorate the 50th anniversary of the discovery of the double helix structure of the DNA molecule. This discussion helped to disaggregate the different dimensions of the ongoing debate relating to genetically modified crops and foods. The different issues are:

- Scientific aspects of genetic modification and their implications for environmental and human health
- Issues relating to the control of gene revolution technologies and the possibility of global food security being determined by

the decisions of a few multinational commercial companies

- The equity and ethical dimensions of genetic modification with particular reference to access to the benefits of new technologies by resource-poor families and
- Choice of research priorities – whether they will be based on considerations of public good or commercial profit and whether “orphans will remain orphans”, with reference to research investment decisions, as for example, underutilized crops and areas suffering from moisture stress or excess.

Based on detailed discussions on these issues, suggestions were made on how to mobilize the powerful tools of genetic engineering, functional genomics, proteomics and bioinformatics for fostering sustainable food, nutrition, livelihood and ecological security.

The Dialogue participants stressed that India will experience a serious genetic divide, if the country does not have a well-defined and forward-looking policy in the field of agricultural and medical biotechnology. The following instruments were recommended for facilitating the safe and responsible use of recombinant DNA technology:

- A National Food and Agricultural Biotechnology Policy
- An autonomous and science-led Biotechnology Regulatory and Advancement Commission
- A National Research Centre for the Safe and Responsible Use of Genetically Modified Crops

It was agreed that considerations of human health and environmental safety should be the bottom line in risk assessment.

Another significant initiative of THMRC was the organization, jointly with All India Radio (AIR), of a workshop for AIR station directors and staff on *Radio and Sustainable Agriculture*. Radio has the greatest reach in rural India and is hence a very powerful medium for the dissemination of information of value to rural families.

As in previous years, *Voicing Silence*, which aims to give women voice through theatre, or voicing the voiceless, organized a theatre festival focused on solo women performers. This interactive women’s theatre festival and the work with rural women performing artistes have demonstrated the power of theatre for the empowerment of women.

The work done under six major Programme Areas (PA 100 – PA 600) are described in detail in this Report. However, it will be useful to draw attention to a few highlights.

In *Coastal Systems Research*, two significant events took place during the year. First, the project “Coastal Wetlands: Mangrove Conservation and Management”, supported financially by the India Canada Environment Facility (ICEF) since 1996 came to an end in Tamil Nadu and Andhra Pradesh in May 2003. The work will however be continued in Orissa until April 2004. Also, ICEF has approved a Small Grant Proposal titled, “Coastal Wetlands: Strengthening the Capacity of the Stakeholders through Education, Training and Policy Advocacy” for one year from 15th July 2003. An

external team consisting of Mr C K Sreedharan, Dr H S Singh and Dr Jaya Chatterjee critically reviewed the work done under this project since 1996. The Review Team commended the ecological, economic and social significance of the work done under this project and concluded, "There is a need for a *National Resource Centre* to take care of the research and development needs of mangrove ecosystem. The expertise and experience gained by MSSRF in mangrove conservation and participatory management could be effectively utilized by State Forest Departments in the coming years through such a *National Resource Centre*. Restoration technology is another important contribution of this project. This is an important area where MSSRF should continue to provide scientific and technical advice to Forest Departments and society at large." It is proposed to set up a National Resource Centre for the sustainable management of mangrove ecosystems. The work on the maintenance of the international and national databases on mangrove ecosystems will also be continued. The Mangrove Atlases of Andhra Pradesh and Orissa will be published shortly.

Another significant development during the year was the successful completion of the 45-acre Green Belt project in the land belonging to the Nuclear Power Corporation of India Limited (NPCIL) at Kudankulam in Tamil Nadu. The Green Belt was handed over to NPCIL for maintenance and further development. The *Genetic Garden* established at Kudankulam has provided very useful plants which can be successfully introduced in the coastal wastelands of that region. Among the useful plants identified,

particular mention may be made of the *Muntingia calabura*, which is very rich in Vitamin C. The project has also demonstrated how every drop of water can be saved and used in an economical and efficient way to raise high value and low water requiring crops.

In the area of *Biodiversity and Biotechnology*, further progress was made in strengthening the *in situ* on-farm conservation traditions of tribal and rural families. Several microorganisms capable of functioning efficiently in saline soils were identified. Homozygous purelines of rice varieties incorporating salinity resistant genes, derived from the mangrove species *Avicennia marina*, have been isolated. They are currently being grown in a greenhouse and have shown tolerance upto 150 mM of NaCl. The Institutional Biosafety Committee has recommended these strains to the Review Committee of Genetic Manipulation for being approved for field-testing. A book on *Bioresources Status in Select Coastal Locations* was released on 27th February 2003, declared as National Science Day, at New Delhi. The NBDB supported this work financially.

Lichen diversity for use in monitoring the health of ecosystems was studied and a Lichen Atlas is currently under preparation. The mangrove propagation technology standardised by the micropropagation group was taken to the field for establishing community bioenergy plantations. SHGs were trained in vegetative and mist propagation techniques in order to help them to raise mangrove plantations as well as to restore degraded mangrove ecosystems.

Work on finding alternative livelihoods for the coastal communities of the Gulf of Mannar (GoM)

area resulted in the organization of several sustainable enterprises like creating artificial reefs, preparing fish pickle and agar and the production of pearls using a technology developed by the Central Marine Fisheries Research Institute (CMFRI). By creating such sustainable livelihood options, anthropogenic pressures on the fragile GoM ecosystem can be reduced. The artificial reef laid by the fisher families of Theresapuram, again using technologies developed by CMFRI, is the first of its kind in India, and should help to augment the fishery resources of the region.

The major aim of MSSRF in the areas of sustainable livelihoods, engendering the implementation rules relating to the PPVFR Act (2001) and BD Act (2002) is to create a paradigm shift in attitudes and approaches to sustainable development through a process of stakeholder involvement and social inclusion.

In the area of *Ecotechnology and Biovillages*, the emphasis has been on achieving a paradigm shift in rural and tribal areas from jobless to job-led growth and from unskilled to skilled work. The biovillage model of socially, environmentally and economically sustainable development was extended to more areas in Tamil Nadu and Orissa. The *Friends of MSSRF* in Tokyo led by Dr Geeta Mehta, continued to help SHGs of women and men living in poverty to take to knowledge and skill intensive professions. Commercial Banks like the State Bank of India, Canara Bank and Indian Bank provided supplementary credit to SHGs involved in enterprises linked to markets. According to the Economic Survey for 2003, presented in Parliament in February 2003, the rate of growth

of employment, as current daily status, declined from 2.7% per annum in 1983-94 to 1.07% per annum in 1994-2000. The decline was sharper in rural areas, from 2.4% in 1983-94 to less than 0.67% over 1994-2000. This was well below the rate of growth of population. A significant part of the collapse in employment occurred in agriculture, where the employment elasticity of output growth declined from 0.7% in 1983-94 to 0.01% in 1994-2000. Thus, there is a need to accelerate the pace of creation of opportunities for non-farm employment in rural areas. SHGs formed on MSSRF's model of SSHGs will help to empower the self-employed women and men with the power of scale both at the production and marketing phases of enterprise development. Decentralised production, supported by key-centralised services such as market tie-ups and e-commerce facilities is an effective pathway for promoting job-led economic growth in villages. Under the BV Rao Centre for Sustainable Food Security, detailed food security analysis was extended to Jammu and Kashmir during the year. In association with the WFP, the following activities are being initiated in Ladakh:

- Establishment of *Community Food and Feed Banks* to meet the needs of the human and animal populations during severe winter months
- Organization of community managed and internet connected Rural Knowledge Centres
- Stimulating the survey, collection, conservation and inventorisation of fruit trees such as apricot and apple

- Multiplication and popularization of *seabuckthorn* or *hippophae* belonging to the family of *Elaeagnaceae* and other valuable species and
- Promoting the organization of a *Rare Birds Park* with the help of the Wildlife Institute of India, Dehra Dun, since there are over 370 species of rare birds in Ladakh.

The NBDB has agreed to support financially the work relating to the sustainable management of bioresources and establishment of a Rare Birds Park. The programme will be implemented by the Field Research Laboratory of the Defence Research and Development Organization and CENFOOD, a NGO with whom MSSRF has agreed to collaborate.

Education, training, capacity building and networking, continued to receive priority. Four scholars of MSSRF obtained the Ph D degree from the University of Madras.

Under time-bound consultancy projects (PA 600) undertaken during the year, mention has already been made of the *Ecology of Hope Initiative* launched at WSSD, Johannesburg with support from GEF and the Lemelson Foundation. Another important project undertaken on behalf of UNESCO relates to an analysis of the ethical dimensions of development, with particular reference to the incidence of poverty, inequity, hunger and food insecurity. The technology push now taking place in many areas of development has to be matched with an ethical pull "if the products of brain are to be a blessing and not a curse", to quote Albert Einstein. Therefore, MSSRF has suggested the mandatory

introduction of an *ethical impact analysis* in the case of major development projects. Also, the right to food and clean drinking water should be regarded as a fundamental human right, and not as charity. Only then, the urgently needed political priority to education, healthcare and employment will be forthcoming.

For the first time in the last 10 years, staff members of MSSRF undertook a detailed strategic planning exercise both at Kalpetta, Wayanad and at Chennai. The aim of this exercise was to foster a critical self-evaluation of what the Foundation set out to accomplish, where we are today and where we should go hereafter. The staff participated enthusiastically and the exercise led to the firm conviction that there is need for greater inter-programme coordination and cooperation. Since MSSRF had organized an International Dialogue on the Heritage of Watson and Crick early in 2003, it was agreed that the staff should strive to build a DNA model of institutional culture in its scientific programmes and management. The principal components of this model are:

Segregation - Select "win-win" patterns of sustainable development

Recombination - Operate on a "Centre without Walls" principle and strengthen the power of partnership with like-minded institutions in India and abroad

Mutation - Introduce mid-course corrections when and where needed and also change course whenever a particular approach violates the pro-nature, pro-poor, pro-women and pro-livelihoods principle.

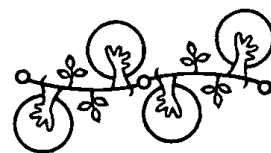
Basic principles -

- Trust must be trustworthy.
- Integrity is the bottom line.
- Social inclusion is a sacred duty.
- Sustainability must underpin all financial, management, social, ecological and entrepreneurship initiatives.

The results of the various programme areas described in this report owe much to the generous financial and technical support provided by a large number of agencies, institutions and individuals. Ministries, Departments and institutions belonging to the Central and State Governments have been very supportive. The Governments of Tamil Nadu, Kerala, Andhra Pradesh, Orissa and West Bengal as well as of the Union Territory of Pondicherry, have been most helpful. They are all acknowledged in the last section of the Report. However, particular mention may be made of the ICEF, CIDA and Summit Foundation as well as the Bernard Van Leer Foundation for their support to projects which have ended during the period covered by this report. The Departments of Biotechnology and Atomic Energy of the Government of India and the NBDB have been extremely generous. The support of the SDC was responsible for the work undertaken by tribal women in Orissa, which received recognition through the *Equator*

Initiative Award at WSSD. The Tata Social Welfare Trust made the establishment of the *MSSRF-Tata Virtual Academy for food security and Rural Prosperity* possible. Various donors have also supported the *Every Child a Scientist* programme designed to foster the growth of a spirit of scientific humanism among our students. *The Touch and Smell Garden* is a source of immense joy and learning for visually handicapped children. We are particularly indebted to the Hon'ble Chief Minister of Tamil Nadu for a generous donation of Rs 10 lakhs to enlarge the *Touch and Smell Garden* as well as to intensify testing of salt tolerant rice strains, containing genes for seawater tolerance from *Avicennia marina*, a mangrove species. Numerous individuals have given generous support and we are grateful to everyone – international and national organizations, UN bodies, Central and State Government Departments, private industry, banks and a variety of donors. The scientists and scholars of MSSRF will do their best to prove worthy of this trust.

This report was compiled by Mr Senthil Kumaran, Ms R V Bhavani and Dr Sudha Nair. As in previous years, Dr Nandhini Iyengar served as Editor of the Report. The cover has been designed by the *Frontline* for which MSSRF is deeply indebted to Mr N Ram, Editor-in-Chief. The printing has been done by AMM Screens.



Coastal Systems Research

The ICEF supported project on mangrove conservation and management has come to an end in Andhra Pradesh and Tamil Nadu. The Final Performance Assessment of the project commended the overall project management and sustainability of the work done. The 45 acre green belt developed in Kudankulam under the DAE supported project was handed over to the NPCIL. The community managed agar plant, fish pickling unit and pearl culture activities have become operational in the Gulf of Mannar region. The status report of the state of bioresources in seven different coastal locations in the country was brought out with support from the NBDB.

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Sub Programme Area 101

Coastal Wetlands: Mangrove Conservation and Management

The Project is being implemented in the states of Tamil Nadu, Andhra Pradesh, Orissa and West Bengal, in collaboration with the Forest Departments (FD) of the respective states, NGOs and local communities and with the involvement of grassroot level elected representatives. The goal of the project is to enhance national capacity and action in the conservation and management of mangrove wetlands. The project has accomplished the restoration of 1,447 ha of degraded mangroves and organized the management of 12,766 ha of verdant mangroves under the Mangrove Management Units (MMU) of 33 village level institutions such as Village Development and Mangrove Councils (VDMC), Eco Development Committees (EDC), Vana Samrakshana Samithis (VSS) and Luna Jangla Samrakshana Samithis (LJSS). 193 women and men SHGs have been organized and linked to income generation activities. Community wood lots have been raised in 70 ha, to reduce the pressure on mangroves for firewood, fencing and house construction.

The Final Participatory Performance Assessment of the project was carried out from 16 March to 5 April, 2003 by a team led by Mr C K Sreedharan, Chief Conservator of Forests (CCF), Tamil Nadu FD, for the six

performance areas of Project goal, Capacity building, Sustainability, Governance, Project management, Learning and Innovations. Each performance area was further divided into a number of sub-areas and for each sub-area, one or more indicators developed on the basis of Project Management Plan and Logical Framework Analysis were used to assess the performance. The results of the assessment are given in the form of a grid (Table 1.1).

Recommendations: The Final Performance Assessment team has made the following recommendations for future activities of the mangrove conservation and management project:

Evolving site-specific regeneration techniques for species that have become locally extinct

Research studies on utilizing the beneficial micro flora of mangrove vegetation and incorporating them in restoration activities

Research studies related to identifying the optimum harvest limit of mangrove forests to meet the minimum requirements of the local community, like firewood and fodder

Identifying suitable indicator species that can be used for long-term monitoring of the physical and biological status of the mangrove ecosystem

Developing and demonstrating techniques to enhance the aquatic resources, particularly fishery resources, of the mangrove wetlands

Identifying and establishing mangrove genetic resource area in each mangrove wetland

Table 1.1: *Performance assessment-grid*

Performance areas	Tamil Nadu	Andhra Pradesh	Orissa	West Bengal
Project goal				
Achievement of results	5	4	4	5
Cost-effectiveness of results	4	4	4	5
Relevance of results	5	5	5	5
Quality of physical activities	5	4	5	5
Environmental concerns addressed	3	3	4	4
Gender and equity requirements	6	5	4	2
Poverty reduction	5	4	4	4
Capacity building				
Strategic selection of local partners	5	4	4	5
Partnership with local partners	5	5	3	4
Institutional strengthening	4	5	3	4
Increased participation and empowerment of target groups	5	4	3	4
Leverage and sustainability				
Strategically focused	5	5	5	5
Replication	5	6	4	5
Resource mobilization	3	5	5	4
Sustainability of the local level institutions	4	5	2	4
Micro enterprise development	3	3	3	2
Governance				
Direction and control of the project management committee	4	5	3	3
Accountability	5	5	5	5
ICEF response mechanism	5	5	5	5
Project management				
Project management plan	5	4	4	3
Project design and implementation	4	4	3	4
Financial control, budgeting and disbursement	5	5	5	4
Human resources and personnel management	4	4	4	4
Learning and innovation				
Review and evaluation	4	4	4	4
Innovation	4	3	3	4
Technology adoption	4	4	4	4
Documentation/communication strategy	5	5	4	3

(6-outstanding, 5-very good, 4-good, 3-adequate, 2-weak, 1-very weak)

Developing a model of integrated coastal wetland management and sustainable use of marine resources

Ensuring legal sustainability of the village level institutions formed under the project

Establishing a National Resource Centre for Mangrove Wetlands to take care of research and development for the long-term conservation of mangrove wetlands

Conducting experimental studies on the response of mangrove wetlands to global warming and sea level rise

Studying the role of mangrove wetlands in carbon sequestration and assessing its potential to mitigate climate change

Assessing the impact of the reduction in freshwater flow on the health and wealth of mangrove wetlands and mobilizing policy support to increase freshwater flow.

In this report, in addition to the activities carried out during the year, cumulative results of the activities carried out since 1996 are also given, to provide an overview of the project.

101.1 Tamil Nadu

The Joint Mangrove Management (JMM) activities are being implemented in 8 demo villages, 4 each in Pichavaram and Muthupet regions, with the participation of mangrove-dependent communities and the FD. Among the 8 villages, three are traditional fishing villages, two are non-traditional villages, and three are farming communities. Mudukkukadu in Muthupet region, the last

demo village of the total target, was included during the reporting period.

Though the project came to an end in May 2003, the conservation and management activities such as protection of restored mangroves and maintenance of restoration canals will continue to be carried out by the Village Level Institutions (VLIs) formed during the last 5 years.

Village level institutions and micro planning

During the current year, one more VDMC was formed, taking the total to 8 VDMCs in Tamil Nadu. Each VDMC prepared annual micro plans for mangrove conservation and management activities as well as for village development, jointly with the FD and this process was facilitated by MSSRF. The VDMCs are regularly monitored in terms of number of meetings conducted, attendance, content of discussion, women's participation in decision-making and the process adopted to evolve consensus on key issues. In all the VDMCs, the Range Officer of the respective region was selected as Secretary of the Executive Committee with the approval of the District Forest Officer (DFO). Out of 8 VDMCs, women head 3 VDMCs. The details of the 8 VDMCs are given in Table 1.2

Mangrove conservation and management

Restoration: The VLIs of the 8 participating hamlets have been successfully implementing the JMM activities. All the VDMCs have developed effective management systems for

Table 1.2: *Details of VDMCs established in Tamil Nadu*

Name of the VDMC	Date of Formation	No. of families	No. of members	No. of times leaders changed
Pichavaram				
MGR Nagar*	August 1998	90	175	3
Vadaku Pichavaram*	September 1998	126	250	3
Kalaingar Nagar	April 2000	85	154	3
T.S. Pettai	July 2000	175	350	2
Muthupet				
Veerankoil	January 1999	130	275	3
Manganangkadu*	June 2001	123	221	2
Karisaikkadu	August 2001	101	176	2
Mudukkukadu	August 2002	55	110	1

* Women lead these VDMCs

managing the restored and existing mangrove wetlands. During the reporting period, about 165 ha of degraded mangrove forest was restored in the Muthupet mangrove wetlands with the participation of Manganangkadu, Karisaikkadu and Mudukkukadu hamlets. The details of the areas under restoration by each VDMC are depicted in Table 1.3

The salient features of the restoration activities are as follows: as against a target for restoration of 600 ha over six years, the achievement was 625 ha; 20 ha were redeveloped with casuarina and cashew plantations; 5.50 million saplings were planted of which 4.80 million were *Avicennia marina* and the balance 0.7 million was accounted for by *A. officinalis*, *Ceriops decandra*, *Bruguira cylindrica*, *Rhizophora apiculata* and *R. mucronata*.

The average survival rate of the saplings was 68.4%; from the second and third year onwards, natural regeneration of candidate and other species is taking place in the restoration site. Total area under community management is 2,723 ha.

Other mangrove management activities: Maintaining the free flow of tidal water is one of the important management activities carried out by the VDMCs in the restoration area. In Pichavaram, experiences gained from the restoration activity started in 1996 showed that the main canals and feeder canals in the restoration area need to be desilted every year for two years and after that it is sufficient to maintain only the feeder canals by desilting, particularly at the mouth region. In MGR Nagar and Kalaingar Nagar, General Body (GB) members desilt the canals by providing

Table 1.3: *Restored areas in Tamil Nadu: village-wise details*

Village	Area of restoration (ha)	Year of plantation - No. of years	Survival %
Pichavaram			
MGR Nagar	40	Dec. 1998 - 4	83
Vadakku Pichavaram	52	Dec. 1999 - 3	88
T S Pettai	83	Dec. 2000 - 2	71
Kalaingar Nagar	75	Dec. 2000 - 2	65
Total	250		76.7
Muthupet			
Veerankoil	100	Jan. 2000 - 3	52
Manganangkadu	125	Dec. 2000 - 2	65
Karisaikkadu	125	Dec. 2001 - 1	55
Mudukkukadu	25	Yet to be planted	
Total	375		57.3

free labour; in Vadakku Pichavaram and T S Pettai a wage is paid by the VDMC. In Muthupet, restoration activities are integrated with fishing activities, following the traditional canal fishing method (described in earlier reports) and these canals are allotted to fishing families, which desilt them every year. Another activity related to management is protecting the restored and adjacent areas from grazing. In MGR Nagar, SHG members are involved in protecting the MMU. In Kalaingar Nagar and Vadakku Pichavaram, the MMUs are protected by a watchman. Rs 5 lakhs has been deposited in the bank by the project and the interest earned is used to provide the salary to the watchman. In the case of MGR Nagar, Kalaingar Nagar and Vadakku Pichavaram, the FD has provided a boat for management activities.

Socio-economic development and poverty alleviation programmes

Self Help Groups: SHGs are formed as small functional groups of the VDMC to increase the resource base of the members by linking them with the project, government agencies, Panchayat and lead banks. During the reporting period, 10 women and 8 men SHGs were formed. A total of 86 SHGs have been formed in the last 6 years. Table 1.4 provides the details of the SHGs in each demo village.

Nearly 87% of the poor and poorest families and 15% of the middle-income families of the project villages (identified through Participatory Rural Appraisal-PRA) have been covered under SHGs. Training in leadership, membership and functional aspects has been given to 76 SHGs.

Table 1.4: *Details of SHGs formed in the villages*

Village	Women	Men	No of poor & poorest	% coverage
Pichavaram				
MGR Nagar	5	6	136	86
Vadakku Pichavaram	13	10	107	100
Kalaingar Nagar	6	3	96	77
T S Pettai.	7	3	168	80
Total	31	22	507	
Muthupet				
Veerankoil	7	3	70	100
Manganangkadu	6	5	106	100
Karisaikkadu	5	3	77	100
Mudukkukadu	2	2	54	55
Total	20	13	307	

The SHGs mobilized about Rs 15,21,502 through savings. Women SHGs alone saved Rs 10,94,738. In the Pichavaram project villages, a total amount of Rs 21,60,200 was interloaned (women SHGs : Rs 14,05,500; men SHGs: Rs 7,54,700) whereas in Muthupet the total amount interloaned was Rs 4,01,650 (women SHGs: Rs 2,94,650; men SHGs: Rs 1,07,000). Tables 1.5 and 1.6 give details of the purpose for which savings were interloaned among the members of the SHGs.

Monitoring and assessing the functioning of the SHGs: SHGs were monitored regularly by the project staff. Grading of the SHGs and their functioning was done by the lead bank, the District Rural Development Agency (DRDA) and the Panchayat Union jointly with the help of external agencies. Out of the 86 SHGs formed, 47 have been graded as very good and they are now eligible for obtaining loans and

financial assistance from the DRDA and the lead bank of the region.

Income-generating activities: micro enterprises

During the reporting period 5 group-based micro enterprises with 54 units were started. In the last 6 years, 16 different types of micro enterprises, covering 112 families, have been started. The lead bank and DRDA provided financial assistance to 4 (3 women and 1 men) SHGs to start micro enterprises. Among the various micro enterprises started, cotton coir rope making, coconut coir rope making, coconut leaf thatching and fish pickle manufacture are functioning well and have established a good market. Two important micro enterprises, crab fattening and palm candy production, started with promising results, were closed due to poor management.

Table 1.5: *Details of interloaning among members of the SHGs in Pichavaram area (Amount in Rupees)*

Name of the hamlet & SHGs	To pay old debt		Agriculture & fishing		Other income generation		Livelihood purpose	
	No.	Amount	No.	Amount	No.	Amount	No.	Amount
MGR Nagar								
Women SHG	52	1,31,000	15	1,87,000	13	23,000	54	1,35,000
Men SHG	28	48,000	12	17,000	3	9,000	17	29,000
Vadakku								
Pichavaram								
Women SHG	30	2,30,000	115	1,25,000	5	13,000	235	3,14,000
Men SHG	21	39,000	118	2,30,000	16	53,000	96	1,18,000
Kalaingar Nagar								
Women SHG	58	1,22,000	10	18,000	9	42,000	17	35,000
Men SHG	42	78,000	15	22,000	5	29,000	8	19,000
T S Pettai								
Women SHG	12	14,500	5	10,000	7	-	4	6,000
Men SHG	5	48,000	12	8,100	5	-	7	7,600
Total	248	7,10,500	302	6,17,100	63	1,69,000	438	6,63,600

Table 1.6: *Details of interloaning among members of the SHGs in Muthupet area (Amount in Rupees)*

Name of the hamlet & SHGs	Agriculture & fishing		Other income generation		Livelihood purpose	
	No.	Amount	No.	Amount	No.	Amount
Veerankoil						
Women SHG	32	42,000	12	23,000	32	1,55,250
Men SHG	30	29,200	12	9,600	84	46,500
Manganakkadu						
Women SHG	12	19,500	7	4,200	14	12,500
Men SHG	12	5,200	4	3,500	5	1,600
Karisaikkadu						
Women SHG	10	20,300	8	5,200	20	12,700
Men SHG	7	4,600	5	3,600	12	3,200
Total	103	1,20,800	48	49,100	167	2,31,750

Training and capacity building

Training to the community

- Activities relating to institution building concentrated on leadership and membership training to VDMCs and SHGs, functional aspects of SHGs, and participatory approaches to VDMCs and SHGs. 85 families were covered under these activities.
- Entrepreneurs Training Programme (ETP) was provided to 30 members of women and men SHGs (two members from each SHG) at the Rural Extension Training Programme Centre at Pattukkottai. It was arranged by DRDA and Women Development Corporation, Thanjavur.
- A training and exposure visit on goat rearing was arranged for 3 women SHGs with the help of the Animal Husbandry Department, Panchayat Union, Parangipettai. SHG members of Pichavaram region were taken on an exposure visit to Krishi Vigyan Kendra (KVK), Vrithachalam; an exposure visit to Vettaikkarar Iruppu was arranged for members of SHGs in Muthupet.
- Training on cotton coir rope making was provided to the SHG members of T S Pettai with the help of the SHG at MGR Nagar, which is producing cotton coir rope.
- An exposure visit was arranged for SHG members of T S Pettai, at M/s Venugopal Fibre Industries, Palayam near Pattukkottai.

Details of all training programmes provided to the community are given in Table 1.7.

Training to the Forest Department

- JMM training was given to only one batch of 16 participants from the Tamil Nadu FD (3 DFOs, 6 Forest Range Officers, and 7 Foresters)
- An orientation and exposure visit was organized for CCF, DFOs and field staff (Range Officers) from the Karnataka State FD.
- Orientation in JMM and exposure to restoration techniques were given to 40 Trainee Assistant Conservator of Forests, 250 Trainee Range Officers, 350 Trainee Foresters and 200 Trainee Guards of Southern Range Foresters College, Coimbatore.

Gender and equity

Direct and indirect benefits to women from project activities: The project, with the help of UDRC and Gender Task Force, internalized gender concerns and planned its activities to ensure that women are full and equal partners in the planning (micro) and implementation of the project programmes and receive equal or more benefits than the men. In the project villages, gender segregated data was collected, using various participatory tools such as PRA, semi-structured interviews, group discussion etc. From these data the following major concerns of women were identified and were seen to be more or less similar in all the project villages:

Table 1.7: *Details of training given to the community in demonstration villages of Tamil Nadu*

Site	Training aspects	Total members	Women members	Men members
Pichavaram	Functional aspects	135	70	65
	Leadership and participatory restoration	40	15	25
	Using boat and nets	50	25	25
	Palm candy making	20	10	10
	New cropping techniques	60	25	35
	Integrated Pest Management	45	20	25
	Dairy farming	29	29	0
	Floriculture	15	15	0
	Coconut leaf plaiting	10	10	0
	Coir rope making	20	10	10
	Fish and prawn pickle making	15	15	0
Muthupet	Functional aspects	60	40	20
	Leadership aspects	20	10	10
	Dairy farming	45	40	5
	Coir rope making	51	51	0
	Fresh water fish culture	13	0	13
	Chalk making	6	6	0

- Lack of social influence, leading to a limited role or no role in the decision-making process
- Lack of a financial resource base and limited ownership rights to household property
- Drudgery in domestic chores

Action taken to empower women in the social domain: As a first step to prevent monopolization by men at the community-level decision-making process, it was made compulsory to give 50% representation to women in the GB and 33% in the Executive

Committee of the village level institutions (VDMCs).

There was hesitation among women and subtle opposition from the men at the beginning. In order to overcome this problem, two important measures were taken: sensitization programmes on gender equity were conducted separately as well as collectively for both women and men; women were trained in leadership and membership skills and were persuaded persistently to participate actively in the decision-making process, both during the VDMC meetings and on other occasions.

3 VDMCs are currently headed by women and in many of the VDMCs, women have more than 50% representation.

Currently, in all the project villages, micro plans are prepared jointly by women and men and women also take an active part in implementing the programmes and monitoring their progress.

Action taken to empower women in the economic domain: Women SHGs were formed in all the project villages to increase the resource base of the women, and the leaders and members of these SHGs have been given training in leadership and membership skills and functional aspects of SHGs.

Women were trained along with men in almost all the micro enterprises started in the project villages. In some cases, ownership of the micro enterprises was given to women members and in other cases both women and men jointly own the micro enterprises.

All the women SHGs have been linked to the Women's Development Programme of the state of Tamil Nadu.

Sustainability of local level institutions

The VDMCs formed in the project villages will continue for a long time as concrete steps have been taken to make them sustainable from the organizational, social, financial and partnership perspectives.

Organizational sustainability: The organizational structure of the VDMCs is similar to that of Village Forest Council (VFC) of Joint Forest Management (JFM) but the villagers

were made to understand the conceptual background of these village level institutions and remember this conceptual background during every GB meeting.

It was understood that VDMCs should not be static from the organizational point of view but should change with changing situations.

Membership is increasing every year and leaders and members of the Executive Committee are elected every year. There was a problem in the initial phase in changing the leadership but now this has been accepted by the members of the VDMC as part of their organizational development.

By-laws prepared by the VDMC provide scope for focusing its efforts on mangrove conservation and management; in fact, the goal of VDMCs is "to improve the socio-economic condition of the village and mobilize and organize the community for active participation in the restoration, conservation and protection of the mangrove wetlands".

Social sustainability: The hamlet is taken as the social unit for VDMCs, where the influence of the traditional system is high, and plays a critical role in solving problems relating to the political situation in the hamlet; in other words, in the hamlets, the traditional system is more dominant than the political system. All the VDMCs have been formed taking concurrence from these traditional leaders.

Hamlets consist of homogenous groups in terms of caste and class; as can be seen in the

PRA reports, the poorest, poor and middle income groups dominate the society of these villages and differences between them are not wide; this homogeneity helps in the smooth functioning of the VDMCs.

Bringing in gender equity was a problem in the initial phase but now this problem has been solved. In fact, in most of the VDMCs women play a more important role than men.

VDMCs are now respected and seen as a source of strength by the villagers, particularly in bringing various welfare schemes to the village as well as in developing effective partnership with the FD and other government agencies and Panchayat Raj Institutions (PRIs). However, the control in many of the age-old social issues is still with the traditional leaders, which does not affect the VDMCs.

At VDMC meetings, the discussion always relates to the village at large and no family problems or feud among the members is brought in.

Financial sustainability: The VDMCs have developed both corpus funds and revolving funds.

The fund allotted for restoration (Rs 14,000 per ha in Pichavaram and Rs 18,000 per ha in Muthupet) is given to the VDMCs in full, with the condition that no more will be available. The VDMCs have been able to save about 10 to 15% from this allotted amount by increasing their efficiency in planning and implementing restoration activities and providing free labour at times. The amount

saved is utilized as corpus fund. In Pichavaram, each VDMC has about Rs 2.0 lakhs as corpus fund and in Muthupet, about Rs 1.5 lakhs.

All the funds allotted to the SHGs and individual families for micro enterprises and other income-generating activities are given as revolving funds to the VDMCs, which distribute them as loans to the SHGs. VDMCs give loans only on written agreement. In Pichavaram, each VDMC, on an average, has about Rs 5.75 lakhs as revolving fund. In Muthupet, each VDMC has about Rs 3.0 lakhs as revolving fund.

The capacity of VDMCs and SHGs to mobilize funds from the PRIs, government agencies and banking institutions, which also play a major role in the financial sustainability, has been improved.

Apart from financial support from project activities, resources were mobilized by VDMCs from other sources. The following resources have been mobilized so far by the VDMCs of the respective hamlets:

About Rs 12.8 lakhs has been mobilized in the Pichavaram area for mangrove restoration from the FD.

In Pichavaram, about Rs 1.65 lakhs has been mobilized from the FD to purchase a boat for patrolling and other management activities.

About Rs 3.5 lakhs has been mobilized from the FD for socio-economic developmental activities in Pichavaram and Rs 1.5 lakhs has been promised by the FD in Muthupet

In Pichavaram, Rs 14.15 lakhs has been mobilized for various village developmental activities from the Member of Parliament Funds, DRDA and Indian Bank and Central Bank of India under Swarna Jayanti Gram Swarozgar Yojana (SGSY) schemes, DANIDA and Revenue Department (to purchase land for the settlement of Irulars in Kalaingar Nagar), Panchayat Union and Citadel Fine Pharmaceuticals, Chennai for MGR Nagar School.

In Muthupet, Rs 11.75 lakhs has been mobilized for village developmental activities, through DRDA and Dhana Lakshmi Bank under SGSY scheme, Village Self-Sufficiency Scheme and Panchayat Union.

Partnership with the FD

With the approval of the DFOs, Range Officers were nominated as Secretary to the village level institutions formed in the project villages both in Pichavaram and Muthupet. Since the Range Officers were previously involved actively though informally in project activities, official nomination paved the way for them to express their views freely during micro planning and implementation. Further, the FD, particularly in Pichavaram, implemented many of the mangrove restoration activities as well as village developmental programmes through the VDMCs. Partnership between the local mangrove user community and the FD, resulted in the following:

- The FD and villagers began to trust each other.
- The FD recognized the VDMC as the main institution through which it can plan and implement its activities.
- The VDMC recognizes that the FD is its inseparable partner in mangrove conservation and management.
- Contact between the institutions (FD and VDMC) has increased and the role of individuals as a bridge between the FD and VDMC has subsided.
- The VDMC is able to approach the FD in an appropriate and formal way to solve problems.

101.2 Andhra Pradesh

In Andhra Pradesh, the JMM activities are implemented in five villages in Godavari and three villages in Krishna districts. The project has been operating through eight village level institutions, 44 SHGs and two youth groups that are dependent on mangroves for their livelihood. These village level institutions were recognized by the FD as EDC / VSS. This has paved the way for the sustainable continuity of the JMM model. The men and women have equal representation in the General Body while in the Executive Body, the percentage of women varied from 33 to 40%. The Chairperson of Sri Kanaka Durga EDC, Gadimoga, is a woman. The project identified the causes for the degradation of mangroves and the dependency of the local population on mangroves, before

developing participatory methods to address the problems.

Institutional development and micro planning

The PRA and micro plan were done for the first time in Nali, Krishna Mangroves. In Zinkapalem, though the activities were being continued for the second year, much of the activities were carried out this year. Micro plans were prepared and implemented as follows: 4th micro plan in Matlapalem, Dindu and Bhairavalanka and 2nd micro plan in Kobbarichettupeta and Gadimoga in Godavari. In Krishna, 4th micro plan was implemented in Dheenadayalapuram, 2nd micro plan in Zinkapalem and 1st micro plan in Nali. The villagers of Matlapalem, Dindu and Bhairavalanka prepared the microplans by themselves, which is an indication of the empowerment of VLI. However, the micro plans were prepared for the remaining villages with the help of MSSRF. In the period under report, the villagers carried out most of the activities of the micro plans. This was to enhance capacity in the committee to plan and implement management activities in future. So far 24 micro plans have been drawn up and implemented in the demonstration villages.

Mangrove restoration and management

Vegetation Survey: Vegetation survey and floristic analyses were completed in Godavari and Krishna mangroves. 35 species belonging to 27 genera of 20 families were recorded. The findings were published as a book titled

Mangroves of Andhra Pradesh - Identification and Conservation Manual.

Restoration of degraded mangroves: 520 ha of the targeted 600 ha of degraded mangroves were restored in the Reserve Forests and protected areas to ensure the management of these restored areas by the FD after the project tenure. The total number of nursery-raised saplings planted was 4,14,000. Permission for carrying out restoration was obtained from the Principal Chief Conservator of Forests (PCCF), Hyderabad, with a team of Forest officials, headed by the Addl PCCF visiting the areas demarcated for restoration. 9,442 ha of verdant mangroves were brought under JMM by EDC/VSS, Andhra Pradesh FD and elected representatives. Through the restoration and nursery raising activities, the villagers earned Rs 5,159,257. The villagers, now used to hard work, took up the "Food for work" programme and laid roads in their villages. Mr Krishna Murthy of Bhairavalanka said, "We are now used to hard work by undertaking activities facilitated by MSSRF and are able to earn money in a better way than by cutting and selling mangrove wood." The details of mangrove restoration are given in Table 1.8.

The mangrove saplings raised by the community last year under the community mangrove nursery scheme were purchased through the EDC and planted near the canals. The villagers of Bhairavalanka, Matlapalem and Dheenadayalapuram earned Rs 2,25,000 by selling the saplings. The canals of the mangrove plantations in Dindu, Kobbarichettupeta, Gadimoga and Bhairavalanka in

Table 1.8: *Restoration of degraded mangroves and MMU in Andhra Pradesh*

Demonstration village	Area restored (ha)	Area under MMU (ha)
Matlapalem	5	502
Dindu	25	900
Kobbarichettupeta	35	3,925
Gadimoga	25	900
Bhairavalanka	75	615
Dheenadayalapuram	236	2,000
Zinkapalem	114	600
Nali	5	-
Total	520	9,442

Godavari and in Zinkapalem in Krishna mangroves were desilted. This has facilitated better tidal flushing during summer. The casualties were replaced in all the mangrove plantations. This year the FD provided employment by allotting canal construction work in Bhairavalanka. Similarly in Krishna the villagers of Dheenadayalapuram and Zinkapalem are involved in the restoration initiated by the FD.

Replication of the restoration model: Although the FD of Andhra Pradesh started canal construction as early as 1990, the staff of Coringa Wildlife Sanctuary, Godavari, have adopted the fish bone type of canal construction after an exposure visit to the plantations at Pichavaram restoration sites. Coastal Community Development Programme (CCDP), an NGO in Machilipatnam, who were trained in Training of Trainers (TOT) programme in 1998 under

the guidance of the staff of the project, restored 105 ha of degraded mangroves near Palakayathippa village in Krishna mangroves, following the community participatory approach of JMM. The CCDP in turn trained the NGO Sangamithra Service Society, who restored another 30 ha in the JMM method. Following the same model of JMM developed by the project, the NGO Sravanthi restored another 15 ha of degraded mangroves in Godavari. Altogether, in addition to restoring 520 ha, the project in Andhra Pradesh has replicated the model of JMM involving partner NGOs and restored 150 ha of degraded mangroves in different areas.

Mangrove Management Units (MMU)

MMU's were allotted for the protection of verdant mangroves and degraded areas. Restoration of mangroves has been completed in the entire MMUs of the demonstration villages.

Land based alternatives (LBA): Plant saplings of fuel, timber and horticultural trees were supplied to the demonstration villages for homestead plantation. 12,000 saplings of Eucalyptus were distributed to all the demonstration villages in Godavari. The saplings were procured from the Planning and Extension wing of the FD. A community plantation of Eucalyptus was raised in Kobbarichettupeta in 0.6 acre to reduce the dependency on mangroves for timber. Horticultural crops and seeds for kitchen gardens were distributed in three villages in Krishna along with timber-yielding trees under homestead plantation. 37 gas stoves were provided in Corangi - Dindu, 20 in Gadimoga, 18 in Kobbarichettupeta and 30 in Bhairavalanka, with a matching contribution from the community. 50 kerosene stoves were supplied in Zinkapalem and 67 in Dheenadayalapuram, to reduce the pressure on mangroves. A total of 20 ha of community wood lot and homestead plantations were raised by the project to reduce the dependency on mangroves. The people were encouraged to use prosopis, palmyrah and coconut waste as alternatives for firewood and fencing. As a result, heaps of coconut or palmyrah refuse is found in each household in the demonstration villages, instead of mangrove wood.

Activities towards poverty alleviation

Table 1.9 gives the details of SHGs formed in the project area. Micro credit loans were provided to 6 women SHGs in Gadimoga and 2 women SHGs in Bhairavalanka for selling

fish. SHG members of Gadimoga contributed Rs 100 and the project provided Rs 900 for purchasing dry fish in the market. The women are repaying the loan, and the money is being deposited in the savings bank account as a revolving fund for each group. In Kobbarichettupeta, 50 families were given fishing nets worth Rs 50,000 with an equal contribution from the community. The nets were provided before the onset of the fishing season. 550 Vanaraja chicks were supplied to all the demonstration villages in Godavari mangroves. One-month-old vaccinated, healthy chicks were bought from a private hatchery in Karimnagar and distributed to the villagers. This has reduced the mortality rate of the birds. Similarly, 160 Giriraja chicks were supplied to all the demonstration villages in Krishna through the KVK.

Village development activities

Rs 20,000 was provided for constructing a compound wall. Furniture and cupboards were given to the Kobbarichettupeta School for which the Government contributed Rs 80,000. At Gadimoga, Rs 5,500 was contributed to get a grant of Rs 60,000 from the Government to construct a toilet, especially for girls and school teachers. In Dindu, a gate was provided for the community hall. For the noon meal scheme Rs 20,000 worth of vessels were provided for the schools (mangrove conservation clubs). In Zinkapalem, Rs 20,000 was provided to construct a concrete bridge across the nearby creek. Rs 5,000 was provided to each school in Gadimoga and Chinavalasala for

Table 1.9: *Details of Self-Help Groups formed in different villages*

Village	No. of SHG	No. of families covered
Godavari		
Matlapalem	5	69
Dindu	4	52
Bhairavalanka	6	73
Kobbarichettupeta	-	-
Gadimoga	6	84
Krishna		
Dheenadayalapuram	7	105
Zinkapalem	6	90
Nali	10	150
Total	44	623

purchasing school furniture and infrastructure. In Bhairavalanka, a culvert was constructed at a cost of Rs 11,000 in the Saveru Creek for bathing and Rs 10,000 was provided for solving the drinking water problem. The Government will provide Rs 90,000 for the same.

Community based micro enterprise

Through the UNDP-Coir Board project, 40 women were trained in coir rope making at the field-training centre in Dindu. Each batch of 10 women was trained for two months. Rs 39,000 was contributed towards buying 30 machines and the trainees contributed Rs 30,000. The balance of Rs 2,07,000 was borne by the UNDP project. The coir rope made during the training will be used in the second phase of the UNDP project for making coir mats for which the Coir Board has already provided the necessary machines and frames worth Rs 1,35,000.

Information, awareness and training

Training to women SHGs: 30 women of a SHG in Gadimoga were trained in tailoring. 8 women in Dheenadayalapuram were also trained while 6 sewing machines were provided to SHG members of Zinkapalem. Training was given to villagers of Kobbarichettupeta and Dheenadayalapuram in fish and prawn pickle making.

National training workshop: A National training workshop on *People's Participatory Approaches in Conservation and Management of Forestry Resources* was organized at Kakinada from 16th-19th December, 2002, for the Forest Officers of Tamil Nadu, Orissa, West Bengal and Andhra Pradesh. The purpose of the workshop was to enhance the capacity of different stakeholders by exposing them to the methodologies and objectives in the participatory approaches of Forest Management. Nearly 60 participants from the

FD, NGO sector and research and academic institutions participated in the workshop. The four-day workshop included a one-day field exposure visit to mangrove restoration areas in Coringa Wildlife Sanctuary near Kakinada. The participants were exposed to technical aspects of mangrove restoration and conservation as well as the geomorphological and hydrological aspects of mangrove wetlands.

A State Guidance Committee (SGC) meeting was conducted at the Secretariat, Hyderabad, at which it was emphasized that 2,000 ha of verdant mangroves occurring outside the Reserve Forests should be protected and appropriate action taken by SGC to include the area within the Coringa Wildlife Sanctuary by extending the boundary.

Awareness: In Godavari mangroves, exposure visits were organized for school children, elected representatives of the District and Panchayat, Government officials and non-government officials. World Environment Day, International Women's Day, World Wetland Day and World Forest Day were celebrated. A Mangrove Conservation Club was formed in Nali and meal plates for the mid-day meal scheme were distributed to the mangrove club members. Folk media and audio-visual aids were used for creating awareness in all the demonstration villages. Cyclone Disaster Day was organized on 19th November at Dheenadayalapuram. 40 LJSS members from Orissa visited the restoration sites and the villages to understand the JMM model. The

interaction between the villagers of Orissa and Andhra Pradesh helped them to understand the various activities implemented by the project.

Inter-sectoral linkage

When the World Bank project was over, the FD requested MSSRF to continue the restoration programme in Kobbarichettupeta and reorient the canals which are the major linkages achieved through the project in the Dindu plantation. The exchange of nursery-raised saplings in Krishna and Godavari between MSSRF and the FD and the mutual help rendered, reveal the partnership mode in which the project was implemented.

Impact of the project

The JMM was made possible by the rigorous awareness exercises conducted in the villages, using folk media and mangrove conservation clubs in the schools. An amount of Rs 3,000 to 5,000 has been deposited in fixed deposits for the schools, the interest from which will be used to conduct annual competitions on the importance of mangroves. Micro plans that were drawn up for each village addressed not only the issues of funding from the project, but also that of tapping other departments wherever it was beyond the projects' scope and through voluntary labour by the villagers. The voluntary labour extended by the villagers is immeasurable. Apart from the voluntary labour, the villagers contributed Rs 8,75,835 towards micro credit and house-building. The impact created by the project in the

demonstration villages made the neighboring villages request MSSRF to adopt their villages as well. Two more villages were taken up for mobilizing and empowering the people for the conservation and sustainable use of mangroves.

101.3 Orissa

The project in Orissa is being implemented in the Mahanadi delta in Kendrapara district and the Devi river mouth in Jagatsinghpur district. To begin with, four demonstration villages, three in Mahanadi delta and one in Devi mouth site, were selected for the project in 1996. Ten additional demonstration villages, four in Mahanadi delta and six in Devi mouth site were taken up after the super cyclone in 1999. The programme activities are being extended further north along the coast, in Dhamara mouth in Banipahi area. The project activities in Orissa will continue till April, 2004.

Institution strengthening towards mangrove management

Entry point activities in the new demonstration villages were followed by PRA, group formation and institutional development. Micro plans were prepared jointly by the stakeholders for village development activities and mangrove restoration and management. Community-based institutions were set up, involving the local people, government officials, FD, NGOs and members of PRI. Linkages were established with NGOs, namely Nature Club, PREM, CASA and VARAT and various government

departments for implementing the socio economic and mangrove conservation and management programmes and for the sustainable continuity of the programme.

Mangrove restoration and management

The restoration of degraded mangrove areas was taken up in collaboration with seven VLLs, namely, LJSS in Jamboo - ward no-14, Kalatunga and Badatubi in Mahanadi delta and Naupal, Amarapat, Dhanuharbelari and Kerabelari in Devi river site and 64 ha of degraded mangroves were restored. In addition to afforestation, gap filling was carried out in 47.5 ha in the existing plantation areas. In Naupal in Devi river site, restoration was carried out through canal intervention in 15 ha on an experimental basis. So far afforestation has been completed in 257 ha of degraded mangroves in both the sites.

Formation of Regional Mangrove Protection Committees (RMPC)

For the first time, two RMPC were formed, one in each site, consisting of representatives and community leaders, to sustain the conservation and management efforts in the mangrove areas. There have been frequent quarrels between the LJSS members and the buffalo grazers and timber poachers who are putting immense pressure on the conservation and restoration activities. These committees are now taking suitable action in settling inter-village conflicts.

Mangrove protection through "thengapalli"

A unique method of protection in the mangrove management unit area has been introduced through *thengapalli* (protection by turn), in some of the demonstration villages in Orissa. Efforts are being undertaken by MSSRF and the FD to popularize this system in all the mangrove areas. Under the system, two or three families join together and patrol the mangrove areas. The stick is carried while patrolling and handed over to the incoming batch the next day. Through this system, the entire village protects the area in a true spirit of participatory mangrove conservation and management.

Land-based alternatives

Raising of community nursery and plantation of Multi Purpose Tree (MPT) species: Homestead and community plantations are being encouraged to reduce the dependence on mangrove resources. As a result, dependence on mangroves has reduced substantially and people have started preferring the alternatives, rather than taking pains to fetch the mangrove wood from the forests. So the LJSS decided to start a nursery in the village itself.

Nursery-raised seedlings were distributed to the villagers at a token price of 25 paise. The money thus collected was deposited in the village fund of the respective villages. MSSRF paid at the rate of Rs 1.50 towards seedling cost. These seedlings were planted in common lands as well as homestead lands.

Supply of portable chullah: Portable *chullahs* manufactured by NEDCAP in Andhra Pradesh, which are in high demand among the communities, were distributed to 500 households in four demonstration villages in Mahanadi site. The people are happy to use this *chullah*, as there is a 20 - 30% reduction in the requirement of wood for cooking, compared to the traditional *chullah*. After seeing the results of these *chullahs*, it has been decided to distribute the same to 300 households in Devi site in the coming year.

Supply of gas stoves: Some of the villagers have shown a keen interest in using gas stoves. The micro plan was prepared accordingly and a matching contribution was sought from the villagers. Initially the distribution was made in Kalatunga and Kharinasi-6 in Mahanadi site and 27 gas stoves have been distributed so far in these villages.

Fodder cultivation: Fodder cultivation was carried out by the villagers in four demonstration villages, to meet the fodder requirement. The villagers have grown fodder grass viz. NB-21, Chinese cabbage, Berseem, Oat, MP cherry, hybrid maize and Para grass in homestead lands and they have started stall-feeding their cattle with the cultivated fodder.

Kitchen garden: To enhance the kitchen garden activity, vegetable seeds were distributed to 1,200 households in all the eight new demonstration villages in the two sites. Vegetable seeds like pumpkin, onion, ridge gourd, bitter gourd, chilly, tomato and knolkhol were distributed.

Poverty alleviation and socio-economic development

Off-farm income generation activities: Poultry farming is one of the off-farm activities, undertaken successfully in the villages, usually by the women. It was decided that the cost of chicks would be borne equally by the villagers and MSSRF and household requirements were assessed. Prior to the distribution of chicks, awareness training on poultry farming was conducted with the help of the local Veterinary Assistant Surgeon (VAS). About 4,000 chicks belonging to breeds such as Kalinga brown, Black rock and Red rock were procured from the Central Poultry Farm, Bhubaneswar, by the villagers. They were immunized with the help of the local VAS. The villagers can now get their own requirement of chicks without depending on the project.

Apiary: Managing an apiary is a very successful off-farm business in mangrove areas. On an average, farmers get 4 - 6 kg of honey every year. Seven beehive boxes were distributed, four in Kharinasi-6, two in Badatubi and one in Bandar village. It is planned to provide more beehives and organize training in apiculture to the farmers to popularize this activity in the coming year.

Dairy farming: Seven households were selected by the Executive Committee of Kajalapatia village to take up dairy farming and seven crossbreed cows were given to the beneficiaries. On an average, each beneficiary is getting 6-7 litres of milk everyday, which is sold at Rs 70-80 in the local market.

Supply of agricultural implements: Agricultural implements, especially treadle pumps, low lifting hand pumps, hand sprayer and foot sprayer, were distributed to the beneficiaries. Besides these, power tillers and diesel pumps were also given to the village committees. As per the requirement, the farmers will hire these equipment and the money collected from them will be deposited in their village fund.

Distribution of storage bin: Training on *Safe Storage of Grains* was conducted, one at Jamboo and another at Kharinasi, with the help of trainers from the *Save Grain Campaign*, Government of India. They provided storage bins to the villagers at a subsidised rate of Rs 91 per bin with a capacity of 1.1 quintal and in total 390 galvanized bins were distributed to the villagers. In addition, two storage bins of 5 quintal capacity were constructed free of cost and donated to the village community for the grain bank in Kharinasi-6 by the *Save Grain Campaign*, Government of India.

Micro enterprises: Several micro enterprises, like fish drying and selling, betel shop, poultry farming, apiculture, rice vending, fish and prawn pickle making, tailoring, seed business, dairy and goat rearing, were facilitated, especially for the women, to improve their income and enhance food and monetary security.

Developmental activity: Latrines and cement rings were provided to households in all the project villages. In the first phase, they were distributed to 113 households in Kharinasi-6

village. They were constructed in the village by local masons under the supervision of the LJSS committees. Renovation furnishing of school buildings and setting up of libraries in the demonstration villages were also taken up and books worth Rs 4,500 were given to each school in Jamboo-14, Kalatunga, Kharinasi-6 and Badatubi in Mahanadi site. The only primary school building in Badatubi village was plastered, white washed and fitted with doors and windows.

In Kajalpatia village, a multipurpose community centre was constructed, with support from UNDP. It is planned to construct similar centres in other demonstration villages in the coming year.

Formation of SHGs in new demonstration villages: 28 SHGs were formed, 19 at Mahanadi (Table 1.10) and 9 at Devi site (Table 1.11). Of the 19 groups from Mahanadi site, three were men groups. Training on record keeping and accounting and exposure visits to other successful groups were also conducted for the SHGs, to ensure the sustainability of these groups. Their activities include establishing MPT nurseries, selling saplings and inter-lending.

Formation of Mahila Mandal: Two Mahila Mandals were formed, one at Kajalpatia and the other at Bandar. Women were encouraged to take up thrift and savings and linked to various enterprises for additional income. A loan of Rs 65,000 was sanctioned by NABARD for six SHGs to undertake micro enterprises.

Information, awareness and training

Information: A brochure and poster in Oriya on mangroves, the mangrove conservation project and the role of MSSRF were distributed to all the stakeholders.

Competitions were conducted for school children on the importance of mangroves and land-based alternatives to reduce dependence on mangroves.

Interventions on LBA and restoration were made in two places in Mahanadi site and two places in Devi mouth site.

Activities like mass community meetings, cycle rally, debate, essay competition and poster display were conducted to enhance awareness among the communities.

A street play group formed by school children of Kalatunga staged 23 streets plays in the project area in Mahanadi site to enhance awareness among the school children as well as the communities on conservation and management of the mangrove ecosystem.

World Environment Day, Van Mahotsav and World Wetlands Day were observed in all the demonstration villages.

Awareness: Six eco-clubs, one in Mahanadi site and five in Devi site, were formed in schools to motivate the students towards mangrove conservation and management.

An exposure visit was organized to a JFM area near Bhubaneswar to help the people to interact with the communities of that area,

Table 1.10.: *SHGs in Mahanadi site*

Name of the village	Total no. of SHGs	Men SHGs	Women SHGs	Total members	Monthly contribution (Rs)	Total saving (Rs)
Kalatunga	5	1	4	81	2,220	24,420
Kharinasi-6	7	2	5	105	1,400	33,600
Badatubi	3	-	3	51	1,170	10,530
Jamboo-14	4	-	4	79	2,370	28,440

Table 1.11: *Women SHGs in Devi mouth site*

Village	Name of the SHG	No. of members	Monthly Contribution (Rs)	Total amount (Rs)
Dhanuharbelari	Radhakrishna	11	100	11,000
Dhanuharbelari	Asta Sambhu	11	100	800
Dhanuharbelari	Maa Annapurna	20	100	14,000
Dhanuharbelari	Maa Tarini	11	100	800
Kerabelari	Maa Duladei	13	100	3,900
Kerabelari	Maa Tarini	13	100	3,900
Kerabelari	Maa Mangala	13	100	3,900
Amarapat	Maa Saraswati	15	20	300
Amarapat	Maa Gotheswari	13	15	1,950

who have conserved and protected their village forest with the help of the FD.

Another exposure visit, to the JMM restoration and management sites and demonstration villages in Godavari mangroves in Kakinada, Andhra Pradesh, was organized for the communities to learn about the activities of MSSRF and the involvement of local communities and the FD in conserving and managing mangroves. Members of SHGs also visited successful groups in Jajpur district.

Training: Training in the cultivation of oyster mushroom was conducted in Naupal village in Devi site for 11 women. A similar training was organized at KVK, Kendrapara for the demonstration villages of Mahanadi site and spawn were distributed to 72 growers.

A demonstration-cum-training on pest control on coconut trees was conducted in Naupal, Amarapat, Dhanuharbelari and Kerabelari in Devi site, in which 55 coconut growers participated.

Training was organized with the help of resource persons from CIFA, Bhubaneshwar, for families in Devi site who wanted to practise backyard mixed fish farming. After the training, the water samples were collected from villages for analyses. On the basis of the report, the resource persons recommended follow up activities, which were carried out by the LJSS. Currently, 10 families from two villages are engaged in mixed fish farming.

Training in hybrid poultry farming was conducted in Kalatunga village, before the hybrid chicks were distributed to the potential farmers.

A workshop on Advanced Agriculture Techniques in improving crop production in coastal Orissa was organized at KVK, Kendrapara, for the farmers from all the four new demonstration villages.

An orientation programme was conducted for LJSS members in all the operational areas on nursery raising and restoration and management of mangroves.

Training on mangrove nursery raising and selection of species was organized in Konark for the forest staff of Puri Forest Division.

The staff of MSSRF and forest officials of Mangrove Forest Division, including the DFO, Kendrapara, met to discuss the technical aspects related to mangrove species propagation, plantation and restoration, as also the phases of withdrawal strategies and policies of the FD to take over the project area before the end of the project.

Training was imparted to 7 animators from the new demonstration villages on their roles and responsibilities.

Training in group management, co-ordination, selection of micro enterprisers, accounting and loan systems was conducted for the members of SHGs, in both the sites.

Training was also conducted in all the demonstration villages, on the management of government-sponsored, socio-economic development schemes.

A JMM training-cum-workshop was conducted during October-November 2002 at Bhubaneshwar for senior officials of the FD and other policy makers, where the JMM policy guidelines and the need for introduction of JMM in Orissa state were discussed.

Sub Programme Area 102

Nuclear and Biotechnological tools for Coastal Systems Research

Salinity is a major factor limiting crop yields in many parts of the world. The total global extent of saline soils ranges between 500 and 650 million ha and it has been estimated that one third of the 230 million ha under irrigation is being affected by salinity. It especially affects the developing world since the technology to combat it is costly, requiring large capital expenditure in terms of energy and maintaining salt balance. The problem of

salinity is most acute in coastal regions, where irrigation with brackish water and poor drainage system often produce secondary salinity. The area of land affected by salt continues to increase and it is likely that the effects of global warming would worsen the situation even further.

102.1 Identification and Isolation of Salt Induced Genes

The programme aims at identifying novel genetic combinations from the mangrove species for developing crop varieties that could offer resistance to the abiotic stress conditions of coastal regions. It was in this context that work was initiated on *Porteresia coarctata*, a mangrove associate species and wild relative of cultivated rice, for the construction of enriched gene libraries, identification, isolation and characterization of salt tolerant genes and their subsequent integration into crop species of importance to coastal agriculture. Earlier reports have dealt in detail with the expression analysis of some of the genes isolated from *P. coarctata*. These studies provided substantial information about the regulation of isolated genes under varying salt concentration and duration. Vectors for transformation of crop plants using some of the isolated genes are under way. Methodologies for vector construction as well as transformation systems for specific varieties have been standardized.

Through random sequencing of the libraries, it has been possible to isolate and characterize

a gene encoding Ubiquitin Conjugating Enzyme. Complete sequencing of this gene revealed that it is 850bp long with a longest Open Reading Frame (ORF) of 459bp (60bp 518bp) coding for 152 amino acids. The 5' untranslated region (UTR) is 59bp and the 3'UTR is 332bp with a 22-residue Poly (A)⁺ tail from 829bp. The 3'UTR did not contain a typical poly-adenylation signal but a putative signal ATTA AAA and is located at position 763768bp.

Homology search for the deduced amino acid sequence of the longest ORF of Am494 was carried out with the global database using BLASLX algorithm. It showed strong homology with UBC2 of *A. thaliana* (AtUBC2). Similarity between the nucleotide sequences of AmUBC and AtUBC2 was 85%. But it showed no significant similarity with any of the UBC outside the AtUBC1 gene family. This clearly showed Am494 to be a homologue of AtUBC2 of the AtUBC1 gene family, and is hence named AmUBC2.

The ubiquitin dependent proteolysis pathway plays a vital role in selective protein degradation in cellular organisms. It is also hypothesized that the interaction between UBC and the proteasome may be regulated by DNA repair and could be induced upon physiological stress. One report shows that mcUBC1 coding for ubiquitin conjugating enzyme in the halophytic ice plant, *Mesembryanthemum crystallinum* is up-regulated under salt stress.

Northern hybridization of total RNA from *A. marina* roots and leaves with gene specific

probe for AmUBC2 was used to study regulation of this gene at RNA level. A single mRNA species of approximately 830 bp was observed with this probe, indicating the expression of RNA transcripts for AmUBC2. However, it was clear from the experiment that the expression of UBC2 is not induced under salt stress either in the root or in the leaves, even after 48 hours of salt treatment. This result establishes that up-regulation of UBC mRNA is specific to only certain members of the gene family. However, the steady state level of different UBCs in different tissues and reasons for up-regulation of only specific UBCs under stress are yet to be studied. In this context, it has to be noted that UBC2 is not only involved in proteolysis but also in DNA repair, which is an essential constitutive function for any organism.

Southern hybridization studies using AmUBC2 cDNA were done to obtain information on the gene copy number. This study would help in understanding and elucidating the functions of this crucial enzyme of protein turnover and DNA repair in wide taxa. This is, however, the first instance of an UBC2 homolog being cloned from a tree species of the mangrove ecosystem and the implications that follow from the characterization of this enzyme from a plant of a unique ecosystem.

102.2 Activities being Undertaken in Kalpakkam

During the last four years, the demo-cum-experimental plot developed in the IGCAR campus at Kalpakkam has concentrated on

the demonstration of an integrated farming system model of agriculture based on low energy inputs, critical water-use efficiency and forward and backward linkages as well as organic methods of cultivation. Integration of mutant pulse crop varieties in the demonstration plot was one of the major activities undertaken during these years. This year, large-scale seed multiplication of the mutants was tried in 3 acres in the demonstration plot. These multiplied seeds were supplied to 20 farmers in the region for further multiplication and testing for suitability in their fields. The average yield of the mutant seeds was about 20 (blackgram) to 30 (groundnut) percent higher, compared to the locally used varieties. These mutant varieties therefore hold enormous promise for adoption in the larger region of coastal Tamil Nadu.

Natural resource management, innovative agricultural practices and agricultural waste management were among the priority areas where training and capacity building of the local farming communities were undertaken. Ten batches of 20 participants were trained during the year. Exposure visits were organized for local farmers as well as school children to the demonstration plot. As many as 350 school children and 400 farmers visited the demo plot.

In order to facilitate the adoption of mutant pulse crop varieties in other regions of Tamil Nadu, exposure visits as well as discussions with farmers in the Kalpakkam region were arranged for farmers from Chidambaram

region. About 37 acres of land was brought under cultivation of both black and green grams in the Kilamanakudi region of Chidambaram, involving 37 farmers. The participatory demonstration in farmers' fields involved the selection of three locally cultivated black gram varieties and the BARC mutant variety. The experimental design included the cultivation of black gram as both a fallow crop and an irrigated crop.

Various growth parameters were recorded by the farmers, which included growth, biomass, number of pods and seeds as well as incidence of insects and pests in the farmers' fields. The participatory assessment carried out by the farmers in Chidambaram region showed that the best yield was recorded in the fallow field experiments where the plants were also free from the incidence of insects and pests. From the harvested crop, the farmers have saved about 600 kg of seeds for sowing in their fields next year.

102.3 Activities being Undertaken at Kudankulam

Kudankulam and adjoining regions are characterized by low rainfall and poor soil conditions, which are the major constraints for crop production. Though the average rainfall is around 200 mm, it is very erratic and unpredictable and leads to frequent crop failures. Texture, depth, calciferousness and salinity/alkalinity are the major soil factors that affect the productivity of the soil. Most of the area is only marginally suitable for field crops.

Since 1999, the programme in Kudankulam has been focusing on natural resource management as well as the demonstration of efficient crop production models that can suit arid and semi-arid regions. Activities in the past included the development and establishment of a demonstration plot for agricultural intervention in marginal land as well as in low rainfall areas, with emphasis on scientific assessment of soil health through a detailed study of the soil health pattern. It also focused on the development of alternate livelihood security and community empowerment through regular training and capacity building.

Detailed soil survey and mapping of the resources at the village level for the three villages located around Kudankulam region and formulation of an action plan for the revival of agriculture in the area were undertaken. During the survey, each and every field was traversed, existing resources were enumerated, characterized and mapped, the potential and suitability of the area for various uses were established and presented in the form of charts and maps. The main report, accompanied by maps, provided the land use options to the farmers and other land users and an action plan for agricultural activities in the dry regions. The high intensity survey was completed by studying the nature of soils in the field and laboratory characterization of more than 200 soil samples. Based on the survey, 26 soil series were established. The detailed report including the maps, titled "Land resources of Kudankulam, Vijayapati

and Erukkandurai villages” was released by Dr Anil Kakodkar, Chairman, Atomic Energy Commission and Thiru R Jeevanantham, Hon’ble Minister for Agriculture, Tamil Nadu, in February, 2002.

Major emphasis, however, was placed on the demonstration of a green-belt in Kudankulam region. A model demonstration plot was identified in the buffer zone of the proposed plant area. A stretch of 1.2 km with 100 meters width was developed as green and shelter belt. About 7,000 seedlings of neem and tamarind have been planted in the area. The survival rate is more than 85%. Some cash crops like cashew and guava were also included in the green belt area. As a part of the objective, the green belt area of 45 acres with more than 4,000 trees was handed over to NPCIL in June 2003.

A genetic garden for fruit crops that are suited for dryland horticulture has been developed as a part of the demonstration activities. Spread over an area of 4 acres this garden harbours about 75 different varieties of fruit crops belonging to about 25 different species. It was heartening that during this year many of the fruit crops including mango, cherry and guava have started producing fruits. This genetic repository of fruit crops will serve as a conservatory of many species of economic importance to dry land horticulture.

The aim is to test the replicability of the models for agriculture and horticultural development. As a part of the ongoing activity, large scale multiplication and demonstration of mutant

pulse crop seeds were tested in farmers’ fields. Seven SHGs of marginal land owners were supplied with seeds of black and green gram varieties. About 8 acres of land was cultivated with these mutant varieties and the effectiveness of these mutants with respect to their growth, water requirement and yield, has been recorded. It is hoped that more area will be brought under these crop varieties in subsequent years.

During the year, activities were also spread to community-owned as well as private lands. Two model demo plots for fruit crops were developed, with technical inputs from MSSRF. Regular maintenance, water harvesting and water requirements were monitored by the members of the SHGs. The demonstration of the genetic garden for fruit crops has generated considerable interest among the farmers and during the year, about 2,000 cashew saplings were provided to the farmers for cultivation in their field through the Horticulture Department of Radhapuram Block. Cultivation of fodder grass (KKM - 1) was also undertaken in some of the fields.

The project concentrates on imparting skills and empowering the coastal, rural communities. Extensive training programmes were conducted on micro credit, leadership development, SHG functioning, milk products, goat rearing, sanitation and hygiene, water harvesting and vermiculture. More than 800 local people, in 15 batches, were given training in these areas. During the year, 10 more SHGs were formed, with a total savings of Rs 3.75 lakhs and these SHGs have obtained Rs 11.00

lakh as loan from financial institutions for various activities. The activities carried out in Kudankulam and adjoining villages have opened up new avenues of micro enterprise development for enhanced livelihood opportunities. The members of the SHGs have perceived the benefits of these efforts. Intensification of these activities, formation of a federation of SHGs with similar micro enterprises and development of market linkages for the products developed through the SHGs are among the activities to be undertaken in the coming years.

During the last three years, four Village Knowledge Centres (VKCs) were established in Kudankulam and adjoining regions and these have helped substantially in developing location-specific information databases as well as training a number of girls in computer skills. While this was done on an experimental basis, more concrete activities will be undertaken in Kudankulam and adjoining areas so as to use these knowledge centres for addressing problems of food, health, livelihood and agriculture security in the region.

Sub Programme Area 103

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

About 1.03 lakh tonnes of fish, including finfish, prawn, crab, lobster, and a variety of

molluscs, are harvested from the GoMBR region in a year. Approximately 1.5 lakhs of poor fishermen, living in 44 revenue villages, are dependent on this resource for their livelihood. In recent times, the fish catch per head is fast declining due to various reasons. Over-exploitation is one of the main reasons for the decline in the bioresources of the GoMBR. The creation of sustainable alternative employment opportunities for additional sources of income is one of the options for sustainable management of the bioresources and biodiversity of the GoMBR. Against this background, the project on promoting alternative livelihoods is being implemented in the GoMBR.

The project has two components. The first deals with promoting and strengthening women SHGs and land-based alternative income generation activities. This component is sub-contracted to DHAN Foundation, Madurai, for implementation. The other deals with promoting livelihood security through marine-resource based activities and establishing VKCs. This component is directly implemented by MSSRF.

The aims of this component: Assessing possibilities and demonstrating models of marine-resource based commercial enterprises that will provide sustainable alternative livelihoods and additional sources of income, establishing linkages between VLIs and technical institutions for technology transfer, processing, marketing and management of the enterprises and establishing VKCs in the GoM region.

Table 1.12: **Marine-resources based alternatives and partners involved in implementation in GoMBR**

Activity	Village	Region	Partners
Agar plant	Kunjarvalasai	Mandapam	CMFRI and PricewaterhouseCoopers Ltd
Fish pickle unit	Vellapatti	Tuticorin	Navam Fish Pickle Unit, Pricewaterhouse Coopers Ltd and Fisheries College and Research Institute
Artificial reef	Theresapuram	Tuticorin	CMFRI, Tamil Nadu Forest Department, Tamil Nadu Fisheries Department
Pearl culture	Mundalmunai	Mandapam	CMFRI, Tamil Nadu Forest Department, Tamil Nadu Fisheries Department

On the basis of the consultations held with the local communities, research institutions and private entrepreneurs, four marine-resource based activities have been selected and they are being implemented in partnership with a number of institutions as shown in Table 1.12

103.1 Establishing a Community-owned Agar Plant

The progress made in establishing a model community owned agar plant, the details of which have been reported earlier, is described in this section.

Functioning of the United Village Development Society (UVDS): The functioning of the society, in terms of frequency of meetings conducted by the Executive Committee, process adopted to evolve consensus, maintenance of records and participation of women in decision-making, is satisfactory. However, the functioning of the General Body of the Society is to be improved. The Society

is registered under the Tamil Nadu Societies Registration Act. Recently the Registrar of Societies has renewed it. The leaders and members of the Executive Committee have been trained in all aspects relating to rules and regulations to be followed in running the society as per the Societies Act.

Development of infrastructure for agar production: Construction of the agar plant with all facilities has been completed. The machinery required for agar production such as agitator, baby boiler, digester and freezing unit have been fabricated, installed and tested. Permission from the TNPCB to establish the agar plant has also been obtained. There was a problem in getting sufficient power supply for the plant, which was recently solved by the TNEB by establishing a new transformer in the village and connecting it to a high voltage electric line. Trial production was conducted to test the efficiency of the machinery. Currently, trial production is being conducted to

conducted to standardize the production technique and minimize the cost of production.

Management plan for the agar plant: A management plan has been prepared in consultation with PricewaterhouseCoopers Ltd and village level institutions of Kunjarvalasai. As per this plan, the UVDS, which owns the agar plant, will function as the governing council. It will appoint the Board of Directors, in which due representation will be given to MSSRF, which will prepare a detailed annual business plan. This plan will be approved by the Society. A manager, who will oversee technical aspects as well as purchase, production and marketing, will be appointed. Three small committees, namely the purchase committee, production committee and marketing committee will also be formed to assist the manager. This management plan will be implemented once production is started and will be reviewed and finalized six months after the first production.

103.2 Establishing a Community-owned Fish Pickle Unit

Fish pickle is a value-added fishery by-product, which has a good market in urban areas. A market survey indicates that fish pickle is largely produced at the cottage-level and mostly under unhygienic conditions. As a result, the supply is irregular and there are problems relating to quality and shelf life. In order to overcome these problems and to demonstrate that fish pickling can be taken up as a successful business venture, a model, small scale fish pickle unit, with adequate hygiene, is being

established in Vellapatti village, near Tuticorin. As in the case of the agar plant, this programme is being implemented through a village level institution namely, Vellapatti Womens Fish and Allied Products Producers Association, an all-women association established under this programme. It is a registered association and all the funds relating to this programme are routed through this society.

Functioning of the society: The functioning of the Association is outstanding. Meetings of the GB and Executive Committee were held regularly during the reporting period and the proceedings of the meetings were properly recorded; decisions taken at the meetings were strictly implemented. The Association also maintains proper accounts after DHAN Foundation, Madurai, provided training in accounting to the leaders and members of the Association.

Development of infrastructure facility and trial production: A building, with separate rooms for fish storage, pre processing, cooking, curing and packing, has been constructed on about 12 cents of non-agricultural land. All the machinery needed for fish storage, processing, cooking, curing, bottle sealing and packing have been installed to produce about 20 kg of pickle per day. 15 trial productions were conducted under the supervision of PricewaterhouseCoopers Ltd to standardize production techniques, uniformity in quality and the cost of production. The Chairman of MSSRF inaugurated the unit on 2nd February, 2003.

Developing marketing linkages: PricewaterhouseCoopers Ltd is involved in developing marketing links for the pickle produced in the unit. It has identified Farm Suzanne Ltd, Chennai, as one of the potential channels for marketing. Directors of Farm Suzanne visited the pickling unit twice and were appreciative of the quality of the pickle produced and facilities created to produce the pickle. They have agreed to buy about 200 kg of prawn pickle per month. Negotiations are going on between the fish pickle society and Farm Suzanne and an agreement will be reached soon. PricewaterhouseCoopers Ltd is facilitating this process. Apart from Farm Suzanne, a number of local companies have also shown interest in marketing the fish and prawn pickle. However, agreements with these companies will be signed only after the outcome of the negotiations with Farm Suzanne.

103.3 Community - managed Artificial Reef

Artificial reefs are man-made structures deployed in the sea to increase the hard bottom habitat available for marine organisms. Currently, the artificial reef programme is being implemented on an experimental basis to assess whether it can be used to enhance both the biodiversity and bioresources of the GoMBR. This programme is being implemented in the village of Theresapuram with the permission of the Tamil Nadu FD.

Functioning of the society: A village level society namely, Theresapuram Artificial Reef Society, has been formed in the village. The GB of the

society consists of representatives from 15 fishers' associations and 5 local NGOs of the Tuticorin region. The society has an Executive Committee with representatives from MSSRF and Tamil Nadu Fisheries Department. The functioning of the society is satisfactory. In addition to addressing the issues relating to the artificial reef programme, the society has extended its function to other areas relating to the conservation of the coral reefs of the GoM. The District Sub-Collector, who is an environmentalist, attends the meetings of this society regularly and provides guidance and support to the activities of the society.

Construction of the artificial reef modules: Four concrete modules of artificial reefs have been identified with the help of the villagers, two of which are for improving the production of commercially important fish such as grouper and lobster and two for enhancing the biodiversity of the sessile and bottom-living organisms of the GoM. As explained in last year's Report, a number of problems were encountered in identifying suitable persons or companies for the construction of these modules. These problems were solved this year by developing a model version of each module with the help of local engineers, architects, scientists from the CMFRI and Tamil Nadu Fisheries Department and members of the Theresapuram Artificial Reef Society as well as volunteers from the fishing community. Construction of all the four concrete modules, 30 each in number, has been completed. The Tamil Nadu Fisheries Department, which was involved in the design and fabrication of the

modules, provided space in its compound and electricity and water for the construction of the modules. The District Collector of Tuticorin and Secretary, Tamil Nadu Fisheries Department, Government of Tamil Nadu, visited the modules and expressed their willingness to extend the activity in other fishing villages along the coast.

Deployment of the modules: The deployment site of the artificial reef is located about 14 km from Theresapuram village. This site was identified by the society with the help of the leaders and members of 15 fishers' associations and CMFRI. The site was selected on the basis of the following criteria: minimum depth of 10 m, hard sea floor, low siltation and current speed and does not affect any of the fishing gear of the local fishers. Following the identification of the site, seafloor survey was conducted with the help of CMFRI and the Society. All the 120 modules were deployed in the identified site in February-March, after the artificial reef programme was formally launched by the Chairman, MSSRF on 2nd February 2003. The Indomer Coastal Hydraulics, Chennai, deployed the modules. A detailed monitoring programme is being worked out.

103.4 Pearl culture

Pearl culture is one of the lucrative mariculture activities that can be undertaken on a large scale in the GoMBR. The GoM is a traditional pearl fishing ground from where natural pearls were collected till the late 1960s, after which it was stopped due to over-harvesting of pearl

oysters from the natural beds. During the early 1970s, the CMFRI developed and perfected the induced pearl culture technique. The current programme, which aims at transferring pearl culture technique to the local fishers, is being implemented with the active participation of the CMFRI and Tamil Nadu FD.

Community mobilization and organization: The pearl culture programme is being implemented in a village called Mundalmunai, located very near Krusadai Island. A village level society namely, Mundalmunai Pearl Culture Society, has been formed with 105 members (52 women and 53 men). The Executive Committee of the society has 11 members. The functioning of the Society is outstanding. General Body and Executive Committee meetings are held regularly to discuss issues and take decisions in a democratic manner. The participation of the women in decision-making as well as in sharing the responsibilities is exceptional. The Society is registered and has its own by-laws. DHAN Foundation, Madurai, provided training on accounts and bookkeeping.

Training on pearl culture: Pearl culture has three steps: producing oysters in the hatchery, implanting the nucleus into the oysters through a surgical procedure and farming the nucleated oysters in the sea. The first two steps require sophisticated facility and a high level of scientific skill, whereas pearl farming requires only limited skill. Since CMFRI has agreed to supply nucleated pearl oysters to the Mundalmunai Pearl Culture Society, 10

families from the Society were trained in pearl farming by CMFRI at its pearl farm. The training in pearl farming covered the selection and preparation of the farming site, construction of the farming facility, preparation of cages for holding nucleated oysters and management of the farm. The 10 families have also been selected as the pearl farmers and profit from the enterprise will go to them. However, they have to give a certain percentage of the net profit to the Society, which will be used by it to start other small enterprises. After training, an MoU was signed with CMFRI to supply one lakh nucleated pearl oysters and provide technical guidance in pearl farming and management.

Identification of pearl farming site: A site near Krusadai Island was first selected for pearl farming but the FD did not give permission as the selected area was within the National Park boundary, where activities are prohibited by the Wildlife Act. Another site located outside the National Park but near the village was identified with the help of CMFRI and Tamil Nadu FD.

Construction of the farm and pearl farming: A pearl farm which can hold about one lakh oysters has been constructed in the identified site after obtaining formal permission from the FD. The area of the farm is about 500 sq. m, which is divided into 5 compartments. Each compartment consists of iron poles in the four corners, which are fixed firmly in the sea floor and are connected by a number of wooden crossbars. Cages containing nucleated pearl

oysters are hung from these crossbars. Each cage contains about 80 pearl oysters. So far, CMFRI has supplied about 60,000 nucleated pearl oysters, which are now being grown in the farm. The harvesting will commence soon.

103.5 Training

Training is another important component of the project. During the reporting period, two training programmes, one on agar production and one on pearl farming, were conducted. Training on agar production was given to 10 members (5 women and 5 men) of the Ramanathapuram Fishworkers Trade Union and 8 families (1 man and 1 woman from each family) from the same union have been trained on pearl farming. Both the training programmes were conducted by CMFRI, Mandapam.

Sub Programme Area 104

Conservation, Inventorization and Enhancement of Coastal Bioresources

Coastal ecosystems are transitional areas between marine and terrestrial ecosystems. Such areas may include brackish water lakes/lagoons, marshes, mangrove swamps, littoral zones and coral reefs. Coastal ecosystems are among the most productive and biologically rich ecosystems on earth and are also the most endangered. The programme, supported by NBDB, aims at undertaking research in priority

areas for conservation and sustainable utilization of bioresources.

In the first phase of the programme, the status report for selected coastal locations was prepared in a network mode. Institutions/organizations with prior experience of working in the selected sites were identified and a common framework was developed at a workshop conducted at MSSRF. These studies were primarily based on published literature, supplemented by field visits wherever necessary. The status report was compiled under the title *Bioresources Status in Select Coastal Locations* and was jointly published by MSSRF and NBDB. This book was released by Hon'ble Mr Bachi Singh Rawat, Minister of State for Science and Technology, Government of India, during the Science Day celebration held in New Delhi on 27th February, 2003. It describes the state of bioresources, their uniqueness and the threat to the seven major coastal locations in our country, which is presented briefly in this section.

The *Gulf of Kutch* (GoK) includes 42 islands with submerged reefs, coastal swamps, estuaries, coastal sand patches, corals and mangroves all along its southern coast. The northern plank of the Gulf, from Jhakhau to Kandla, has irregular dissected configurations. The western half, overlooking the open Arabian Sea, is dominantly muddy with extensive mud flats. The east-west coastline, lining the inside of the Gulf, is sandy and silty, with narrow beaches. The GoK is the only area in Gujarat where corals exist. Of the 42 islands, 33 are fringed with coral

reefs (25 with live corals) and 20 with mangroves. The monograph *Biological Diversity of Gujarat* lists 40 species and 23 genera of stony corals, 3 species of soft corals and 4 sea fans from the Gulf.

The biological diversity of the area is attributed to the varied habitats, which support over 103 species of algae, including 3 species of sea grasses, 10 species of mangroves, 279 coastal flora, 74 species of sponges, 52 species of soft and hard corals, 4 species of sea-anemones, 144 species of fish, 27 species of prawns, 21 species of crabs, 200 species of molluscs, 3 species of turtles, 4 species of sea snakes, 3 species of aquatic mammals and about 200 species of birds. Colourful sponges and corals, reef fish, prawns, lobsters, pearl oysters, windowpane oysters, sea horses, sea hares, giant sea anemones, puffer fish, sharks, cat fish, ray fish, star fish, sea urchins, sea turtles, dolphins and the dugongs or sea cows are some of the important inhabitants of this Gulf. It harbours around 210 species of marine algae, with a projected biomass of more than 1,00,000 ton/year. The Gulf contributes the maximum number of species and biomass level as well to the west coast of India. A total of 81 species of algae are reported from the Gulf. The fauna of the GoK is equally diverse. It is moderately rich in zooplankton species with frequent occurrence of high-standing organisms. The composition of zooplankton consists mainly of copepods and decapods. Other major groups include Chaetognatha, Siphonophores, Medusae, Amphipods, Polychaetes and fish eggs. The other invertebrates are corals, molluscs,

crustaceans, echinoderms, amphopods, gorgonias and bryozoans.

Malvan tahsil in Maharashtra is spread over 66.3 km² (16°04' North latitude and 73°28' East longitude). It covers 136 villages and 772 hamlets (wadis) under 630 Gram Panchayats. The tahsil has good potential for tourism. The bioresource is very rich and has reached the world market in the form of prawns and Alphonso mangoes.

The tahsil is surrounded and also crisscrossed by estuaries, which support virgin mangrove vegetation, especially at Achra. Malvan tahsil has recorded a population of 1,16,091 for 2001. The population has increased by 3.55% as compared to the 1991 census. The urban population is 18,675. The average sex ratio is 55,777 males to 60,314 females.

The biodiversity and conservation values of Malvan are high. The area is rich in mangroves, medicinal plants, horticultural crops and marine corals. It forms a part of Konkan and is rich in scenic beauty. The coastal boundary of the area merges into the Western Ghats. Thus the site is unique, with a great diversity of habitat as well as plant and animal life.

The bioresources of Malvan can be categorized as wild as well as domesticated. In general, the site supports wild bioresources such as forests, estuaries, mangroves, medicinal plants and marine life. As for fishery, the catch is more than 10,000 tonnes. The major varieties are ribbon fish, polynomids, pomfrets, prawns, shrimps, lobsters, cuttle fish and

squids. The fish are salt cured, sun dried, or sold fresh. Among domesticated bioresources, cereal crops, pulses, oil crops, horticultural crops like mango and cashew, livestock, aquaculture, coconut, areca palm and kokam are important.

The ornamental plants are about 35-40, belonging to different families, including Orchidacea. The mangroves, including associates, are about 30. There are 6 species of corals and more than 150 algal forms. In addition there are amphibians, reptiles, birds, mammals and fish varieties contributing to the bioresources of the site.

The major threats are environmental pollution and exploitation of the bioresources for food, fodder and timber. Reclamation by bunding the estuaries is yet another threat. Most of the threats are anthropogenic.

The Vembanad Lake in Kerala, stretching across 96.5 km and covering an area of 87,000 hectares, is the largest and most important lake in southern India. From the fishery point of view the lake is very important as it happens to be the nursery ground of many of the fishes and prawns and more importantly that of giant freshwater prawn.

The published literature shows that there are 115 species of fish belonging to 84 genera and six species of penaeid prawns, four species of palaemonid prawns and three species of crabs. It was observed that fishing has increased over a period of time but at present, a decline in the catch has been noticed. One of the reasons for this is the catch of juveniles in large

quantities. Penaeid prawns have also shown a decline in recent years. The chief among them are the *M. dobsoni*, *M. monoceros* and *P. indicus*. Of the two palaemonid prawns found here *M. rosenbergii* and *M. idella*, the former has received more attention. After the construction of the barrier, these species are unable to migrate upstream to the northern side of the lake where they get the required salinity for spawning. The berried females are also subjected to heavy fishing during this period, resulting in over-fishing.

The present study emphasizes the necessity of opening the Thanneermukkam barrier for a longer period, to give more nursery ground for fishes and prawns, as well as a reduction in the number of nets to ease the pressure on the penaeid prawns. It is even more important that there should be a total ban on catching the berried females of *M. rosenbergii* to revive the wealth of this resource. Attempts should be made to increase the area of mangrove vegetation, to develop an existing bird sanctuary. The mangrove vegetation would improve the nursery/recruitment grounds of penaeid, non-penaeid prawns and fishes.

The Lakshadweep islands are the only coral atolls in India. There are four natural ecosystems in the islands: land, lagoon, reef and ocean. The soils of these islands are structureless, formed by the disintegration of coral debris. Soil fertility and water holding capacity are extremely poor. Freshwater resources are limited. The water is periodically renewed by rainfall. The coral reefs of the islands are mainly atoll, except one platform

reef at Androth. The reef flat occupies an area of 136.532 km². Sea grass occupies 10.932 km² and lagoons occupy 309.432 km². The lagoons have sand bottoms with scattered coral boulders and pinnacles followed by extensive sea grass beds on the landward side. The ocean contains substantial living and non-living marine resources. Several tuna varieties, shark, seer fish and half beaks move about in shoals around the islands.

The coral fauna of Lakshadweep is known to include a total of 105 species, divided among 37 genera. 29 new species have been recorded. The lagoon and reef flat faunal elements are dominated by *Accropora spp.*, *Pocillopora spp.*, *Porities spp.*, and massive and encrusting favids. *Psammocora spp.* is common in the northern islands. There is a profusion of blue coral *Helipora coerulea*. 86 species of macrophytes, 10 species of Anomuran crabs, 81 species of Brachyran crabs, 155 species of Gastropods, 24 species of Bivalves, 13 species of sea stars, 6 species of brittle stars, 23 species of sea cucumbers, 15 species of sea urchins and 120 species of fish are also found.

The islands are rich in floral composition with about 150 species of plants. They include hard wood trees, soft wood trees, shrubs, medicinal herbs and fruit trees. Mangroves are found only in Minicoy Island. The land fauna consists mainly of rodents and lizards.

The bioresource profile of Lakshadweep includes both the wild and domesticated flora and fauna found on land, lagoons, reefs and oceans. The people utilize resources from each

of these natural ecosystems to sustain themselves. The reefs provide basic construction material for building houses and the coconut trees provide wood for frames and thatching for roofs.

Complete quantitative and qualitative details of local, ecological, social, economic and political information are lacking. Such information is essential to prepare a plan that integrates conservation and local economic development. The islanders are literate and hence can be educated on the importance of coral reefs. They are already aware that they owe their existence to reef-building corals. Through integrated conservation and management approaches, the livelihood security of resident populations could be greatly enhanced. For timely detection of anomalies and threats, information can be collected by monitoring resources and pollution.

Pulicat Lake is situated between 13° 24'N and 13° 47' North latitude, and 80° 3' - 80° 16' East longitude and is confluent with the Bay of Bengal. The regional/landscape diversity around Pulicat Lake includes mangroves, wetlands, marine system, tropical dry evergreen vegetation, shore vegetation, lake and cultivated fields with cashew, paddy, fruits and vegetables. Mammals, sea turtles, amphibians, snakes, birds, insects and reptiles form the most important faunal biodiversity. Tiger prawns, white prawns, crabs, mullets, clams, edible oyster and catfish form the important aquatic bioresources on which the economy of the local people depends.

The mangrove systems consist of 12 tree species and the tropical dry evergreen vegetation is dominated by 11 tree species. The faunal diversity of the lake includes 25 species of polychaete worms, 12 species of penaeid prawns, 29 species of crabs, 19 species of mollusca, 8 species of amphibians, 69 species of reptiles, 56 species of birds, more than 50 species of mammals and 88 species of fishes.

Fish species like sea bass, milkfish and threadfins, prawns like flower prawn and tiger prawn, are threatened species found in these areas. *Cardisoma carnifer* (Herbst) crab, mud skippers like *Periophthalmus sp* and edible oysters (*Crasostrea madrasensis*) are vulnerable to environmental changes.

Fish catches could be regulated through specifying the type of nets, mesh size, fishing season and magnitude of catches. Licensing for fishing is an important measure to be taken to ensure sustainable development. Policies have to be formulated, taking into consideration ground realities, the link between communities and their common resources and their right to livelihood. Constructive initiatives for the restoration of the local ecology should emerge through the active involvement of coastal communities.

Bhitarkanika Wildlife Sanctuary is located on the east coast of India, in the state of Orissa, covering an area of 672 sq km and has been recently declared as a Ramsar site. The sanctuary is bounded by the Dhamara River to the north and Maipura river to the south. It has a stretch of 35 km of sea coast, adjoining the Bay of

Bengal to the east and the Brahmani River to the west. The deltaic mangrove swamps of Bhitarkanika area are subjected to regular tidal inundation and are extremely low lying. The core area of the sanctuary has been formed mostly by alluvial filling of the littoral zones.

The mangrove vegetation is locally known as *hental jungle* as the *hental* plants (*Phoenix paludosa*) predominate in many areas of the sanctuary and are very useful to the local inhabitants. The mangroves of Bhitarkanika are the only surviving, relatively undisturbed examples of this vegetation on the Orissa coast. The area is recognized for its natural and viable population of salt-water crocodiles and nesting Olive Ridley sea turtles.

There are more than a hundred villages in the six panchayats that are within the sanctuary, with a population of 41,296, dependent on the resources of the forest. Paddy cultivation and subsistence fishery are the sources of livelihood of the people. Recently, fishing has been prohibited within 20 km of the Gahirmata beach and officers have been appointed to regulate fishing, through a notification issued in December 1993.

This sanctuary harbours one of India's largest mangrove forests in terms of number of species and levels of variation in ecological conditions. It is estimated that mangrove detritus production of a ton per hectare has a potential fish yield of 800-1,000 kg/ha/year. The decline in the offshore shrimp catch and populations of mangrove mud crabs has been attributed to the destruction of mangroves in Indonesia. The animals that are associated with the

mangroves cover a wide range of invertebrate and vertebrate groups. 199 species of birds have been identified in the sanctuary. Bhitarkanika provides feeding, perching, roosting and nesting facilities for thousands of resident, local, migratory and long distance migratory birds. It holds the largest population of endangered estuarine crocodiles in India.

There are 5 species of amphibians recorded so far in the mangrove swamps of Bhitarkanika. Algae and detritus sustain shrimps and prawns, which provide a food source for species such as Bhukti (*Lates sp.*) and cat fish. The invertebrate fauna includes macro fauna and meio fauna. As many as 60 genera and 64 species of sedimentary macro fauna are found to be inhabiting the littoral sediments of the Bhitarkanika mangrove ecosystem.

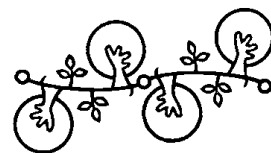
The conservation values for Bhitarkanika are very high, since it is the only site in mainland India that has enough mangrove and associates to provide a secure habitat for many endangered species, especially reptiles. The protected area also provides an undisturbed mass-nesting beach for Olive Ridley turtles.

40 villages are entirely dependent on the mangroves for their firewood needs. All mangrove species can be used as fuel. Nearly all mangrove species are used for building houses or making farming implements. Under the eco-development plan of the Sanctuary Authority, there are provisions to undertake avenue plantations. These plantations will cater to the fuel and timber needs of the local population.

Chilika Lake, a Ramsar Site, located on the East Coast of Orissa, India, is the largest brackish water lagoon in Asia. The total area of the lagoon varies from 89,100 ha during the dry season (December - June) to 116,500 ha during the rainy season (July - October). The lagoon is separated from the Bay of Bengal by a sand bar of 60 km length, with two mouths opening into the sea, a natural one at Arakhakuda and an artificial one, opened on 23rd September, 2000 at Sipakuda. Chilika Lake is spread over the three coastal districts of Orissa that include 2 notified area councils and 293 villages distributed under seven blocks. According to the 1991 census, the total population of the area is about 2.25 lakhs. The lake, with its rich biodiversity, scenic beauty and cultural heritage, has been supporting the people of the region. The ecosystem of the lake, however, is under increasing natural and anthropogenic threats due to heavy silting, choking of the mouths, decreasing salinity, eutrophication, shrinkage of water area, loss of biodiversity and increasing human interference. Fish constitutes the principal resource that determines the socio-economic status of the people depending on Chilika Lake. Fishery, however, has been considerably influenced by

the economic liberalization initiated in the 1990s that boosted export and introduced modern techniques. There have also been changes in policies relating to the *capture and culture* of fish/shrimp in Chilika that promoted the entry of non-fishermen into fishery, eventually resulting in marginalization of the traditional fishermen dependent on its resources. The report calls for more in-depth research on fish, fishery, ecology and exploration of alternative bioresources that would augment the socio-economics, particularly of the less privileged and weaker section of the people living in and around Chilika Lake.

Studies carried out in the seven coastal locations have documented the status of bioresources in each location, the dependence of the community on them, the potential of these resources and the threat to the systems. Based on this analysis, two or three villages in each location have been selected to develop site-specific action plans for conservation and sustainable utilization of bioresources. This is being done in a partnership mode involving all major stakeholders, and it aims at developing alternate livelihood options that reduce the pressure on the bioresources.



Biodiversity and Biotechnology

Progress was made in generating an economic stake in the conservation of traditional genetic strains of crops. The tribal community in the Koraput region of Orissa was awarded the Equator Initiative Award of UNDP and the UN Fund for Partnership at the WSSD in recognition of their work. Capacity building of local institutions for facilitating a better understanding of the Biodiversity Act and Protection of Plant Varieties and Farmers' Rights Act and their implications was initiated. Significant progress was achieved in identifying stress tolerant genes. New projects were initiated at new sites for PGPBR and lichens. Community nurseries were established for mangrove plantations.

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Sub Programme Area 201

Community Based Agro-biodiversity Conservation and Management

The projects on biodiversity are supported by the SDC, the Summit Foundation, the Ford Foundation (FF), and the IFAD and are being implemented in the Kolli Hills of Namakkal district in Tamil Nadu, Wayanad district in Kerala and Jeypore tract, Kalahandi and Simlipal Biosphere Reserve (SBR) in Orissa.

Conservation efforts in the Jeypore tract received international recognition, marked by the visit of Ms Komala Pujari, representative of the tribal communities of Jeypore, to the WSSD at Johannesburg in August 2002, to receive the *Equator Initiative Award*. This award, constituted by UNDP and several other international agencies, was given to the tribal women and men at Jeypore, for 'Innovative Partnership for Sustainable Development in Tropical Ecosystems'.

The project continues to lay emphasis on participatory conservation systems and economically rewarding and sustainable methods. It also takes into consideration the two recently enacted national legislations, namely, the PPVFR Act, 2001 and the BD Act, 2002. Attempts were made to understand the implications of these Acts on project activities, by holding a series of workshops at the field sites (that led to the generation of case studies) as well as at Chennai (Policy Makers'

Workshop). It is now planned to focus more on information dissemination, networking with various stakeholders (farmers' groups, NGOs, research institutions, academicians and lawyers) and capacity building of local institutions (PRIs etc) for facilitating a better understanding of the Acts and their implications. Efforts will be made to build a consensus and engage in advocacy, based on a common action plan.

In collaboration with the UDRC for Gender and Development, the project has attempted to mainstream gender concerns in all its activities. A series of internal brainstorming sessions were conducted to consolidate the work done in the three sites so that they could be streamlined and prioritized to focus on key work areas. Biodiversity legislations (PPVFR and BD Acts) have been critically examined for their implications, from a gender perspective. A workshop on 'Farmers' Rights and BD Act: a Gender and Community Perspective' held on 27th and 28th February, 2003, focused on analyzing the implications of these legislations on community conservation.

201.1 Conservation Traditions: Chronicling and Revitalization

In the first year of Phase II of the SDC-supported project, issues relating to cultivation, consumption and commercialization of millets were identified. Different models were created and tested under varying conditions to evolve sustainable management strategies. This year, promotional activities were initiated to

cultivate vegetables and medicinal plants, in addition to the adoption of several natural resource management techniques. For the purpose of reporting, activities have been broadly classified as exploration, participatory conservation system, value addition, marketing, training and capacity building, engendering and policy research.

201.1.1 Kolli Hills

Exploration: Pineapple is one of the commercial crops in the region and its export has been enhanced through the MSSRF-IEEF (Ion Exchange Enviro-farm Private Limited) partnership and organic certification. Issues related to the decline in the quality of the fruit due to nutrient deficiency (yellowing of leaf), lack of shade trees, dryness and decrease in size of the fruit due to erratic rainfall were explored and solutions to address some of the issues were evolved.

Surveys on the cultivation practices of millets - *Samai* (little millet), *Thinai* (Italian millet), *Varagu* (finger millet), *Kezhvaragu*, are being conducted at Devanur Nadu, Alathur Nadu, Selur Nadu, Thinnanur Nadu, and Valapur Nadu to identify hotspots of different land races under cultivation, to strengthen the practice of consumption and conservation, through the process of commercialization.

Conservation of wild genetic resources in the form of sacred groves is an institutional practice prevalent among the Malayalis. Studies are being conducted on the botanical, social, cultural, ethno-botanical, ecological

and institutional aspects of sacred groves in Kolli Hills, in the light of biodiversity conservation and natural resource management. The study is currently being concentrated in fifteen sacred groves, from which keystone species have been collected, identified and preserved. In addition, a survey of traditional healers (*Nattuvaidiyars*) is also being conducted at Devanur Nadu, Selur Nadu, Thinnanur Nadu and Valapur Nadu to strengthen and network the traditional healing practices and practitioners.

Participatory conservation system: Seeds of traditional varieties of millets (*Karunsamai*, *Senthinai*, *Sadansamai*, *Malliasamai*, *Palanthinai*, *Varagu* and *Kelvaragu*), rice, soya beans and maize were multiplied under irrigated conditions at Namakkal in the seed multiplication plot and exchanged among the farmers in Kolli Hills through SHGs in weekly markets and seasonal festivals like *Kodai Vizha* in May and *Aadi 18* festival in July involving the *Kolli Malai Ottruneer Kootamaipu* (Federation of Kolli Hills SHG) created with the active support of MSSRF. During the *Aadi 18* festival, street plays were organized in the temple premises that disseminated the importance of millets, their cultivation and current developments in promoting millets, organic export of pineapple, conservation and sustainable management of natural resources.

In the seed multiplication plot at Kondichettypatty, 453 kg of *Samai*, 357 kg of *Thinai* and 227 kg of *Kezhvaragu* were raised under irrigated conditions. The little millet varieties sown included 130 kg of *Karunsamai*,

71 kg of *Sadansamai* and 90 kg of *Malliasamai*. The Italian millet varieties sown included 120 kg of *Senthinai*, 95 kg of *Palanthinai* and 142 kg of *Vellathinai* and the finger millet varieties included 155 kg of *Sattai kelzharagu* and 72 kg of *Karakezhvaragu*. About 120 kg of *Varagu*, 315 kg of *Sorghum* and 28 kg of soya beans were harvested.

In the Kolli Hills, 0.75 acre of land was tested for seed multiplication. The quantity of seeds obtained from the harvest was less than that obtained at the Namakkal seed multiplication plots. This was due to poor and erratic rainfall this year. 30 kg of *Sadansamai*, 10 kg of *Malliasamai*, 15 kg of *Perunthinai*, and 15 kg of *Karumochai* were harvested. Black paddy (*Karunellu*), Italian (*Senthinai*) and little millets varieties (*Malliasami*, *Karunsamai*, *Sadansamai*) are yet to be harvested.

Seeds of tomato, bottle gourd, bitter gourd, brinjal, beet root, chilly, lab lab, ribbed gourd, carrot, cluster bean, ash gourd, radish, ladies finger and drum stick were distributed to SHGs in Asakkadu, Arippalapatti, Ellaikiraipatti, Perunkiraipatti, Thannimathipatti and Ariyur Solakkadu to promote vegetable cultivation and consumption.

To ensure continuous storage and exchange of seeds among farmers in Kolli Hills, the traditional seed storage system (*Thombai*) was revitalized and strengthened. With the support of village level SHGs, the sustainability of these systems was strengthened through institutionalizing processes like maintaining registers and distributing responsibilities to different members of the local community.

Five such model seed storage structures have been established and are being maintained by the SHGs.

To meet food shortages during natural calamities like drought and to address seasonal migration, the need for grain banks for the local community was considered. As a result, MSSRF has facilitated a linkage with the DRDA, Namakkal, to obtain a grant of Rs 64,000 for SHGs. A Community Grain Bank (CGB) has been started in Periyamangalam, Alathur Nadu, supported by TRIFED-DRDA-MSSRF-SHGs on an agreement basis. Apart from this, MSSRF has contributed Rs 30,000 as a one-time grant for the construction of a CGB. The local groups in Periyamangalam, Chinnamangalam and Aleripatti have also contributed their share and bought five cents of land for constructing the godown. The groups have cleared the land and basement work has been completed. So far Rs 34,000 has been utilized for construction and Rs 20,000 for grain distribution. 1,275 kg of paddy and 1,900 kg of minor millets (*Samai*, *Thinai*, *Kezhvaragu*) have been distributed to 30 women and 17 men at Alathurnadu. It is expected that these will be returned in six months, with 5% interest.

Saplings of 3,500 medicinal plants are currently being maintained by the M S Swaminathan Nature Club in Val Vil Ori Tribal Residential Higher Secondary School. These plants will be distributed to the SHGs once the area receives enough rainfall. They include the following species: *Veteveria zizaniodes* (*Vettiver*) - Poaceae, *Acorus calamus*

(Vasambu) - Araceae, *Ruta graveolens* (Aruvadha - Rutaceae), *Vitex negundo* (Nochi) - Verbinaceae, *Andrographis paniculata* (Nilavembu) - Acanthaceae, *Alphinia galanga* (Sitharathai) - Zingiberaceae, *Adhathoda vasica* (Adathada), Acanthaceae, *Coleus aromaticus* (Karpuravalli) - Lamiaceae, *Coleus* sp (Omavalli) - Lamiaceae.

Though quality seeds have been made available to the tribal communities in Kolli Hills, the plants suffer from low productivity due to decreasing soil fertility. Hence, efforts were made to promote the use of biofertilizers in the villages. Training was imparted to create an awareness on different biofertilizers and composting and 100 kg of biofertilizers were distributed to 10 SHGs. *Nadep* compost was introduced at a test trial at Karamangadu to promote organic manure production at the village level. This manure sample was analyzed and it was found to contain Nitrogen-0.3454%, Phosphorous-0.0612% and Organic Carbon-3.084%. Members of the SHG are planning to sell this manure to the organic pineapple growers' SHGs as there is poor rainfall in the area. IEEF Private Limited will support them in transporting manure and distributing it to organic pineapple growers.

During the project intervention, loss of forest cover, failure of rainfall, low soil fertility, low level of ground water and crop failure were discussed. The people are exploring rain water harvesting techniques and issues related to sacred grove conservation.

The Hill Banana plot was attacked by the stem borer. Organic control measures were tested.

An anticipatory programme for pest control has also been initiated, to cultivate an interest among the local community in the use of bio-pesticides. *Trichogramma* parasitoid production units were tested under varied temperature, humidity and altitudinal ranges. Hatchability of *Corcyra* eggs and fecundity test trials of *Corcyra* have been carried out in Arippalapatti, Ellaikiraipatti, Navakkadu and Kalappanaikkanpatti. The results of the experiments were promising and 26 members from 4 SHGs are being trained in *Trichogramma* parasitoid production. Moreover, marketing opportunities for *Trichogramma* parasitoid were also explored at the Government Sugar Mills at Mohanur, Pugalur and Pudukkotai at EID Parry Sugar Mills. As soon as official linkages are created, production will be started in Kolli Hills.

Value addition: During the first phase of the SDC project, it was identified that the processing of millets involves significant drudgery among women, particularly after harvest and during preparation or value addition. Therefore, two mini de-husking mills were installed in Chinnamangalam and Valavandinadu to reduce the drudgery involved in the process. Value addition has been identified as a process for enhancing income through millet cultivation. Value addition involves dehusking, powdering, rava making, stone removal and formulation of different food items. A mini flour mill for ragi has also been set up. Training programmes have been conducted and training materials have been prepared in collaboration with other MSSRF projects (Community Food Bank project and

IFAD project) for value addition in millets and other traditional crops. A de-stoner is being installed at Periamangalam, Alathurnadu.

Marketing: Marketing involves procurement, storage, packing and delivery. Until the project intervention, the local community rarely sold minor millets in markets for generating income. However, in the last two years, 9 -10 tons of minor millets were sold through TRIFED. The procurement is being undertaken by SHGs in different villages; the grain is stored and cleaned at different spots in the villages and packed at Namakkal. The final product is delivered in both local and distant urban markets like Food World, Chennai. Marketing opportunities for millets have been standardized over the last one year. Local outlets have been established at the Namakkal supermarket, Thiruchengodu supermarket and Salem supermarket. In the local markets, the demand for Italian millet (*Thinai*) products are higher compared to that for little millets (*Samai*). About 90 kg of grains and 50 kg of the flour of Italian millet were sold, as compared to only 50 kg of grains and 40 kg of the flour of little millets.

Marketing of millets to Food World outlet: This activity is being coordinated from Chennai. Since April 2002, attempts were being made to benefit traditional conservers and growers of millets by trying to establish links with urban markets. *Setaria italica* (Italian millet or *thinai*) and *Panicum sumatrense* (little millet or *samai*) were cleaned, packed and transported to Chennai for sale in Food World, a supermarket chain store that caters to urban, upper middle

class clientele. For this purpose, millets were packed attractively, giving details of the nutrient quality, along with recipe books for the preparation of dishes. Recipe books proved to be a useful addition as millets have almost been erased from the social memory of the present urban middle class. The SHGs involved in the marketing of millets have been trained in weighing, packing and sealing, to ensure quality.

The analysis of the sales so far shows clearly that there is a demand for millets in urban centres. However, it is difficult to cope with the current demand. There was no supply during some months, due to lack of production at the field. It is hoped that in the coming years more area will be brought under cultivation of millets so as to meet the demand from urban areas.

It was pointed out by the marketing agency that a large number of packets were being rejected from the earlier stocks because the seal indicating the date of packing and expiry date were not clear. So new packaging has been introduced and it is hoped that the change would create more customer satisfaction.

Low cost zero energy chambers: The village shops experience considerable difficulty in storing vegetables for long periods, particularly during summer. To provide an alternative, a low-cost zero energy cool chamber is being tested and a model suited to local conditions is being evolved in a demonstration village. The zero energy cool chamber model was constructed, using two layers of non-cemented bricks, and

the gap filled with sand, which is periodically sprinkled with water. It was found that vegetables could be stored in such a chamber for a period of 15 days.

Engendering project activities: Women's empowerment, engendering local institutions (in terms of women's participation), and mainstreaming a gendered approach in all project activities are being attempted. Activities were initially targeted at empowering women through the creation of women SHGs, facilitating access to small savings and credit facilities for different livelihood options and enhancing self-confidence. Steps were taken to reduce the drudgery associated with the processing of minor millets. Awareness was created through a number of training and capacity building programmes that enabled confidence building and facilitated participation in community development efforts.

37 SHGs have been formed so far, of which 18 are women groups, 10 are men groups and 9 are mixed groups. This year 14 new SHGs were formed, of which 8 were women groups. Awareness of engendering was attempted through workshops and meetings with other local level institutions.

SHGs from Sembuthuvalavu, Ariyursolakadu, Solakkadu, Ellaikiraipatti, Thannimathipatti and Panachatupatti have received a revolving fund from Indian Bank, Semmedu, Kolli Hills. Each group has received a sum of Rs 25, 000 as loan, out of which Rs 10,000 was received as subsidy. The SHGs are expected to return the amount over a period of 10 months. If

the bank is satisfied with the performance of the SHGs, It will support economic enterprises with a subsidy of 50%.

Iyarkai Vali Vivasayigal Sangam (Women SHG) from Ellaikiraipatti received a loan of Rs 2.3 lakhs, out of which Rs 1.15 lakhs is a subsidy from DRDA. Using this money the SHG has bought a Minidor vehicle, which is currently operating in Kolli Hills.

Training and capacity building: Kolli Malai Ottruneer Kootamaipu (Federation of SHGs of Kolli Hills) has been formed. Representatives of SHGs visited Kannivadi to interact with the Kulumai federation farmers of Kannivadi region. Kolli Hills SHG members have learned about the operational strategies of the federation and various enterprises such as *Trichogramma* parasitoid production, banana waste compost production and information village programmes.

A team of barefoot taxonomists led by Dr Ravikumar, from the Foundation for Revitalization of Local Heath Traditions (FRLHT), Bangalore, visited Kolli Hills to interact with the farmers. The team was trained in the methodology of interacting with farmers in chronicling information, minor millet conservation, values, threat and various promotional channels of millets. Details of the other training programmes conducted during the year are summarized in Table 5.5, under SPA 506.

Policy research: A field-level awareness workshop on PPVFR Act and BD Act and their implications was organized. Case studies

on Vilari (*Dodonaea viscosa* var. *angustifolia*), black paddy (*Oryza sativa*) and black banana (*Musa paradisiaca*) were documented. They were used at the workshop on Gender and Community Rights in PPVFR Act and BD Act at Chennai.

201.1.2 Wayanad

The Community Agro-biodiversity Centre (CAbC) continued its participatory mode of working with all key stakeholders, especially NGOs and functioned as a facilitator, catalyst and a strategist for sustainable agricultural and rural development. The five major areas reported last year progressed as planned, which helped CAbC to serve as a Resource Centre in areas of biodiversity management and the gender dimensions of livelihood, food and ecological security. The year's notable highlight was the designing and completion of database ODISK (On-farm Diversity Information System Kerala) to document and deliver information about all plant varieties/wild relatives and breeds known in the district and state. The Centre's *Every Child A Scientist* programme was given facilities to educate children on genetic wealth and traditional wisdom, with the generous support of the Department of Biotechnology (DBT).

Exploration: CAbC generated information on over 300 wild food types, which in the next phase will result in developing methods for introducing wild food into the productive system. It continued studies on the taxonomy and *ex-situ* conservation of major plant groups

like angiosperms and gymnosperms of the district. These collections (one good *orchidarium* with over 100 species; *arboretum* with many rare tree species) attracted a large number of students and other visitors as they provide a rare opportunity to appreciate much diversity at one place. From the perspective of education, conservation and use (ecological and option use) special attention was given to the preservation of species of high conservation value.

Another notable event of the year was a strategic planning workshop held at CAbC on 30th and 31st December, 2002 to set strategies and priorities in the programmes for the next 5-7 years. A range of stakeholders, both internal and external, from Programme Directors to farmers, participated in this exercise. A rank list of 13 action points, grouped under three major themes, to contribute to agrobiodiversity conservation and livelihood improvement of the poorest of poor in the district, was drawn up.

Biodiversity conservation and Natural Resource Management (NRM) for poverty reduction: This programme, supported by the SDC project, completed two years in April 2003, with the consolidation of activities in three villages. Earlier, the project activities had been dispersed among various sites, mostly along the wet southern zone of the district. The programme focused on five long-term objectives, namely conservation of the paddy ecosystem; conservation of traditional rice varieties; development of model NRM

villages; women's empowerment and capacity building and preparation of People's Biodiversity Registers (PBRs) and submitted a strategic plan to the State Planning Board. This strategy paper outlined ways and means to tackle poverty, food security and environmental protection, particularly the soil and water of the district, by revamping the present agricultural development approaches. Copies of the plan were submitted to all the Local Panchayats. This helped them to prepare the agricultural development plans and schemes for their respective territories.

Major achievements during the year:

- A total of 10 SHGs and 7 farmers' forums were formed during the year and training was imparted in vermicomposting, trench making, rain water harvesting, *Azolla* cultivation, biopesticide preparation, herbal medicine preparation, nursery techniques, kitchen gardening, fruit preservation and value addition, homestead poultry, bamboo handicrafts and soap making.
- The folk taxonomic classification of *Vayal* (paddy field) types, their peculiarities and their threat status were documented. The innovative practices followed by the Kurichiya community in paddy cultivation was presented.
- The number of traditional rice varieties conserved through farmers' networks was increased to 21 and information on 14 traditional rice varieties was added. Support was extended to the Community Gene Bank to carry out the characterization work on six traditional rice varieties.
- A CD highlighting the importance of paddy fields, reasons for shift from paddy to other crops, impact of this shift and water security, was released. All the issues of the quarterly newsletter *Vayal*, with leading articles on Farmers Rights, food security and water conservation, were brought out.
- *Veliyan* - a high-yielding traditional rice variety with a unique taste and quality has been recommended as a potential farmers' variety for getting recognition and reward. The crux of PPVFR and BD Acts was translated into Malayalam and distributed during the training programmes.
- The SHGs were able to sell nearly one ton of special products: 300 kg of *Njavara* rice, 175 kg of *Gandhakasala* rice, and 500 kg of *Navadhanyappodi* during the year.
- Seedlings of 5 tree species that are listed as highly-threatened medicinal trees of South India were multiplied and distributed to about 50 households in Panthippoyil village.
- 4 SHGs were linked with nationalized banks for availing of loans and 3 other SHGs were linked with the National Network on Biovillages and Community Banking of MSSRF for starting micro enterprises. The women SHGs were able to circulate Rs 30 lakhs among the members as internal loans. Table 2.1 gives the current

status of the micro enterprises developed or strengthened during the year.

- Training and awareness on PBR preparation received attention. Four Gram Panchayats earmarked money for the preparation of PBR and Pozhuthana Panchayat allotted Rs 10 lakhs for post-PBR activities.
- A biovillage on the model set up in Pondicherry was initiated in Panthippoyil village, with about 500 households, to demonstrate NRM and precision farming, designed to enhance factor productivity and to reduce cost and ecological risks. It promotes an integrated farming system involving vegetable production, mushroom cultivation, cultivation of commercially viable plantain varieties, vermicomposting

and medicinal plant cultivation and ensures recycling of agro wastes to make the farm family sustainable and nutritionally secure.

Conservation and sustainable use of medicinal plants: The Centre focused on activities such as conservation and sustainable use of locally available medicinal plants, training in preparation of healthcare products and market facilitation and documentation of ethno-medicinal knowledge. Successful community-level marketing of healthcare products was a major aim. The marketing of herbal products however, faced a serious problem in the form of Good Manufacturing Practices (GMP) put forward by the health authorities, that adversely affected marketing by rural and

Table 2.1: *Livelihood enhancement activities: current status of micro enterprises*

Activity	No. of units	No. of women involved
Nursery raising	4	40
Bamboo-based handicrafts	2	14
Herbal medicine preparation	6	52
Vegetable cultivation	5	43
Cattle rearing	5	43
Poultry	16	16
Banana cultivation	2	23
Goat rearing	16	16
Bee keeping	1	1
Soap making	1	10
Tailoring	6	6
Readymade garments	2	2
Bakery units	4	4
Flour mill	1	4

tribal women and traditional healers. The problems of no proper buy-back arrangement; lack of seedlings for large-scale cultivation and secret raw drug market prevented the achievement of some of the targets set under this programme. The education and awareness programmes for the sustainable use of medicinal plants generated interest among farmers and the public.

The major results achieved during the year are:

- An ethno botanical study on the plants used by the Kurichiya community for religious purposes was completed as part of a M Sc study programme carried out by Calicut University in partnership with CABc.
- Six herbal products which do not require GMP license were short listed and market linking for their sale was initiated through a professional body. A market study was conducted and the possibility of the sale of a minimum of 15,000 packets of these products within a period of three months was reported.
- Special attention was given to skin diseases among the Paniya community, training in health care and preparation of medicines. It has helped to prevent skin diseases in children and in the use of plants for preparing medicine. An agreement was made with a local agency to market six, commercially important medicinal plant species including *Njavara* rice. The establishing of a market outlet in a village to sell the health care products produced by women's groups was facilitated.
- Field and molecular level studies on *Dioscorea* were completed.
- Information on traditional healers of three more panchayats was collected. Five cases of innovations were notified to the National Innovation Foundation (NIF) for recognition and reward. A computerized format for details of tribal healers was incorporated in the ODISK database.
- A 20-minute CD on primary healthcare training programmes was produced.
- Approximately four thousand medicinal plants of about 25 species were distributed to the six different tribal colonies of the district.

Developing Low External Input Sustainable Agriculture (LEISA) farms: The programme supported by the FF Endowment Grant, envisages the emergence of LEISA farms as Rural KCs, to help traditional farming communities to protect their age-old farming and conservation traditions. Priority was given to equipping the Centre with training materials and conducting demonstrations to provide skills to farm families on a package of practices for the crops identified for village intervention. The Centre also provided farmers with useful information about marketing (mushrooms, medicinal plants and spices), cultivation practices and soil and water management. The following activities were taken up:

Mushroom cultivation: Studies were conducted on the use of various agro wastes such as banana pseudo-stem, arecanut waste and

wild grasses for oyster mushroom cultivation besides the conventional substrate, paddy straw. Training in spawn production was conducted for 290 farmers (both men and women) and 190 women trainees from Wayanad district. Regular mushroom cultivation training was conducted on the first wednesday of every month. Each trainee was given a packet of spawn and containers (bags) for growing mushroom at the end of the training. Post-training evaluation was conducted at the end of each training module for getting feedback from the trainees. During the year about 290 packets of spawn were used for training and 770 packets were sold. Oyster mushroom spawn were prepared and distributed to farmers for coir pith composting. The spawn production unit was strengthened to meet the heavy demand for spawn, both for mushroom cultivation and coir pith composting. The Centre took the initiative to market the produce under the brand name *Angel* through the Mushroom Society of Wayanad, which had been formed earlier.

Extending training skills in agro-eco technologies to farmers: Intensive training, aimed at

empowering farmers, was given to a batch of 50 farmers for one year. A number of women and men were exposed to various farming techniques (Table 2.2). The number of vermicomposting units established at the farm of the Centre has increased to six. Field level training programmes were conducted for vermicomposting and *Azolla* cultivation in five NRM sites under the SDC programme. A technology for the large scale production of vermicompost from plantation wastes has been standardized and demonstrated at CABc farm, using a voraciously feeding large pigmented earthworm species brought from CPCRI, Kasargod. In about 60-75 days all waste is converted into pure granular vermicastings. The recovery of vermicompost was about 60-70%.

LEISA farm programme: As part of crop diversification, one acre of the farm was planted with a Farmers' variety of cardamom called *Njallani* and 125 vanilla cuttings, with arecanut palms as support. Three apiculture units were established, besides a small nursery structure, four vermicompost units and an *Azolla* unit. Interpretation boards explaining various cultural practices, plant protection

Table 2.2: **Details of training programmes conducted during the year on farming techniques at CABc, Wayanad**

Training details	Target Group	No. trained
Mushroom Cultivation	Women Farmers	480
Vermicomposting	Farmers/women SHGs	158
<i>Azolla</i> cultivation	Farmers	138
Biopesticide preparation	Farmers/women SHGs	76
Coir pith composting	Planters	6
Mushroom spawn production	Women SHGs/individuals	28

measures and the importance of organic agriculture have been displayed in the LEISA farm. The irrigation pond in the farm was renovated. Many people visited the LEISA farm. A preliminary study was also initiated to find the status of the Vesicular Arbuscular Mycorrhizal association in the crops grown in the LEISA farm. A blueprint of the LEISA farm activity is also under preparation. A number of publications were brought out this year, which include books, brochures, popular articles, research papers, presentations at scientific meetings, dissertations and radio talks. The Farm Radio serial on *Sustainable Agriculture for Food Security* was compiled, published and released at a Farmers' Meet.

Ethnobotany and gender dimensions of wild food management

The project on wild foods was initiated for a better understanding of wild food management mechanisms in terms of community, gender and age, and correlating people's knowledge with scientific understanding on different wild food species. This was completed during the year. The wild foods selected for in-depth study were green leafy vegetables, mushroom, fruits and seeds, tubers and yams, honey, crabs, fish and other aquatic animals. 15 locations from 5 sites (four from the wet zone and one from the dry zone) were surveyed and a total of 362 informants (men, women and children) of different age groups were directly interviewed during the study. Data was generated largely through focus group discussions, informal conversations and interviews, collection of specimens and participatory transect walks in various

landscape elements with both men and women of different age groups. The study made significant findings.

Various socio-cultural groups in the district, including three dominant tribal communities, use more than 340 wild food species (Table.2.3). The study shows that the knowledge and skills of communities in managing various food species, as well as the landscapes, vary according to gender, class, economy, environment, age and time.

Wild and weedy greens: These form the most regularly used food supplement in the three tribal groups and are of great dietary importance among the Paniya families. Approximately 102 wild edible leaves have been identified, but only a few species are widely used, for instance, Paniya women and children regularly collect only 8 species, while Kuruma collect 4, Kattunaikka, 4 and settlers, 3 species. The household survey revealed that Paniya families eat about 83 species, Kattunaikka 43, Kuruma about 21, and the settlers, 3-6. Most of the species consumed by the Paniya tribe are herbs (90%), and very few are trees (10%). An analysis of the dependence on landscapes for collecting these plants shows that wayside and open areas provide the maximum species (28) followed by thickets and forests (20 species), paddy fields and associated ecosystems (18), river and riversides (13) and marshy areas (9). Tribal and non-tribal men and women use leafy greens for other purposes as well, like medicines, rituals etc. Such knowledge is largely confined to women. It shows that among the 30 documented multiple uses of

Table 2.3: *Number of wild species used as food by different socio-cultural groups in the study sites of Wayanad*

Wild Food	No. of species/kinds known to different socio-cultural groups						
	Tribal families			Others			
	Paniya	Kuruma	Kattunaikka	Hindu	Muslim	Christian	Way.Chetty
Leafy vegetables	83	21	43	8	12	12	14
Tubers	19	12	25	2	4	6	7
Mushrooms	25	14	3	3	8	6	12
Fruits and Seeds	50	15	37	10	10	11	8
Crabs	5	3	4	2	2	2	3
Honey	4	3	5	2	2	2	2
Fish	36	25	30	12	12	14	15
Total	222	93	147	39	50	53	61

wild food species, uses known only to women are 14 and known only to men are 3.

Mushrooms: This forms another important genetic resource collected chiefly by women in all the tribal communities. The present survey shows that the people of the area consume around 33 different mushrooms. The availability of these mushrooms is seasonal and specific to their habitats and host plants. The common habitats where mushrooms are found are open areas in plantations, forest edges, along the borders of forest paths, in bamboo brakes and fallow fields.

Wild tubers: This forms another important food source. At least 25 wild plant species/types of edible roots, tubers and rhizomes are eaten by the tribal and non-tribal communities of the district. Of these, 19 are species/types of

Dioscorea, which is the main tuber plant known and used in this region. Wild *Dioscorea* species continue to be a major source of food for forest communities like Kattunaikka and these species serve as a 'life saving' plant group during periods of food scarcity.

Honey: The nutritional value of honey has been widely known to men and women of all the communities studied. The Kattunaikkas and hill Paniyas are highly knowledgeable about its nutritional and therapeutic value. These two communities have been using honey regularly, and it has contributed greatly to their health and food security.

Fruits and seeds: These are also important edibles which contribute to their nutritional requirements. Much of their vitamin and mineral needs are met by this category of food. Information on 62 such fruits and seeds

(fruits-55, seeds-7) was collected during the study. Among the fruit-yielding plants, 33 are trees, which are usually found in forests and hills. It can be seen that fruit trees like *Plavu* (*Artocarpus heterophyllus*), *Mavu* (*Mangifera indica*), *Athi* (*Ficus racemosa*) and *Njaval* (*Syzygium cumini*) are protected on waysides and in the agricultural landscapes in the study sites.

Fish: The study shows that the Paniya community alone knows a lot about 35 different varieties of edible fish. Almost all these species are available throughout the year. Fishing is an important activity for men, women and children in the tribal communities.

M K Ananthasivan Knowledge Centre & Every Child a Scientist Programme:

Information plays a central role in conservation, but it has to be disseminated in the right fashion at the right time, to the right audience. Farmers, women, youth and children benefit from the *M K Ananthasivan Knowledge Centre*, which provides information on various plant genetic resources. The Centre is now developing computerized documentation systems that describe major components of biodiversity, farmers' varieties and traditional knowledge. The Centre's *Every Child A Scientist* programme provides a useful facility to educate children on genetic wealth and traditional wisdom. About 100 students in the age group 6-16 years, largely students and school dropouts, are brought under this programme.

Results achieved during the year:

- Curriculum committee formed, resource persons identified and curriculum prepared
- Two school dropouts (tribal children) re-entered school
- Study materials prepared (Daily nature diary, Plant morphology, Bird watching, Fruits and vegetables, Computer basics)
- Three nature camps conducted (field visits, farm visit, trekking etc.)
- Database of medicinal plants/wild orchids/wild food of tribal communities being prepared
- The summary of the project was presented at the International Congress on Botanic Gardens at Sydney
- A nursery of 10 sacred tree species was raised and 500 plants distributed to various schools
- Awareness programmes organized for parents and teachers
- Newspapers are regularly brought out by students
- Booklets published (Know a plant, Sea news, Do you know, Butterfly world etc.)
- Parents' meetings called to explain the programme status
- Regular classes conducted as per syllabus
- Tuition for Malayalam and English given by two teachers residing near CAbC

201.1.3 Jeypore

Participatory Conservation System: In-situ on-farm participatory conservation of agrobiodiversity in Jeypore is one of the major endeavors of MSSRF as a response to the severe depletion of genetic resources. Participatory conservation by villagers was undertaken this year and farm families could evaluate many of the landraces of their choice. They could cultivate the landraces that are on the verge of extinction on their land, following scientific methods of cultivation. In addition to the varieties which were grown for their own use, they generously provided space for 5-10 varieties to be grown in 3 or 4 lines for multiplication and evaluation purposes. Many of the farm families took great care of these landraces in spite of severe drought in the last season. A total of 55 farm families from eight villages participated in this process. They evaluated and multiplied around 72 land races.

Community Medicinal Plants Gardens (CMPGs): 5 NGOs in Koraput, Malakangiri and Kalahandi replicated CMPGs, after exposure visits were conducted. The CMPGs help the local people to learn about the importance of plants. As per the decision of the Palli Samiti (village committee), no one is allowed to destroy any of the plants inside the CMPGs. Nevertheless they are used during emergencies. Village children are taking part in this programme with great enthusiasm. CMPG has now become a source of inspiration for several villages and institutions in Koraput district.

Poverty Reduction: Activities were undertaken to reduce the pressure on biodiversity, which has been facing a serious threat from the human population, by utilising the strength of organizations at the village or community level. Several interventions have been introduced.

Horticulture activities: Vegetable cultivation has been undertaken in Tolla, Boliguda, Patraput and Pujariput villages. Group-led poverty-reduction approaches were successful at Tolla, where 20 families came together informally and demonstrated community efforts. These villages were supported with diesel pumps for vegetable production, multiplication of rice germplasm for field gene bank and cultivation of sugarcane, maize and onion near streams, using surface water.

Spices: Ginger and turmeric cultivation was undertaken in wastelands and up lands in the villages of Tolla, Nuaguda and Boliguda. A total of 48 families were involved. They utilized 0.5 acre of land for the pilot study. Under direct monitoring of the Palli Samiti, 13 farm families in Pujariput village opted for ginger and turmeric cultivation on 0.1 acre of land. Ginger was cultivated on 0.12 acres of land by 10 farm families.

Parched paddy: The preparation of parched paddy from identified landraces of rice in Patraput village was organised by women SHGs. They are also adding value to parched paddy and selling it at a better price in the weekly markets and in Jeypore town. Large-scale promotion is required for better marketing of these products.

Poultry breeding: Group-led poultry activity at Patraput village made a significant contribution to the concept of micro-enterprises. They are now self-sufficient in managing the group, finance, book keeping, marketing, preparing poultry feed, the health of chickens, including advising people on rearing chicken in backyards and linking with the bank for loans. This group is now capable of managing 500 or 700 chicks per year and makes profit.

Status of Community Seed Bank (CSB), Village Grain Bank (VGB) and SHG micro enterprises: CSB were established in eight villages, but currently only six villages are continuing the Seed Bank. The VGB established in five villages are functioning smoothly. Several micro enterprises have been initiated as well. The details are provided below.

Patraput: Since the year 2000, 102 households have contributed 564 kg of 22 traditional varieties and 10 high-yielding varieties of paddy to the Seed Bank. 33 households have benefited from the Seed Bank. 47 households contributed 347 kg of 14 varieties of paddy to the grain bank. A total of four SHGs have been formed in the village. *Gudi Thakurani*, an all-women SHG has so far deposited Rs 4,185 earned from parched paddy processing and marketing in the bank; *Baman Dei* SHG, a mixed group, has deposited Rs 2,800 earned through poultry farming and vegetable cultivation; and two new all women SHGs, *Maa Santoshi* and *Maa Durga* have collected Rs 605 and Rs 421 respectively through savings. They are to decide on the type of micro enterprise to be taken up.

Tolla: Between 2001-03, 25 households contributed 140 kg of seeds to the Seed Bank, consisting of seven varieties of traditional and three high-yielding varieties of paddy. A total of nine households benefited by it. 108 households contributed 684 kg of grains of 20 varieties of paddy to the Grain Bank. *Mahuli Maa* SHG (mixed group of men and women) formed in the year 2001 has so far deposited Rs 2,315 earned through parched paddy processing and marketing in the bank. *Baman Dei*, women SHG has deposited Rs 9,047 for green gram and vegetable cultivation. *Maa Thakurani*, men SHG has deposited Rs 8,587 earned through procurement and marketing of agricultural produce, NTFP collection, cultivation of groundnut, green gram, black gram and vegetables. A new men SHG, named *Birakhamba* has saved Rs 9,970 and will choose the micro enterprises to be started.

Pujariput: The seed bank was initiated in the year 2001 and so far, 114 households have contributed 277 kg of seeds, belonging to 10 traditional varieties and 14 high-yielding varieties of paddy. A total of 21 households benefited from the Seed Bank. 48 households contributed 284 kg of grains of 24 varieties of paddy to the Grain Bank. *Patdevata* men SHG has saved Rs 3,810 and will initiate enterprise activity after meeting all the members.

Boliguda: The seed bank was initiated in 2001 and so far 11 households have contributed 61 kg of seeds, of which 8 are traditional varieties and one is a high-yielding variety of paddy. 134 households contributed 1,201 kg of 28 varieties of paddy to the Grain Bank. *Patdevata*

SHG has deposited Rs 2,979 earned through the cultivation of groundnut, maize and onion, in the bank.

Nuaguda: 23 households contributed 69 kg of seeds of 4 traditional and 2 high-yielding varieties of paddy. Four households benefited from the seed bank.

Mahuli: 140 households contributed 390 kg of seeds, of which 16 were traditional and 11 were high-yielding varieties of paddy. The village opted out of the seed bank system in 2002. However, the VGB is functioning. 20 households contributed 200 kg of six varieties of paddy.

Santaliaguda: The seed bank was initiated in 2001 and so far, 23 households have contributed 110 kg of traditional and high-yielding varieties of paddy.

Natural resources management: Conservation of biodiversity at the grassroot level entails natural resources management. Management of agrobiodiversity will not be possible if the climatic condition, water availability and soil condition are not taken care of. To manage natural resources in and around villages, rainwater harvesting activities were undertaken, which have helped in the growth of forest species, restricted soil erosion, increased ground water table and restricted sand casting on cultivated land. Therefore, to retain and conserve agrobiodiversity resources for future generations and to set a model of *in-situ* conservation with the help of communities, various activities were undertaken.

In Tolla, new small ponds were constructed to collect spill-over water. Other activities included proper dressing of farm bunds, reconstructing channels from the ponds and streams and special orientation sessions for the Palli Samiti on water and soil management. These activities will hopefully increase the availability of water in the village. The upland soil around the ponds will remain moist and become suitable for the cultivation of medium land crops. There will be better land and water management at the community level, better status of perennial flow of water, more land under second crop, better economic growth and better employment opportunities. Voluntary efforts are on to construct water reservoirs and water channels. This in turn will result in more water being available and land being brought under horticulture.

In Boliguda, farm bunds were redressed, ponds renovated and special orientation given to the people on water and soil management. The renovated pond is now ready for fish cultivation. The effort has helped in better soil and water management at the field level. The youth of the village are actively involved in the efforts and have resolved to increase arable land.

In Pujariput, a series of contour and check dams were constructed to restrict water flowing through arable land. Special orientation was given to the people on water and soil management. It has increased water availability for extending irrigation during the cropping season and improved soil and water management. This has created interest among members of Palli Samiti to undertake work

and it is hoped that this will reduce pressure on the forest. However, a series of contours constructed in the lowland to restrict flash floods failed, due to the lack of interest among the owners of uplands and medium lands to redress their farm bunds.

Capacity building and networking:

- An NGO workshop encouraged NGOs from different districts to adopt CSB, VGB and CMPG in their operational area. 11 NGOs and 7 Community Based Organizations (CBOs) are now replicating CSBs and VGBs successfully after availing the capacity building programme.
- 367 farmers and 27 NGO staff were trained in different districts.
- 280 trainee days were utilized for farmers of 6 demo-villages.
- A request from the Government and NGOs to conduct an exhibition resulted in 3 district level panchayat and village level exhibitions.
- Exposure visits and training for Central Village Committee (CVC) leaders, volunteers and farm families led to horticulture activities and the construction of a water reservoir.

201.2 Participatory Plant Breeding (PPB) for Poverty Reduction among Tribal Poor

This programme has been in progress in the tribal tracts of Jeypore district of Orissa. The

major objective is to empower people and provide technical inputs for integrated natural resource management, particularly the rich genetic diversity of rice, for poverty reduction. During the past few years, it focused on enhancing the utility of people-preferred land races of rice through simple, easily adoptable plant breeding techniques. A field evaluation was conducted on methods of cultivation of landraces preferred by the community, *vis-à-vis* tribal tradition and scientific practices of cultivation. The realized productivity of the latter was found to be substantial. It had a telling effect on the farming community who not only switched over to formal practices but also recommended them to fellow farmers. In turn, they selected a few land races for large-scale cultivation in various upland, medium land and lowland plots. Gradually other villages which were not participants in the experiment also switched over to formal cultivation. In the rainy seasons of 2000 to 2002, the possibilities of realizing high yields through scientific practices of cultivation were broadly confirmed, in general, in farmers' fields. However, yield levels did vary across the seasons in proportion to the vagaries of weather experienced at the sites. The years 2001 and 2002 experienced severe drought at crucial stages of crop growth and in 2001, it was interspersed with unexpected bouts of heavy rainfall. An attempt to collect yield data from farmers' demonstration plots succeeded in 2000 and only partly in 2001 and 2003, as yield data could be collected only from sub-samples from demonstration plots of 0.3 to 0.5 acres (Table 2.4).

Table 2.4: **Comparative performance (in kg) of some landraces during the rainy season in Jeypore, Orissa**

Year	2000	2001	2002
<i>Sapuri</i>	3,593	3,250	4,167
<i>Barapanka</i>	4,514	1,500	2,250
<i>Limbachudi</i>	3,424	1,733	—
<i>Kalajeera</i>	4,151	4,116	3,083
<i>Velijan</i>	—	3,800	2,083

The general trend of high yields of landraces is clear, though Limbachudi and Barapanka suffered higher losses during 2001. Kalajeera, on the other hand, yielded around 4 tons during 2000 and 2001 and suffered in 2002. The results cannot be generalized, however, as the crops suffered due to aberrant weather, telling upon the realized yields. The performance of *Velijan*, introduced in Jeypore from the collection in Wayanad, appears to be good, from the results of trials in 2001 and 2002, both in grain and fodder yield (3,085 kg/ha and 9,467 kg/ha). The need for collecting precise data from large demonstrations was the reason to continue this activity through the next season.

Currently people are cultivating landraces such as *Paradhan*, *Pandakakura*, *Sapuri*, *Gathia*, *Kalajeera*, *Macchakanta*, *Muktabali*, *Haldichudi* and *Barapanka*. *Kalajeera* has a special rating. It has small, scented and white kernels, though the husk colour is black. Tribals prefer the black husk for religious and festive occasions. This variety fetched a high sale price of Rs 22/kg at a Government fair and its popularity is growing. A market sample survey confirmed its large selling capacity.

The tribal people who were once finding it difficult to meet even their consumption needs from landrace cultivation have now been able to realize high yields that make it possible to save a considerable quantity of grains for sale. *Kalajeera* is one such preferred landrace with a potential of around 3.5 to 4 tonnes/ha in optimal weather conditions. Therefore the need arose for finding a profitable market for *Kalajeera*. During the course of participatory selection of landraces earlier, people learnt to select seed. If the small landholders can come together and store the seeds and grains in a common structure, it would be possible to arrange for sale in commercial markets. This concept was discussed with the farmers who welcomed the idea and have constructed grain banks on their own. Such banks, now found in a few villages, can serve the purpose of field gene-seed-grain banks. Pure seeds are crucial in raising commercial crops with high and sustainable yields. Farmers, particularly tribals, were severely handicapped earlier owing to non-availability of pure seeds at an affordable cost at sowing time. Selected from panicle-to-row populations in one or more cycles, representative seeds of *Kalajeera* genotype, for example, could be obtained and stored in the

field gene bank. As a backup, a portion of the seeds could be kept at the Community Gene Bank at MSSRF, Chennai to rescue landraces that might be eroded.

The field gene-seed-grain bank is to be managed by a committee selected by the people, through the Panchabati Grama Unnayana Samiti and Palli Samiti, which are the structures of the PRI in Orissa. Depending upon its success, similar field gene-seed-grain banks will be replicated in other participating villages.

201.3 Community Gene Bank

As part of the Integrated Gene Management System, the Community Gene Bank plays a major role in linking *in situ* and *ex situ* on-farm with *ex situ* facility. The ongoing work includes the collection of land races, traditional cultivars and wild and medicinal plants. Apart from exploration, collection and on-farm conservation, a special programme is being carried out to document Indigenous Technical Knowledge (ITK), related to agriculture.

Germplasm collection: This year a collection of 86 germplasm has been processed and deposited in the gene bank. The collection includes paddy, millet, pulses and wild species from the states of Tamil Nadu, Kerala and Orissa. Some of the important collections are paddy (*Chennellu, Chomala, Gandhagasala, Jeeragasala, Kottai Nellu, Kullan Kar, Samba Nellu, Thondi*), pulses (*Malai Thuvarai, Nattu Motchai, Nattu Kollu, Motchai, Sword Bean, Payar* (black and red), millets (*Bangalore Manavari, Karun Samai, Karun Suruttai, Kothu Samai, Nattu Samai, Nattu Thinai, Pottu*

Cumbu, Vella Samai, Vella Suruttai Kezhvaragu, Vellai Erum Kezhvaragu), Cholan (*Kakka Cholan*), Maize (*Nattu Makka Cholan*), wild plants (*Aan Nerunji, Aavaram, Kumalam, Kundumani, Maruthani, Mudakkathan*); vegetables (ash gourd, bitter gourd, bottle gourd, cheera (green and red), cucumber, pumpkin, ridge gourd, winged bean, spices (chillies) and oil seeds (*Nattu Ellu, Malai Kadugu, Thattu Ellu* (Niger Seed).

A joint exploration with the National Bureau of Plant Genetic Resources (NBPGR), Thrissur, resulted in the collection of 30 wild species and 18 traditional cultivars in and around Wayanad. The collection included *Abelmoschus angulosus, A. esculentus, Adathoda zeylanica, Artemisia vulgaris, Asparagus racemosus, Colacasia sp., Cucumis sativus, Curculigo orchoides, Curcuma caesia, C. longa, C. zeodaria, Curcubita moschata, Dioscorea bulbifera, D. hispida, D. intermedia, D. oppositifolia, D. pentaphylla, D. wallichii, Ipomea digitata, Lycopersicon pimpinellifolium, Nervilia sp., Oryza sativa, Phyllanthus niruri, Piper attenuatum, Solanum indicum, S. nigrum, S. viarum, Trichosanthes bracteata, Vigna dalzelliana, V. radiata var. sublobata, V. wightii, Vitex negundo, Zingiber macrostachyum, Z. officinale, and Z. roseum*. These collections are currently housed at the Regional Station, NBPGR, Thrissur.

Traditional cultivars such as *Bandel, Bastul, Bayahundar, Bhogi, Chetaka, Chitakannei, Dudhamani, Gadaba, Gelei, Gurugi, Haladi gunda, Jhitipiti, Kaurakee, Kewa, Khandadhan, Khutuli, Kureswar, Kusuma, Luder, Magura, Mahipal, Mati, Merlo, Mirchatul, Para, Sekara,*

Sela, *Sunakhadika*, *Sunaseri*, and *Tuma* are the important collections from Kalahandi district, Orissa.

Germplasm deposit: As a mandate of the Foundation, a duplicate sample of the material collected is deposited with NBPGR, New Delhi. This year 55 germplasm accessions were deposited and the NBPGR has assigned IC numbers to 54 germplasm accessions, which include the identity of the depositors.

Characterization: An effort was made to characterize some accessions from the Gene Bank. As of now, this Gene Bank holds characterization information for 18 varieties of paddy. 12 traditional paddy germplasm, namely *Ambasamuthiram*, *Arcot Kitchilli*, *Bangalore kar*, *Gundu nellu*, *Kalar palai*, *Kullan kar*, *Madumulingi*, *Neikitchidi*, *Puzhuthikar*, *Seeraga samba*, *Thuyamalli* and *Vadan samba* collected from Tamil Nadu were characterized in a farmers' field at Chengam, Thiruvannamalai district, Tamil Nadu. Five traditional paddy germplasm namely *Chempathy*, *Chennellu*, *Gandhakasala*, *Kalladiyaran*, and *Veliyan* collected in 1999 in Kerala were taken from the Gene Bank for characterization in farmers' fields at Wayanad.

For the purpose of characterization, descriptors developed by NBPGR and International Plant Genetic Resources Institute (IPGRI) were used to record observations in the field. The descriptors such as leaf length, leaf width, ligule length, culm diameter, days to 50% flowering, number of productive tillers, grain length, grain width, plant height, panicle length, days to maturity, 100 seed weight,

milled grain length, milled grain width, single plant yield, early plant vigour, basal leaf sheath colour, leaf blade colour, leaf pubescence, leaf angle, flag leaf angle, ligule colour, ligule shape, collar colour, auricle colour, culm angle, internode colour, lodging resistance, panicle exertion, stigma colour, apiculous colour, shattering, endosperm type, leaf senescence, panicle type, panicle secondary branching, panicle axis, lemma and palea colour, lemma and palea pubescence, spikelet sterility, awning, seed coat colour, threshability and aroma were recorded in the field.

On-farm conservation: Keeping in focus the mission of the National Agricultural Technology Project on Plant Biodiversity (NATP-PB) viz., exploration, collection, conservation, evaluation and management for sustainable utilization, the work carried out in the villages and the important target crops are as follows: On-farm conservation of traditional crops at Galigattum, Dharmapuri district, Tamil Nadu; medicinal plants at Keerapalayam, Cuddalore district, Tamil Nadu; traditional crops at Chengam, Thiruvannamalai district, Tamil Nadu; and legumes and cucurbits at Nedungode, Pallookappil and Panai Colonies, Wayanad district, Kerala.

To emphasise on-farm conservation of traditional paddy in Chengam, Thiruvannamalai district, a one-day workshop was held on methods of traditional cultivation practices, conservation and management. Farmers (both women and men) participated and the results obtained through field trials

were discussed. The workshop provided a pathway to spread information on the availability of a number of traditional varieties, cost of cultivation as per the survey and collection undertaken in the village. Farmers interacted with the resource person and made requests for seeds of a few traditional varieties for cultivation. In order to conserve sufficient seed material, the Pudupattu Village CSB has been established. A separate register is being maintained to monitor the inflow and outflow of seed material. The seed bank is functioning with generous support from a progressive farmer who has provided some space at his residence for operating the seed bank.

A week-long orientation and field visit was organized for farmers. A group of five men and two women farmers visited MSSRF, Chennai, Biovillage and Information Village, Pondicherry, Chidambaram, and Kuriamangalam project sites. This was the first time that they had moved out of their village and they were amazed to see the ongoing programmes at MSSRF. As a result of the project intervention, two women SHGs have been formed. On request by the farmers, a one-day training on biopesticides and organic farming was conducted by a resource person from the Biovillage project. A village level committee has been formed at Chengam which organizes periodical meetings.

In Galigattum village in Dharmapuri district, one men SHG group has been formed; field trials and multiplication of traditional varieties of *avarai*, *amanakku*, *karamani*, and *thubarai*

have been undertaken. The seeds are now stored in the newly established Galigattum Village CSB. Some farmers have borrowed seed material from this seed bank.

A one-day workshop on herbal home remedies was organized at Keerapalayam village in Cuddalore district, with the help of a resource person from Anthyodhaya Sangh, Trichy. Nearly 55 SHG members belonging to 11 SHGs took part in this workshop. The training helped them to prepare six medicines in the form of powder (*suranam*), syrup (*kashayam*) and oil (*thailam*): *adathoda kashayam*, *seemai agathi thailam*, *sirukurinjan suranam*, *thiripala suranam*, *mathar thailam*, and *karpurathi thailam*.

In continuation of the herbal home garden project, a one week special training programme on herbal-based home-remedies was organized at Anthyodhaya Sangh, Trichy. Two members each from 21 women SHGs were trained. The training programme included the identification of medicinal plants, diagnosing disease, practical training on preparing medicine for 30 diseases, yoga and meditation exercises. Certificates were issued to the participants.

A training programme on biodiversity conservation was organized for school children, unemployed youth and school dropouts, through puppet shows. 37 participants received certificates at the end of the programme.

In Wayanad, Nedungode, Pallookappil, and Panai colonies have been selected for on-farm

conservation of legumes and cucurbits. Seeds were distributed to farmers, enabling them to start cultivation in January. A women SHG has been formed to monitor the agronomic practices. Farmers, merchants and consumers were invited to attend a one-day workshop at the Wayanad site office to discuss the conservation, cultivation and promotion of market links for legumes and cucurbits being cultivated in these places.

Indigenous Technical Knowledge: The National Agricultural Technology Project on Indigenous Technical Knowledge (NATP-ITK) funded by the ICAR, has identified MSSRF as the Zonal Leader for Zone-II, covering Tamil Nadu, Kerala, Karnataka, Goa, Diu, Daman and Andaman & Nicobar Islands. The mission of the project is to collect, document and validate indigenous knowledge-based practices employed in agriculture and allied activities in different agro-climatic zones of India. The objectives are to catalogue and characterize the information for developing a database, ascertain the extent and level of use of various ITKs by farmers in the management of their systems, validate ITKs through quick-screening and formal experimentation, evolve a mechanism to protect peoples' property rights and facilitate the sharing of benefits by the farming community.

Collection and documentation: The project has collected a total of 225 ITKs in this Zone. They have been given a score and classified as fit for documentation, documentation and incentive, and documentation, incentive and validation. 12 ITKs have been selected for

validation and 58 for incentives. Compilation of already published information was also undertaken.

Validation: Validation includes cross checking the disclosed information and testing its applicability at the laboratory level, as well as the field level. If the ITK involves crops, the validation includes replicating the field trials. Institutes and universities have been identified to undertake the validation as given in Table 2.5.

The first phase of validation was started in July 2002 and results are being recorded. Almost all validations are found to be very effective, inexpensive, viable, and user-friendly.

As an outcome of this project the ICAR, has published two volumes of documented information.

Community herbarium: The community herbarium at the Foundation holds a total of 500 classified voucher specimens belonging to 82 families, 180 genus and 247 species, including 133 voucher specimens collected this year from Tamil Nadu, Kerala and Orissa. The voucher specimens belong to traditional cultivars as well as rare, endangered and medicinal plants.

Unique voucher specimens: The voucher specimens from Orissa are traditional paddy varieties such as *Baigani*, *Basubhoga*, *Basumati*, *Batachudi*, *Bayagunda*, *Bayahundar*, *Bhaktachudi*, *Bhasabhoga*, *Bhatakubudi*, *Danger Asamchudi*, *Deulabhoga*, *Dudhamani*, *Gelei*, *Haladichudi*, *Haladigundi*, *Kalajeera*, *Kalamohara*, *Kaliasura*, *Kaurki*, *Khutuli*,

Table 2.5: **Organizations identified to undertake validation**

Name of the Institution	ITK for validation
TNAU, Coimbatore	<ul style="list-style-type: none"> ● <i>Helicoverpa armigera</i> management in groundnut (<i>Arachis hypogaea</i> Linn.) by using <i>Prosopis juliflora</i> (Swartz) DC. leaf extract ● <i>Oryctes rhinoceros</i> beetle management in coconut (<i>Cocos nucifera</i> Linn.) by using cowdung slurry ● Rain water management for teak (<i>Tectona grandis</i> Linn.f.), mango (<i>Mangifera indica</i> Linn.) and neem (<i>Azadirachta indica</i> A. Juss.) in arid and semi-arid regions ● Performance evaluation of portable single pan improved wood stove of high efficiency for domestic and industrial applications ● Pest management by using <i>Cynodon dactylon</i> (L.) Pers. leaf extract in tomato (<i>Lycopersicon esculentum</i> P. Miller) plants
Indian Institute of Horticultural Research, Bangalore	<ul style="list-style-type: none"> ● Pest management by using <i>Cynodon dactylon</i> (L.) Pers. leaf extract in tomato (<i>Lycopersicon esculentum</i> P. Miller) plants ● Increasing the germination percentage of Solanaceous tropical vegetable seeds ● Enhancement of productivity of onion (<i>Allium sativum</i> Linn.) through cassia (<i>Cassia tora</i> Linn.) leaf application ● Preparation of Bori using Pigeon Pea
UAS, Bangalore	<ul style="list-style-type: none"> ● Meat preparation using Oyster, freshwater snail ● Use of fish bait to attract fish
TANUVAS, Chennai	<ul style="list-style-type: none"> ● Effect of kumati (<i>Colocynthis vulgaris</i> Schrad.) fruit pulp and neem (<i>Azadirachta indica</i> A. Juss.) oil mixture on maggot wounds in cattle ● Effect of black pepper (<i>Piper nigrum</i> Linn.) and turmeric (<i>Curcuma longa</i> Linn.) water on day-old calves ● Effect of gingelly (<i>Sesamum indicum</i> Linn.) oil, pig fat and banana (<i>Musa paradisiaca</i> Linn.) mixture and <i>Gloriosa superba</i> and neem (<i>Azadirachta indica</i> A. Juss.) oil paste to cure foot and mouth disease ● Effect of Sapota fruit (<i>Achras zapota</i> Bedd.) and Jack fruit (<i>Artocarpus heterophyllus</i> Forst.) leaves to control diarrhoea in cattle

Kusunakuda, Laktiman, Lalata, Lalei, Limba chudi, Matidhan, Mer, Mora, Mugudi, Muktabali, Osagathiali, Raja nuan, Sapuri, Sela, Singhpuri, Sunakhadika, Tulasiganthi, and Umeriachudi and traditional ragi cultivars such as *Badamandia* and *Sanamandia*. Voucher specimens of traditional cultivars of *avarai* (*Lablab purpureus*), *kadugu* (*Brassica nigra*), *kottamuthu* (*Ricinus communis*) and *ragi* (*Eleusine coracana*) were obtained from Tamil Nadu. Prepared voucher specimens of wild species such as *Andrographis wightiana*, *Catharanthus roseus*, *Diospyros peregrina*, *Garcinia spicata*, *Jambos ramavarma*, *Syzygium montanus*, *S. rubicunda*, *S. whitianum*, *S. zeylanicum*, and *Ziziphus rugosa* were received from Kerala.

201.3.1 Community gene management system - Orissa

The project is being implemented in three districts of Orissa, namely, Kalahandi, Kandhamal and Koraput with support from the Summit Foundation, USA. All the districts experienced genetic erosion, although the reasons for erosion are different.

There are several reasons for genetic erosion in agrobiodiversity such as poor natural resources management, natural calamities like flood, drought and cyclone, pest and insect attack, consumption of seeds as food during lean periods (food insecurity) and festivals, non-availability of pure seed, introduction and extensive popularisation of HYV of crops by the Government and media over the last 30 years, increasing application of chemical and synthetic pesticides and water scarcity.

Several interventions were taken up to improve the situation through gene-seed-grain-water banks. The Field Gene Bank (FGB) at Koraput has 44 landraces of rice and 5 varieties of finger millets, Kalahandi FGB has 29 landraces of rice, 73 varieties of finger millets, 9 varieties of pops sorghum and 29 varieties of black gram, and the FGB in Kandhamal has 13 landraces of rice and two varieties of pigeon pea. The details of CSB and VGB are given in Tables 2.6 & 2.7.

To support gene security, the approach was to establish seed banks and water banks, which support crop security. To support seed security the grain bank programme was initiated. It prevented villagers from consuming seed as food during lean periods. To retain the agro biodiversity materials, each family of the village under the programme is willing to grow at least one variety.

Rainwater harvesting was a major activity under this project. Villagers of each district built contour dams and check dams to upgrade the ground water table in their region and to restrict flash floods and sand casting on arable land.

As per the micro plans, the following activities have been undertaken:

Community effort towards self-reliance in crop security, leading to livelihood security, where participation by both women and men is very encouraging and has created a precedence for other organizations and villages

Empowerment of Village Development Committee (VDC) or Palli Samiti which has

Table 2.6: *Seed Bank status in different districts in demo villages in Orissa*

District	No of CSBs	Seeds kept	No of Land races	No of FFs contributed	Initial deposits (in kg)	No of FFs who availed of loan	Interest collected (in kg)	Total stock after repayment (in kg)
Koraput	01	Rice	07	61	180.00	29	90.00	270.00
		Finger Millet	02		02.00		01.00	03.00
		Minor Millet	01		35.00		18.00	53.00
Kalahandi	04	Rice	09	121	591.00	38	296.00	887.00
		Finger Millet	03		21.00		10.50	31.50
		Minor Millet	02		08.00		04.00	12.00
		Legumes	03		0.50		00.25	00.75
		Pop-Sorgham	01		0.50		00.25	00.75
		Niger	01		3.50		01.75	05.25
		Pigeon Pea	02		9.50		04.75	14.25
		Maize	01		2.50		01.25	03.75
Kandhamal	02	Rice	09	94	125.00	09	63.00	188.00
		Maize	01		02.00		01.00	03.00

CSB: Community Seed Bank, FFs: Farm families

Table 2.7 *Grain Bank status in different districts in demo villages in Orissa*

District	No. of VGBs	No. of FFs involved	Total grain contributed by the FFs (in kgs)	Grain provided by MSSRF (in kgs)	Initial grain stock (in kgs)	Interest collected (in kgs)	Grain stock after repayment (in kgs)
Koraput	01	57	***	Rice= 200	Rice= 1200	Rice= 600	Rice= 1800
				FM= 150	FM= 150	FM= 75	FM= 225
Kalahandi	01	25	Rice= 50	Rice= 250	Rice= 300	Rice= 100	Rice= 400
Kandhamal	01	37	Rice= 52	Rice= 400	Rice= 452	Rice= 226	Rice= 678
TOTAL	03	119	Rice=102	Rice=1850	Rice=1952	Rice=926	Rice=2878
				FM= 150	FM= 150	FM= 75	FM= 225

VGBs: Village Grain Banks; FFs: Farm Families; FM: Finger Millet

emerged as a powerful institution in the Gram Panchayat, with significant participation by women. All men and women above the age of 18 are members.

Formation of SHGs to initiate micro enterprises, as a result of which activities such as value added rice products have emerged

Facilitation of linkages between SHGs and Palli Samiti to ensure fiscal discipline and better management of group funds.

Construction of check dams and water storage systems to restrict soil erosion, make the village free from drought and to manage agricultural activities throughout the year

Conservation of a number of rice and millet germplasm under *in-situ* on-farm conservation approach as per the decision of the Palli Samiti

Training and exposure to farm families and opinion leaders on vegetable cultivation, land-soil management and poultry rearing

Providing amenities to continue literacy programmes and regular information exchange activities

Establishment of community medicinal plants garden

Demonstration of compost making with greenleaves, waste straw of paddy and cow dung

Programmes on natural pest management to reduce incidence of insects and pests and manage the crop effectively.

In situ on farm conservation of rice and millets in the villages.

Networking and awareness generation: Networking has been established with NGOs and government organizations, welfare agencies, FD and marketing agencies. Awareness has been created among villagers on various development and welfare schemes being implemented by the Government and the means of accessing them.

201.4 Participatory Management of Simlipal Biosphere Reserve

The project supported by the Summit Foundation, USA, was started with the objectives of linking conservation of genetic resources with eradication of poverty and enhanced food security at the household level and integrating Biosphere Management in the context of human development through participatory multi-stakeholder involvement. Working in three demonstration villages (Badagaon, Chapdih, Baniabasa), it sought to achieve this through the promotion of a Gene-Seed-Grain-Water Bank continuum.

Food and Seed Bank

After a study of the food security situation, food bank and seed bank were set up in Badagaon and Chapdih villages. In Baniabasa, the villagers already had a grain bank and its operation was strengthened.

Status in Badagaon demonstration village: The villagers and MSSRF contributed food and seed,

which are being managed by the VDC. The villagers constructed a common storage house with partial contribution from MSSRF. Contributions made by the villagers were in the form of labour and raw materials.

The villagers decided that each household would contribute 10 kg of rice and 10 kg of paddy to the food bank. 54 households contributed 10 quintals of rice and paddy in all, while MSSRF contributed five quintals of paddy to the bank. For the seed bank, local varieties of seeds were collected from the villagers and some samples of landraces were contributed by MSSRF.

Status in Chapdih demonstration village: Initially the food bank was maintained in the President's house, with contributions from the villagers. The food and seed bank in the village have been named after the land donor. When MSSRF left the village, thirty percent of the construction of the storage house had been completed, with the assurance that that it would be completed shortly. The overall responsibility to complete the construction lies with the VDC.

SHGs and micro enterprises

26 SHGs (13 men SHGs and 13 women SHGs) were formed in the three demonstration villages. Of these, 12 groups in Badagaon and Chapdih have started micro entrepreneurship programmes, apart from their regular monthly contribution towards the group fund. Monthly meetings are being conducted regularly and systematically. Inter-loaning has started and record maintenance is proper. A sense of

solidarity has been achieved. The total deposit by all the groups is currently Rs 75,000.

Some of the micro enterprises initiated by the SHGs are described below:

Mushroom cultivation: The Horticulture Department of Baripada conducted a training programme to demonstrate mushroom (DHINGRI variety) cultivation in both Badagaon and Chapdih villages. 50 women trainees (30 from Badagaon and 20 from Chapdih) attended the programme. MSSRF contributed 40 bottles of spawn to start the activity.

The Horticulture Department monitored and evaluated the project and found the results very impressive. The participants were also trained in the preparation of spawn. Women from Badagaon are more skilled and capable in this activity, compared to the women from Chapdih village.

Apiculture: The Integrated Tribal Developmental Agency (ITDA) of Baripada conducted a training programme for 20 people from both the villages (10 each from Badagaon and Chapdih). For demonstration purposes, MSSRF supplied two bee boxes to each village committee.

Following training, ITDA has agreed to supply the required number of bee boxes and also to take care of marketing the honey and other related products. Some young carpenters are willing to prepare the bee boxes and sell it for the promotion of bee keeping in their area. It would help them to develop a new entrepreneurship activity in the area.

Agarbati making from sal gum: As sal gum is abundantly available in the area, Agarbati from sal gum (latex of sal) is a good enterprise. MSSRF motivated groups to start this activity. In the initial period, 20 trainees were identified (10 each from Chapdih and Badagaon) according to their capability. MSSRF arranged for a resource person to impart training. After the comprehensive training they started the activity and the market demand is growing slowly.

Poultry rearing: A programme was organized by MSSRF to impart training in poultry rearing, selection of good productive hens, feeding procedures, housing pattern, disease control etc. The villagers follow the new techniques for the preparation of chicken feed from naturally available raw materials that are nutritious and cheap.

Leaf plate making from Siali leaves: Leaf plate making with machines is four times more profitable than making them manually. The leaves are available in plenty in the nearby forests. MSSRF conducted a study on different aspects and approached ORMAS, Baripada, for marketing leaf plates. MSSRF identified six trainees (three each from Badagaon and Chapdih) in the initial period, who wished to undertake training to initiate the activity. A resource person was arranged by MSSRF to impart training. When MSSRF withdrew from the villages, the training was being conducted. The lead bank had agreed to provide a loan for the purchase of a sewing machine.

Exposure visit to Jeypore site: 12 farmers from the three villages were taken on an exposure

visit to the field site at Jeypore to see the micro enterprises in operation there. The exposure visit had a good impact in the demonstration villages.

Formation of VDC and EDC

Two Palli Samitis/VDCs have been formed, one each in Badagaon and Chapdih village. In Baniabasa village, a Palli Samiti was functioning even before our intervention.

At the suggestion of the Field Director of the SBR, during a visit to Badagaon village, the VDC is now functioning as an EDC. The Director has promised financial support to it. Chapdih VDC is also functioning as an EDC.

In the participatory micro plan it was decided that in Chapdih village, renovation of two wells would be carried out. Two unused wells were renovated with the effort of both MSSRF and the villagers. MSSRF contributed some bags of cement, sand and wages, while the villagers contributed stones and about 150 labour days.

Training programmes and demonstrations in the villages

Training to SHGs and VDCs: MSSRF staff imparted training to SHGs and VDCs on various aspects like record maintenance, book keeping, cash book maintenance, resolution writing, the inter-lending process, fund raising, communication with the bank, and team management.

Training to the Forest Department of Baripada belt: Training programmes on "Self help groups and micro credit" and "Eco-development in Simlipal", were conducted for the Forest

Officers of Baripada belt by MSSRF staff. They were organized and sponsored by the Field Director's office, Baripada.

Demonstration on biofertilizers: A pit with complete structure was prepared by the villagers of Badagaon for the demonstration of vermicompost. MSSRF trained farmers in the techniques related to the use of biofertilizers.

Demonstration on Integrated Pest Management: It was observed in the villages that the crops and vegetables were prone to a variety of pests. Two indigenous methods of pest management were demonstrated to control the pests in the demonstration villages.

Networking and awareness generation

A good network was set up with the NGOs working in Mayurbhanj, the government organizations, welfare agencies, marketing agencies and FD

Counselling on social problems: Many social problems (such as liquor addiction, illiteracy, gender inequality) were perceived in the demonstration villages. Various measures like individual counseling and group counseling were undertaken to address these social problems.

Awareness on other aspects: Awareness has been created among the villagers on various welfare schemes provided by the Government and procedures to avail of benefits.

The Village Committees are now aware of various developmental agencies, tribal welfare agencies and different schemes for

development. They have also been trained on how to approach various agencies to avail of benefits from different developmental schemes.

201.5 BR Barwale Chair in Biodiversity

The B R Barwale Chair in Biodiversity was established to provide technical assistance to the biodiversity components of the projects, particularly those dealing with agrobiodiversity. This year assistance was rendered to the projects supported by the SDC Phase II, THMRC, the Summit Foundation Project at Simlipal, Coastal Bioresources Wetland Project and the ICEF Mangrove Project.

SDC supported project: Inputs were given at the brainstorming sessions on linkages among *in-situ* and *ex-situ* conservation strategies of biological diversity, emerging gender issues in TK and IPRs and case studies conducted in Orissa on community and gender concerns, improving the strategies adopted in marketing millets from Kolli Hills to Food World in Chennai studies on evolving indicators for NRM, biodiversity and poverty at household levels and the BD Act in the light of gender and community concerns..

Summit Foundation project: Reports and articles were prepared on the role of SBR in creating livelihood options based on Biodiversity Conservation. In addition, a detailed report was prepared on identifying development strategies that hinge on nature-based sustainable livelihoods through the creation of a SBR Trust.

The ICEF project: The Barwale Fellow contributed to two workshops at the state level and national level, in communicating the success of the GoMBR Trust and called for the need for the creation of a SBR Trust on similar lines for the conservation of biological diversity, by creating an economic stake in conservation within a participatory framework.

Awareness creation: Efforts were made to promote awareness among people in and around Pallikaranai swamp, located in the outskirts of Chennai, on the importance of conserving the wetland for biodiversity conservation and management of natural resources. Interest groups were created and linked to the District Collectorate to evolve sustainable strategies for effective conservation. Technical inputs were also provided to the Kanchipuram Watershed Committee.

The Environmental Information Systems (ENVIS): Attempts were made to impart knowledge on biological diversity and options in creating an economic stake for people and developing ventures for conservation of biological diversity. For the State ENVIS, contributions were made towards effective documentation of the biological diversity of the state and identification of areas to be emphasized for funding research to enrich knowledge on biodiversity.

201.6 Enhancing the Contributions of Nutritious but Neglected Crops to Food Security and to the Incomes of

the Rural Poor: Asia Component - Nutritious Millets

The role of minor millets in the food security of many developing countries, including India, is well recognized. These crops have been playing an important role in dry land agriculture because of their hardy nature and ability to contribute to the food basket of farmers in spite of the erratic monsoon. Their nutritious properties have been recognized as they have relatively higher levels of sulphur-containing amino acids and lysine in their grain protein, high levels of minerals and favourable vitamin content. Their importance as a source of dietary fibre is gaining increasing attention. Notwithstanding these positive attributes, minor millets as a class have been neglected by researchers and even more by policy-makers, and have been losing ground as a result of the changing cropping pattern and competitive food production and supply management policies in developing countries.

Pilot study

In recognition of their role in expanding the food basket of the rural poor and providing nutritious food and income generation opportunities in the semi-arid tropical regions, MSSRF in collaboration with the IFAD and IPGRI, initiated a pilot study on millets in Asia, involving Indian and Nepalese partners. The study focuses on three minor millets, namely, finger millet (*Eleusine coracana*), little millet (*Panicum sumatrense*) and Italian millet (*Setaria italica*) under the Indian component and on finger millet under the Nepal component. The partners in the Nepal

component are the National Agricultural Research Council (NARC), Kathmandu and LiBird, Pokhara. The partners in the Indian component include the University of Agricultural Sciences (UAS), Dharwad, UAS, Bangalore and CFTRI, Mysore. The project activities in India are located at Kolli Hills in Namakkal district of Tamil Nadu, Jeypore in Koraput district of Orissa and Dharwad, Bellary, and Kolar districts of Karnataka. Value addition activities are being conducted at UAS, Bangalore and UAS, Dharwad. This report covers work under the Indian component.

Activities under the Indian component: Major activities taken up under the Indian component included setting up of a germplasm supply system among rural communities in conjunction with village seed banks; participatory testing of national germplasm, local land races and varieties from national research programmes; refinement in cultivation practices to enhance income-linked productivity; participatory survey for collation of traditional knowledge associated with local land races, their cultivation, utilization and inter-related constraints and opportunities; development of value addition for increased consumption, marketing and income generation and spreading public awareness on the food value of these millets.

Participatory testing

Under participatory testing of national germplasm, local land races and varieties from national research programmes, a total of 6,729 accessions of three crops were assembled from ICRISAT Gene Bank (6,431), All India

Coordinated Small Millets Improvement Project (97) and other millet growing states in North and South India (201). Among these, 5,129 stocks comprising 3,486 finger millet (FM), 1,191 Italian millet (IM) and 452 little millet (LM) were evaluated by MSSRF at Namakkal. The material, as expected, showed a large variation in all traits, with some of the stocks having favourable maturity duration, yield, panicle shape, grain colour and size. All these millet varieties were subjected at maturity to a selection process by the 21 farmers and project scientists involved in crop improvement. Of the 452 LM accessions available for selection, 48 were selected by farmers accessions and 33 by scientists. 28 accessions were common between the two selections. However, when field maturity and other data were used for post-harvest selection of accessions, 24 were found promising. Of these only 13 shared commonality with the selections made by farmers and scientists. Significantly, selection by the farmers did not miss most of the promising accessions.

Out of the 1,191 IM evaluated, a good number of accessions, including some selected ones, were found to have variable intensity of yellow endosperm ranging from dark yellow to pale yellow, suggesting their richness in pro-vitamin A. It is important to note that all data based selections of FM, IM and LM had yield levels significantly higher than the local landraces, with some of them possessing earlier maturity as well. These selections are to be subjected to another round of participatory selection. Similar participatory varietal selection, deploying 15 improved varieties, conducted by

the UAS, Dharwad, involving 20 selected farmers, identified varieties *Sukshema* under LM, *HMT 100-1* under IM and *GPU 26* under FM.

Refinement of cultivation practices, conducted by the UAS, Dharwad showed NPK fertilizer application at 30:15:15 for LM and 50:40:25 for FM led to higher income-linked productivity in Northern Karnataka. Different patterns of intercropping and sequence cropping with millet studied in this region indicated that 4 rows of LM or FM with 2 rows of pigeonpea provided a higher net return.

Participatory survey

A quick participatory survey at Kolli Hills indicated that all the three millets are cultivated by farmers, with more importance given to FM and less to LM. The local land races of FM are *Karakevuru*, *Sattaikevuru* and *Kezhvaragu*, IM are *Palanthinai* and *Senthinai* and LM are *Karunsamai*, *Sadansamai* and *Malliasamai*. These crops are grown invariably in mixtures by broadcasting and also with other crops such as pigeonpea, mustard, bean, grams and maize, with the seed rate of each component being variable from farmer to farmer. With the importance established by tapioca as a cash crop, millet cultivation is not only losing area, but also being pushed to less fertile, steep and rocky terrains. Consequently there is a significant reduction in millet production, leading to reduced consumption and marketable surplus. Shortage of seed is another major reason for decreasing area under these crops.

A similar survey in the Kolar district of Karnataka by the UAS, Bangalore, revealed

that a greater share of millet seed is contributed by farm-saved seed and occasional monsoon failure-related crop loss leads to wide seed shortage and crop area decline during the succeeding season. Some of the traditional varieties are also lost in this process. Farmers attach high value to FM straw due to its high fodder quality. The survey in Dharwad and Bellary districts of Karnataka by the UAS, Dharwad showed that farmers are keen to cultivate high-yielding varieties of these crops but seeds of such varieties are not readily available. A survey on value addition taken up in Dharwad district showed that millet consumption is more regular among millet growers and low-income farm families and more often it is consumed in traditional recipes. They recognize the value of a special variety of IM as a health food and the importance of LM during fasting. However, many of the value addition technologies are unfamiliar to the village communities. This is true in the case of Kolli Hills as well. Except for an earlier milling intervention established by MSSRF to reduce the drudgery of women in the traditional pounding, value addition in millets is totally absent.

Other activities

Bridging the gap between people and technology, promoting entrepreneurship in value addition among village communities, creating the capability to produce good quality seed of preferred varieties and ensuring sustainable supply through seed banks are some of the project objectives. The CFTRI, Mysore, UAS, Bangalore and UAS, Dharwad have developed a range of value addition

processes and value added products from these millets. Most important among them are the use of FM malt in special foods and beverages, blending of milled millets with rice or wheat to prepare traditional and baked foods and the development of a health food for diabetics. Transfer of these technologies and know-how to the farm women and their SHGs is a project priority. So training on value addition processes was organized at different levels. A two-day trainer's training programme was organized at CFTRI for selected housewives, women agricultural officers, NGOs and SHGs. Another training programme was organized for selected women members of SHGs in Kolli Hills, at UAS, Dharwad on FM malt production, using malt for product development and handling machinery associated with these processes. These value addition processes require milling at one stage or another.

Hence, the trained SHGs were provided with mini-milling capability to start value addition of millets at home and initial commercial levels. They have made progress in the production and marketing of FM malt. The problem of seed shortage in millet crops is being addressed by seed multiplication and linking seed supply with village seed banks established in the project villages. This is expected to meet the seed demand of these and neighbouring villages and enhance capability in quality seed production, apart from assisting conservation of local land races. While working with the villagers to promote these crops, MSSRF is also generating awareness among policy makers on the need for reviving interest in these crops.

Sub programme Area 202

Molecular Mapping and Genetic Enhancement

Advances in the field of biotechnology and molecular biology have opened up new avenues of research for the conservation, enhancement and management of bioresources. The ongoing programme on molecular mapping and genetic enhancement has been making concerted efforts since its inception for the application of modern molecular techniques in the characterization, conservation and enhancement of coastal bioresources. It also aims at understanding the genetic relatedness and diversity among cultivars, landraces and wild relatives of crop plant species. The major objectives of the ongoing programme are to analyse genetic diversity and species relationship among Indian mangrove species using molecular marker technology as a prelude to genetic conservation, and isolate and characterize stress tolerant genes, particularly salinity, to develop salt tolerant crop varieties for coastal agri-ecosystems.

202.1 Genetic diversity of black gram (*Vigna mungo*) landraces from a secondary centre of genetic diversity as evaluated by AFLP markers

Twenty-six black gram (*Vigna mungo*) landraces, collected from Kalahandi district in Orissa, India, were analyzed in the present

study. They were analyzed using seven primer combinations. The total number of AFLP loci recorded per primer combination varied from 47 in E-ACG x M-CTA to 67 in E-ACG x M-CAA. A combined analysis of seven primer combinations yielded 397 AFLP loci of which 343 were polymorphic. The percentage polymorphism across the landraces ranged from 74.5 (E-ACG x M-CAG) to 93 (E-ACG x M-CTG).

The present study therefore points to a high degree of genetic variability, despite no discernible morphological variation among the 26 landraces analyzed. In fact the only variation observed in these landraces relates to longer maturation period (120 days) in a few landraces. A dendrogram was constructed, based on simple matching coefficients, taking into account the presence or absence of the bands and ignoring their intensities. These showed three major clusters. The first cluster comprised four landraces at a similarity of 78%. The second cluster was a larger one that included 16 of the 26 landraces at 74% similarity. A separate cluster at 68% similarity comprised 2 landraces, while the remaining four formed *Operational Taxonomic Units* (OTUs). Principle component analysis (PCA) was performed using the same data in order to obtain a better understanding of the relationships of the landraces. The first principal component accounted for 58% of total variation. All the samples were tightly grouped and formed four distinct groups. These four groups revealed 2, 8, 10 and 5 landraces. Three samples showed distinct clustering in the dendrogram as well as the PCA; hence another

PCA was done without the three samples. This data grouping was in tandem with the dendrogram results. Absence of geographic exchange of genetic material that contributed to the genetic distinctness of the landraces could well be utilized for future breeding work.

202.2 Genetic Enhancement

Construction of the cDNA library: Total RNA was isolated from one year-old *Avicennia marina* plants that had been collected from their natural mangrove habitat (Pichavaram, Tamil Nadu, India). The root systems of intact plants were submerged in a nutrient solution supplemented with 500 mM NaCl for 48 hours. Total RNA from leaves of *A. marina* was isolated, from which poly (A+) mRNA from the leaf tissue was purified and cDNA was prepared using the Superscript Lambda System. The cDNAs were size fractionated over SizeSep-400 spun column and directionally cloned in 5' *Sall* - 3' *NotI* sites of pSPORT1. This cDNA library was transformed using *Escherichia coli* DH5 *alpha* competent cells. A total library of approximately 1,00,000 recombinants was obtained.

Sequencing and analysis of the EST clones: This forms the foundation for a large scale Expressed Sequence Tag (EST) project. ESTs are partial sequences of 300-500 base pairs read from a cDNA clone. Plasmid DNA was extracted from randomly selected clones, using the alkaline lysis method. Single run sequencing on the 5' end of each cDNA clone was performed on an automated DNA sequencer (ABI Prism 310, Applied Biosystems) with the BigDye Terminator kit using M13/

pUC18 reverse primer. 52 clones were also sequenced from the 3' end with the universal standard M13/pUC18 forward primer. After editing to remove the vector and adapter sequences, each EST was subjected to both a BLASTN and BLASTX search provided by the National Centre for Biotechnology Information and compared with the nonredundant protein databases. Default parameters of the programme were used in both cases. A stringent *P* cutoff value (the probability that alignment would be generated randomly is $1 < 1000$) was used to determine the homology of ESTs to known proteins. Each EST sequence was classified as a single hit or redundant (two or more copies in the library or when they exhibited more than 95% identity over aligned regions). Redundant ESTs were assembled in overlapping contigs and nonoverlapping sequences that correspond to different parts of the same gene. ESTs were identified as the protein showing the highest score among the candidate proteins and classified according to 12 functional categories. A total of 1,700 ESTs have been deposited at NCBI.

Reverse Northern hybridization: 52 cDNA clones were selected for further study, based on their sequence analysis (significant homology in TBLASTX results, presence of an initiation codon for the ORF and a poly A tail). 10 ng of these clones were amplified using M13F and M13R primers in a 50 μ l reaction volume. 18S and PR244 were used as controls. 1.5 μ g of Polymerase Chain Reaction (PCR) amplified products were electrophoresed, transferred to nylon membranes and immobilized via UV crosslink.

2 μ g each of mRNA from control and salt treated leaves were reverse transcribed for 1 hr in the presence of 50uCi 32 P (dCTP). The twin filters were hybridized, one set with the control radiolabelled cDNA probe and the other with the treated radiolabelled cDNA probe in hybridization solution for 12-16 hr, at 65 °C then washed for 15 minutes each, with 2X SSC, 0.1% SDS and 1X SSC, 0.1% SDS. Membranes were wrapped in cellophane and exposed to Kodak X-ray films at -80°C and developed after 3-48 h exposure.

Full length gene sequencing was performed for 5 clones (PR177, PR379, PR541, PA89 and PA188). These 5 were selected as they had a size range of 750 - 1,000 base pairs.

Characterization of PC57: PC57, one of the ESTs sequenced from the *Avicennia* library, showed significant homology to *rab18*, an abscisic acid and drought-induced gene from *Arabidopsis*. Upon sequencing, the clone was found to have the polyA tail showing that the 3' end of the gene was complete. Analysis of the ORF showed that there was a premature stop codon in the coding sequence. The translation preceding and following the stop codon showed significant homology to the same dehydrin, *rab 18*. Sequencing the clone with gene specific primers revealed no errors and the ORF continued to show premature termination. Gene specific primers were then designed to amplify the complete ORF by RT-PCR from mRNA isolated from roots of *Avicennia marina* treated with 0.5 M NaCl. A 588 bp product that was obtained was cloned in a T-vector and sequenced. Upon sequencing the RT-PCR

product, a region corresponding to about 102 bp was found to be missing as compared to the original PC57 clone. The ORF was found to be restored upon removal of this segment. The original PC57 clone probably represents an incompletely processed heterogeneous mRNA with a 102 bp intron that was not cleaved. The primers for RT-PCR have been designed to include restriction sites to facilitate cloning into pET28a (*E. coli* expression vector).

Northern analysis of total RNA isolated from salt treated (0.5M NaCl) roots of *Avicennia marina* suggests that expression is sharply induced at 6 hr of salt treatment and this expression level reduces gradually until 48 hr salt stress. Upon withdrawal of salt stress (12 hours), gene expression reduces approximately 3-fold. In leaves, the expression is increased approximately 1.5 fold at 6 hr of stress and reduces below control levels at 12 hr of stress. At 24 and 48 hr, the levels are approximately twice those of control. Upon withdrawal of salt stress, the expression level is seen to decrease at 12 hr and then equalize at 24 hr. Western blot analysis of total leaf extracts (12 hour salt stress) with anti-dehydrin antibodies (gifted by Dr Close) reveals the presence of a single band of about 25 kDa. The size obtained corresponds with the molecular weight of *rab18* like protein from *Avicennia marina*. Further analysis of expression pattern of this clone is being carried out.

Isolation and cloning of the gene coding for Super Oxide Dismutase (SOD) in binary vector: A cytosolic Cu/Zn SOD gene coding for the enzyme SOD was previously isolated from the

Avicennia marina cDNA library. It was named AMSOD1 and cloned into a binary vector pCAMBIA 1301. The full length gene was released from the *Sma*I and *Sna*BI site of pSport1 vector and was cloned into the *Sma*I site of the pCambia 1301 vector. This construct was named pSF SOD and mobilized into the *Agrobacterium* strain LBA 4404. This strain, containing the binary vector, was used for subsequent transformation experiments. Another isozyme of SOD - MnSOD was isolated from the same cDNA library. The gene was sequenced from both the 5' and the 3' directions and the full length of the clone was submitted to the gene bank (Accession no: AY137205).

Transformation of AMSOD1 into rice: Rice calli were generated from mature seed scutella of Pusa Basmati 1 on a callus induction medium. The calli were then infected with the LBA4404 carrying pSFSOD1. The infected calli were washed and selected on the callus induction medium containing hygromycin for a period of six weeks. The selected calli were then transferred to the regeneration medium containing hormones that induce shoots and hygromycin. The regenerants were transferred to the rooting medium for induction of root formation. The regenerants were initially screened for the presence of the gene by PCR using gene specific primers designed in the 3'UTR (Untranslated Region) of the transgene. The regenerants were then transferred to the hardening medium for a period of two to three weeks and finally transferred to the soil in pots for seed setting. The flowering tillers of the rice plants were then bagged with the onset of

flowering in order to ensure self-pollination. The selfed seeds were then collected and again sown for the next generation. The T1 generation plants were then screened for the presence of the gene using PCR. Subsequently a southern blot was performed in order to analyse the T1 transgenic plants for the presence of the gene. The expression of the gene was confirmed by the isozyme technique and staining for isozyme. The second generation of selfed seeds raised from the T1 generation were tested for the presence of the gene and confirmed using PCR, Northern hybridization and Isozyme analysis.

Characterization of catalase isoforms

The multifarious functions of catalase require that the enzyme evolves different isozymes coded by different genes for the various roles it plays in plant systems. The plants have therefore multiple catalase isozymes, ranging from two isozymes in castor bean to three in tobacco and *Arabidosis* and five in spinach, maize and cotton. Therefore, experiments were conducted previously to isolate catalase variants from *A. marina* by using AmCAT1 as a probe to screen the cDNA library. After a step-wise isolation method, a clone differing in size was isolated. This clone was designated AmCAT2.

Physical map of AmCAT2: A physical map of AmCAT2 with restriction enzymes showed differences from the map of AmCAT1. Hence, complete sequencing of both strands of this clone was undertaken to characterize this variant. Sequencing of AmCAT2 showed that it is 2,280 bp long. It was also found that there

is 400 bp insertion that disrupts the coding region of AmCAT2. *Web cutter* analysis of the AmCAT2 showed that the *EcoRI* site was not found in AmCAT1 at 1,385 bp. Another difference in the restriction pattern was the presence of two restriction sites for *Sall* at 10 bp and 1,873 bp.

Efforts were made to find the basis for the uniqueness of the 400 bp insertion in AmCAT2. It was presumed that this insertion could be an intronic sequence. Initial sequence analysis of this 400 bp revealed the common characteristics of intronic architecture. Work was therefore initiated during this period to confirm the presence of intronic sequence in the cDNA clone AmCat2 by two methods: RT-PCR analysis of the stressed *Avicennia marina* plants for both the splice variants and isolation of the Genomic clone of catalase to confirm the unspliced transcript.

RT-PCR analysis of *A. marina* RNA

The presence of the transcripts CAT1 and CAT2 in RNA samples of *A. marina* was analyzed by amplifying the 400 bp region that was different between the two-catalase forms. Total RNA was isolated from leaves of the mangrove plant and then purified for getting the m-RNA. RT-PCR analysis showed two fragments, which could confirm the presence of two transcripts coding for AmCAT1 and AmCAT2.

PCR amplification of Genomic catalase: Cloning of catalase of genomic origin was done to confirm if the catalase variant AmCAT2 has the intronic message. A modified PCR reaction

was done to amplify the coding sequence of the *Avicennia genomic* catalase. An initial PCR reaction was done by designing two primers CAT1F and CAT1utr to amplify the target sequence. This initial PCR product was used for a second round of amplification reaction with a nested (internal) primer CAT1R. The PCR amplicons were loaded to check the length of the PCR product. A 2.0 Kb product was obtained

Cloning of PCR product: The PCR product was cloned using a TA cloning system of *MBI fermentas*, eluted and purified. The purified DNA was ligated to an *Ins T/A* vector. The ligated DNA was then transformed into *E.coli* DH5 alpha cells. X-gal analysis of the transformed cells revealed many white colonies. The white colonies were streaked on to fresh plates, plasmid isolated and sequenced. Initial sequencing of the plasmid clone showed that these could be catalase clones. Further full-length sequencing of the genomic catalase clone was carried out and it was deposited in NCBI Gene Bank under the Accession Number AY272049, coding for *Avicennia marina* catalase gene.

The genomic clone is 2,036 bp and is interrupted by a 446 bp intron between 1,267 bp and 1,713 bp. The AmCAT2 and the genomic clone had similar sequence, thus confirming that AmCAT2 had the un-spliced variant of catalase gene from *Avicennia marina*.

The presence of intronic sequence in the cDNA could be due to the failure of proper intron recognition or excision. Interestingly, previous reports on such unspliced messages suggest

that though splicing is in general, an efficient and accurate process, there were reports on the presence of intronic messages in cDNA. Researchers hypothesize that such splicing failure could be a common experience in plants growing in variable environments.

Cloning of AmCAT1 in an E. Coli expression vector: AmCAT1 from the *E.coli* DH5 α was transformed to the strain BL21-codon plus-RP strain. These strains could be used for protein expression studies with protein expression vectors from Life Technologies, driven by non-T7 promoters. Transcription from the ribosomal binding site was induced by adding 1mM IPTG to the culture medium. Total protein from the un-induced and induced bacterial cultures was extracted and resolved in 10% SDS-PAGE. SDS-PAGE analysis showed induction of the catalase gene from *A. marina*. Efforts are underway to confirm whether the catalase 1 from *Avicennia marina* could complement the activity of *E. coli* catalase mutants.

Drought tolerance studies: Water availability and water use in agriculture in the coming years hold the key for sustained agricultural productivity. Work has been initiated on isolation of genes responsible for drought tolerance from *Prosopis juliflora*.

The attractive feature of *Prosopis juliflora* is its extreme heat and drought tolerance. The plant can tolerate water potentials as low as -4.8 megapascals while most crop plants cannot tolerate water potentials below -1.5 megapascals. Seeds of *Prosopis juliflora* collected from Kudankulam were treated with 70% HCl

for easy germination and then sowed in polythene bags in a mixture of red soil and farmyard manure (1:1). Half of the one-month-old plants were subjected to drought stress by withholding water. Total RNA was isolated from leaf tissues of water stressed and control plants at different intervals (15, 20, 25 and 32 days of drought stress). Relative water content and morphological data (plant height, number of leaflets, length of the sixth leaf, breadth of the sixth leaf etc.) of control and stressed plants were measured before isolating the RNA. mRNA was isolated from all the RNA samples. This will be used for cDNA library creation and differential gene expression studies.

Sub Programme Area 203

Monitoring Ecosystem Health using Microbial Diversity

Having completed the first phase of indexing and documenting growth-promoting bacteria, prospecting them for their functional efficiency and developing a site-specific ecological methodology to quantify lichen diversity and forest/urban quality, the project moved on to the second phase of product development. Fresh initiatives were also taken to extend the work to other study sites.

203.1 Microbial Diversity in Coastal Agri-ecosystem

The recent intensification of research on natural resource and input management for

suitably enhanced production to feed millions signifies more pressure on land resource. In such a situation the importance of beneficial plant-microbe interaction to mitigate the problems of soil stress/pollution, compliment plant mineral nutrition and minimize soil diseases can be hardly exaggerated. To harness bacteria which are beneficial to plant growth, it is necessary to understand thoroughly the individual growth and survival characteristics of each beneficial microorganism and its nutritional and environmental requirements. It is in this context that the study carried out over the last few years to understand the diversity and functional efficiency of these organisms in the coastal belt gains importance. The study moved from a phase of isolating/characterizing and screening the functional efficiency of microbes under laboratory conditions into the next phase of evaluating it under greenhouse conditions, before venturing further.

Twenty strains of *Azospirillum brasiliense*, which could tolerate 500 mM NaCl short-listed from 302, confirmed *Azospirillum* strains isolated from the coastal belt, were tested for their growth promoting ability under 25% artificial saline water in the greenhouse in two rice varieties, CO43 and White Ponni. CO43 is a salt tolerant variety widely used in the breeding and development of salt tolerant varieties and White Ponni is one of the varieties grown in the coastal area. Both CO43 and White Ponni showed consistent increase in growth with the age of the plant. A maximum of 27% increase in height was observed in CO43 with the *Azospirillum* strain MSA148 without

ammonium nitrate application. The maximum increase in dry weight of 44.8% with only *Azospirillum* inoculation was observed with MSA 146 in White Ponni. These observations clearly show the superior performance of the selected strain under saline conditions. The enhancement of plant growth after inoculation with *Azospirillum* might be caused by better root development, which in turn may increase mineral uptake and crop yield. Conspicuous morphological changes in the root system due to its association with *Azospirillum* were reported earlier. In this study also, the root morphology of *Azospirillum*-inoculated rice seedlings showed more dense development of lateral roots than the uninoculated control plants. *Azospirillum* inoculation has been reported to modify the concentrations of free IAA and IBA as well as the specific respiration rate and specific activity of enzymes in the tri carboxylic acid cycle and glycolysis pathway in the roots. These morphological and biochemical changes enable the roots to take in more water and mineral nutrients, resulting in faster growth. Plants which showed significant increase in height and dry weight were analyzed for the total nitrogen content also. In this study, a maximum of 67.9% increase in nitrogen content was observed. The efficient strains, which showed significant increase in dry weight and height, were also found to increase the total nitrogen content of the plant. From the 20 strains tested, seven strains (MSA146, MSA 148, MSA160, MSA210, MSA 222, MSA274 and MSA289) that showed significant increase in plant growth as measured by plant height,

dry weight and total nitrogen content were selected for field trial. All selected strains were also subjected to survival analysis. The initial analysis showed low MPN value in 20-day-old plants. However, there was an increase in the number of cells after 20 days, suggesting that there was an initial time lag for their establishment in the soil.

Further studies had to be conducted to make a comparison with newly reported genera and species to confirm the novo state of the dual property species proposed. Based on the additional tests carried out in terms of fatty acid profile and some more bio-chemical tests, the sps nov has been proposed as genera nov too and the results have been communicated. Further studies were also done to study the colonization pattern of this particular bacterium in saline and non-saline paddy to test its colonisation ability. To study the colonisation of *Porteresia coarctata* (wild rice), Pokkali (salt tolerant variety), and Ponni (salt sensitive variety) by the novel strain PA12, seedlings under sterile conditions were inoculated with PA12 tagged with *gusA* gene. 24 h after of inoculation the roots of *Porteresia* were stained blue with X-Gluc indicating intensive colonisation of isolates on the root. The cells were distributed mainly on the root surface. After seven days, more intensive colonisation was observed in the lateral root emergence. The sections of root from 15-day-old plants showed the presence of isolates only in the epidermal region of the root. The rhizosphere populations of the roots increased up to 15 DAI and the maximum population was reached after 7 DAI, which then remained

stable for a further 15 days of observation. Inoculated samples of Pokkali (salt tolerant variety of paddy) roots, showed blue colour after 24 h incubation. Cells were distributed mainly on the root surface. More intensive colonisation with fibre attachment was observed in the emerging lateral roots. (15 days after inoculation) transverse sections of roots showed GUS activity within many of the cortical intercellular spaces next to the stele and within the aerenchyma. Both the external and internal populations, particularly of the roots, increased up to 15 DAI. The bacterial population then remained stable for a further 15 days of observation. In Ponni (salt sensitive variety), the root showed very low colonisation of isolates since the blue color was not predominant. The cells were on the root surface. The sections of root from 7-day-old plants showed the presence of isolates only in the epidermal region of the root. Both the external and internal populations, particularly of the roots, increased only upto 6.1×10^5 even after 15 DAI.

More experiments have been initiated at the greenhouse level to take the strains short-listed for their functional efficiency for the coastal belt. To study the effect of differential salinity levels in soil on the functional efficiency of the beneficial organisms, soil was brought in from four study areas with E.C. values ranging from 0.54-8.63 (mS/cm). Physico-chemical characteristics were analyzed in terms of pH, available nitrogen, phosphorus, potassium and texture and lime status. Four strains of efficient phosphate solubilisers were tested in paddy (CO43). Similar studies have also been initiated to test them in black gram and green gram.

Survival rates of the organisms are being tested periodically by enumerating their colony counts and on harvest the crop weight and phosphorus content will be monitored. These tests will be repeated twice and then the strains will be taken to the field. Further studies will also be done in combination with *Azospirillum* strains in these crops and other vegetable crops.

In order to extend the work to other study sites, the DBT has sanctioned a project to characterize the rhizosphere Plant Growth Promoting Bacteria (PGPB) in selected mangroves and mangrove-associated plants. In India alone the area under mangroves is distributed over 4,900 km, i.e. about 8% of the coastline, and provides a source of livelihood to the people living in close proximity to it. Although mangrove ecosystems are rich in organic matter, in general they are nutrient-deficient, especially in nitrogen and phosphorus. It is also proposed that a decrease in the bacterial population in a deforested mangrove area in India is being probably caused by increased soil salinity in the absence of mangrove trees. Inoculation of plants with plant-growth-promoting bacteria has been proposed as a useful agricultural tool to enhance crop yields and it may be possible to use PGPB to speed up the development of mangrove plantlets for reforestation of the damaged areas or even to create artificial mangrove wetlands out of wastelands. PGPB specific to mangrove ecosystems are unknown. Limited work initiated in this direction has shown encouraging results. The proposed work is to carry the strength of this group into the mangrove area to understand if any specific

PGPB can be identified and understand the diversity associated with them. This will help in harnessing them towards the revitalization of the nurseries and increasing the survival rates for effective restoration activities.

203.2 Lichen Research

Lichens are symbiotic organisms of fungi and algae and contain a great number of organic compounds commonly known as "lichen substances" which are more or less typical of this group of cryptogams. These substances have many ecological functions such as excessive light screening, antibiotic, antiherbivory and antidessication. Globally only 700 compounds have been isolated from a small number of lichens out of 13,500 lichen species described so far. The secondary chemistry of many of the tropical lichens is still unknown or remains under-explored and these organisms may serve as the potential source of novel compounds.

The large-scale quantitative data collection and characterization of lichen diversity from the Siruvani Hills (Western Ghats) facilitated the screening of some of the potential, chemically rich lichens for their secondary compound profiles. Preliminary screening of secondary compounds was carried out on species belonging to *Dirinaria*, *Heterodermia*, *Parmotrema*, *Phyllopsora*, *Ramalina* and *Usnea* and these species will be taken up for further studies later. Extensive extraction of lichen compounds from *Rocella montagnei* was carried out with solvents in the increasing order of polarity and this yielded four different crude extracts of the secondary compounds, which

were subsequently screened against *Staphylococcus aureus*, *Proteus mirabilis*, *Proteus vulgaris*, *Salmonella typhi* (Typhoid), *S. paratyphi A and B*, *Shigella flexneri*, *S. boydii*, *Vibrio cholerae* (Cholera), *Pseudomonas aeruginosa*, *Klebsiella pneumonia* (pneumonia), *Bacillus subtilis*, *Corynebacterium diphtheriae* (Diphtheria) and *Candida albicans* (whitspots on the skin).

Lichen crude extracts showed anti-microbial activity in the form of a zone of clearance in the disc-diffusion assay. Lichen extracts from *R. montagnei* have shown maximum activity in the form of a wider zone of inhibition against *Staphylococcus aureus* and *Klebsiella pneumoniae*. The concentration levels of the crude extracts along with the positive and negative controls were noted and it is evident that each of these extracts has different activity levels.

Lichen culture: A major obstacle to the mass production of lichen substances is that they cannot be satisfactorily cultured in either fermentors or glass-houses, or even cultivated. This reflects a generally poor understanding of the environmental conditions necessary for the maintenance of the symbiosis. Industrial production of useful lichen compounds where feasible, currently involves extraction of lichens gathered in the wild. However, a majority of the species form thin crusts over their substrata, making harvesting on a commercial scale impractical. The mycobionts and the photobionts isolated from the symbiosis can be grown on artificial media. Hence protocols have been standardized for the mass multiplication of the isolated fungal and photosynthetic partners in *R. montagnei*,

Parmotrema sp. *Porina mastoidea* and *Leptogium* sp. The cultures are at various stages of development and are monitored for the production of secondary compounds.

Impact of cement dust on lichen diversity: Adverse environmental conditions affect lichen communities in many ways such as species loss, gross distribution pattern changes, reduction in population size, reduction in reproductive potentials of individual species etc. Hence lichens are used as indicators of air pollution levels in many parts of the globe. In order to study the impact of cement dust pollution on its diversity within the hot spot, ecological studies have been initiated on lichen diversity and distribution pattern in the Madukkarai region of Coimbatore district. So far 5 transects have been laid around the cement factory near Walayar Reserve Forest. Preliminary analysis indicates a no-lichen zone (lichens absent) within the 3-4 km radius of the factory, followed by a sparse lichen zone (up to 12 km; maximum 16 species). The lichen diversity in the slopes facing away from the factory remain unaffected.

Sub programme Area 204

Conservation and Bioprospecting of Endangered, Medicinal and Mangrove Species

The thrust of this programme has advanced to the transfer of the mangrove propagation technology to the field, with the objective of establishing bioenergy plantations in the

coastal areas with community participation and identifying antipest compounds from selected plant species.

204.1. Bioprospecting studies

Identification of antipest compounds from Excoecaria agallocha: *Helicoverpa armigera*, a lepidopteron, is considered as one of the world's most damaging and devastating polyphagous pest. It is a pest on cotton, tomato, tobacco, corn and pulses. Among these, pulses are very badly affected by this pest, and loss, according to ICRISAT surveys, reaches more than \$300 million per year in chickpea and pigeon pea alone. The problems associated with the large-scale use of synthetic pesticides and the speedy evolution of insecticide-resistant populations dictated the need for effective, biodegradable pest control materials which have greater selectivity. Plant resources have been an important alternative since they are safe for non-targeted organisms and are eco-friendly in nature, ensuring a non-polluted environment.

Excoecaria agallocha, a medicinally important mangrove plant, was selected for the study, to develop antipest formulations against *H. armigera*. After a series extraction with hexane, ethyl acetate, methanol and water, all the extracts were tested for their activity against *H. armigera*. The hexane extract and aqueous extracts showed promise of insecticidal as well as antifedency properties. The larvae fed on artificial diet with Hexane extract at 5% concentration and aqueous extract at 1% concentration showed the highest larval mortality and no moth

emergence. The activity is comparable to commercially available formulations like Ekalux and neem gold. The antifedency index was highest in the treatments which constituted 0.5% aqueous extract or 2% hexane extracts. The hexane extract was further fractionated and made into 12 pools, based on the TLC profiles. These partially purified fractions were subjected to antifedency experiments. The fractions 2, 3, 10 and 12 showed an increase in antifedency index, higher than that in the crude extracts and positive controls like Ekalux and neem gold. Experiments are underway to characterize the bioactive fractions and greenhouse evaluation of these compounds.

204.2. Establishing Efficient Bioenergy Plantation in Coastal Areas with Community Participation

Vegetative and tissue culture propagation protocols were developed earlier for several mangrove species. During the current year studies were initiated to develop community nurseries and establish mangrove plantations with community participation.

Establishment of field nursery: The plantlets of various mangrove species such as *E. agallocha*, *Avicennia marina* and *Ceriops decandra*, developed through various propagation methods (seed, vegetative and tissue culture) were transferred to the field nursery at Keelavanjore, Karaikal. Approximately one lakh plants are available as of today, which are ready for field transfer.

Interaction with local communities and formation of SHGs: Four women SHGs were formed in Karaikal, Pondicherry, with 15 members in each group. All the members are landless agricultural labourers or rain-fed farmers with very small land holdings (less than one acre). Their agriculture season is only for six months and very often there is crop failure due to poor monsoon and no water in the Kaveri river.

These SHGs are being trained in maintaining a nursery, with vegetative propagation of selected species, for maintaining micropropagated plantlets. Initially two low cost mist propagation facilities are being established for vegetative propagation and hardening of tissue culture propagated plants.

Establishing bioenergy plantation: A 20 ha site was selected in Karaikal, Pondicherry. The soil salinity of the site is 25 ppt and water salinity is 35 ppt. A very small mangrove patch was present in the selected site before plantation activity was undertaken. Initial experiment of field transfer was conducted in 3 ha area with 2,000, 7,000 and 4,000 saplings each of *Excoecaria agallocha*, *Avicennia marina* and *Ceriops decandra* respectively. The mangrove plantation was undertaken in 3 ha from December to February, just after the northeast monsoon period, with community participation. The data on biophysical parameters such as soil characteristics, water quality and growth rate is being recorded.

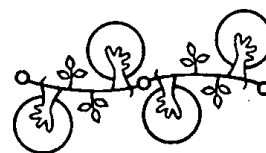
204.3. Salinity Tolerance Studies

Sesuvium portulacastrum L. is a mangrove associated CAM plant that can tolerate NaCl

concentrations up to 500 mM *in vitro*. It is widely distributed across the coastal lands and adapted to diverse soil conditions. This plant is being used by local communities as a green leaf vegetable. Studies on the nutritional qualities of this plant species have been presented in earlier reports. This plant is chosen to study the mechanism of salt tolerance because of its herbaceous habit, natural habitat preference in saline areas and CAM photosynthesis in adverse environments.

cDNA subtraction was carried out between control and salt stressed (400 mM for 7 days) plants to clone over 50 differentially expressed genes under salinity stress. Sequencing results carried out so far have shown several interesting genes viz. Ethylene Responsive

Element Binding Factor (EREBP), Ankyrin, RAB7, Putative senescence-associated protein, Elongation Factor (EF 1a), Late embryogenesis associated protein (LEA), Putative transposase, Alpha-mannosidase, OsRac3 like small GTP-binding protein, Suppressor of K⁺ transport growth defect-like protein, Pyruvate dehydrogenase kinase, Glutamate synthase, 3 - Phosphoglycerate dehydrogenase etc. Experiments are underway for the identification of full-length genes and characterization of EREBP, known to influence the expression of an array of genes during abiotic stresses and Phosphoenol Pyruvate Carboxylase (PEPC) which is known to play an important role in sustaining yield during various abiotic stresses.



Ecotechnology

The year saw the Ecotechnology Centre focusing on capacity building and sustainability of the grassroot institutions that have emerged. Twenty-seven thousand, four hundred and forty-four trainee days in various areas of sustainable development were achieved, with more than sixty five percent of the participants being women. The Youth Employment Summit (YES) 2002 conferred the YES Innovator Award on Poomani Women's SHG of Kannivadi. A significant development was the acceptance of the Biovillage model by SBI as a strategy for rural credit management and supporting extension of the activity in Pondicherry.

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Sub Programme Area 301

JRD Tata Ecotechnology Centre

The JRD Tata Ecotechnology Centre continues to evolve methodologies for sustainable development through participatory research, capacity building and grassroot institution building. The Centre also carries out laboratory research at Chennai to support the developmental activities at the field. The Biovillage concept, which combines livelihood security with the sustainable management of natural resources, is being extended to more villages. It develops entrepreneurship among the rural poor and focuses on environment-friendly enterprises, which promote eco-jobs. This report describes the activities carried out by the grassroot institutions whose formation was facilitated by the Centre.

Table 3.1 gives a broad outline of the activities of the Centre. This year the administration of projects at Pudukottai, Kolli Hills and Karaikal have been shifted to SPA 302, SPA 201 and SPA 204 respectively. However, the Centre, in keeping with the interdisciplinary approach adopted by the Foundation, continues to support the various activities carried out in these project sites, in the areas of capacity building, promoting gender sensitivity and identifying suitable micro enterprises. Since 2002, the Centre is working in Thonimalai, in Dindigul district of Tamil Nadu to evolve a model of sustainable development for the hill region.

In continuation of the recommendations made by Dr Manjul Bajaj during her review in 2002, the following measures have been implemented:

- Two staff members with experience in economics and banking, have been appointed.

Table 3.1.: *Region-specific activities of JRD Tata Ecotechnology Centre*

Region	Area	Focus
Coastal	Chidambaram in TamilNadu; Pondicherry and Karaikal in Pondicherry; Mallikapur and Gayaspur in Orissa	Water-use efficiency, soil conservation, alternative agriculture pattern and disaster management
Hill	Thonimalai near Kannivadi in Tamil Nadu	Agro-biodiversity and food security, linking conservation and development through ICT
Semi-Arid	Kannivadi in Tamil Nadu	Value addition to the time and labour of rural poor, increasing the productivity of rainfed agriculture system
For all the above	Chennai	Coordination, laboratory studies

- Insurance of the micro enterprises has now become a regular feature, with the SHG members themselves negotiating the terms with the insurance company. SHG members are also taking up group insurance.

The important activities of the year may be summed up as follows:

- The Centre facilitated the management of nearly 300 SHGs and four federations, with an annual turnover of nearly Rs 4 crores.
- Capacity building to the tune of 27,444 trainee days in various areas of sustainable development took place; more than 65% of the participants were women.
- The evolution of grassroot institutions into development agencies, with organisations like Reddiarchatram Seed Growers Association (RSGA) conducting direct training programmes on sustainable agriculture to the tune of 4,000 trainee days, thereby facilitating horizontal transfer of knowledge, is an important development.
- A Medium Range Weather Forecasting Meteorology Station has been set up at Kannivadi. RSGA operates the weather station and provides weather forecasting for a radius of 20 km in and around Kannivadi.
- The innovative adult literacy programme, using modern information and communication technology, has enabled 150 illiterate people to become literate. This programme was evaluated by the Commonwealth of Learning (COL).
- The staff of the Centre published 4 papers, 1 monograph and 1 book.
- Project completion reports have been submitted for the following projects:
 - *Mission Mode Projects on Ecoaquaculture* to DBT
 - *Feeding the Rice Plant without Ecological Harm* to DBT
 - *Bio-utilisation and Conservation of Minor Millets* to Hindustan Lever Ltd
 - *Horizontal Transfer of Knowledge* to COL
 - *Adult Literacy through Information and Communication Technology (ICT)* to COLLIT Programme of COL
- Funding agencies have evaluated the performances of the following project activities during this year:
 - NABARD on Precision Farming
 - COL on Horizontal Transfer of Knowledge
 - COL & DFID on Adult Literacy Through ICT
- The evaluation of the project on Horizontal Transfer of Knowledge encouraged COL to support the second phase of the project.
- The Centre facilitated SHGs to establish 70 eco-enterprises.

- The Centre completed the third year field trials of the impact of grass carps in controlling water hyacinth and the fourth field trial on the impact of *Dodonaea* in controlling American bollworm.
- Grassroot institutions were promoted as development agencies through various activities:
 - The school building at Thonimalai was constructed by the village community and inaugurated by the District Collector of Dindigul. Prof M S Swaminathan participated in the function from Kannivadi through video conferencing with the Collector of Dindigul who was at the terminal installed in the school on 1st May, 2003.
 - A Community Bank was established in collaboration with *Kulumai*, a Federation of SHGs in Kannivadi. *Kulumai* also monitors the activities of SHGs.
 - The Integrated Intensive Farming System (IIFS) demonstration plot was handed back to the farmer who is continuing the practice of IIFS on his farm.
 - Grassroot institutions facilitated the promotion of the use of biofertilisers and biopesticides in more than 5,000 acres in Kannivadi region.
 - They also facilitated negotiations between various stakeholders on issues such as pricing of agricultural products and wages of agricultural labourers.
- New interventions such as horticulture in Kendrapara and Chidambaram, System of Rice Intensification in Pondicherry and Kannivadi and Zero Energy Cool Chamber at Kannivadi were tested.
- New eco-enterprises, such as local transport using a battery operated zero-emission vehicle by the members of a women SHG in Pondicherry, were introduced.
- The bioactive compound in *Dodonea sp.* that shows biopesticidal properties has been identified as oleandrin through HPLC, GCM and NMR studies.
- Networking has been established with institutions such as Ponlait, KVKs, Veterinary Colleges, DRDA, French Institute, Auroville at Pondicherry; Public Works Departments (PWDs), Annamalai University, TANUVAS, TNAU, TANWA, National Horticulture Board and the private and corporate sectors.
- State Bank of India (SBI) and State Bank Institute of Rural Development (SBIRD) have accepted the Biovillage model as a strategy for rural credit management and have come forward to support some of the activities at Pondicherry.
- RSGA launched a fortnightly community newspaper, *Seidhi Solai* reaching 2,000 households in Dindigul.
- Knowledge Centres communicate information every day on various aspects to 600 persons in Dindigul.

- Articles about project activities have appeared in popular English and Tamil newspapers and periodicals.
- Youth Employment Summit in Alexandria conferred on Poomani Women's SHG of Kannivadi the *YES Innovator Award* for 2002.
- TNPCB awarded a certificate to Jhansi Rani Women's SHG for promoting ecofriendly products.
- The Centre participated in the organization of Gender Concerns Forum in the foundation, 30th Session of UN's Standing Committee on Nutrition, South-South Exchange on ICT Enabled Development and Methodologies Workshop for Ph D students from Universities of South India
- The staff of the centre participated in the World Summit on Sustainable Development (South Africa), Second Assembly of Global Environment Facility (China), Farmers Dialogue (Cambodia), FAO's workshop on Raising Resources for Forestry Research (Sri Lanka), Micro credit Summit(USA), Conference on Hunters and Gatherers (UK) Advanced Training in Climate Variability and Food Security (USA), Introductory Chickpea Conference (India) and Enviro 2002 of Confederation of Indian Industry (India)
- The successful completion of the training programme at the Advanced Training Institute on Climate Variability and Food Security by one of the staff of the Centre helped in developing a proposal, which was selected on a competitive basis and research

funds were awarded for establishing a grassroot weather station.

301.1 Coastal Region

The activities of the Centre in the coastal region laid stress on efficient water management, diversification in the cropping pattern and generation of multiple livelihoods. The focus was on issues such as water and soil management in agriculture and common property resources.

301.1.1 Chidambaram

Models for sustainable development suitable for coastal regions are being studied in villages around Chidambaram since 1997. The models focus on water and soil management. Ecoaquaculture, IIFS and Community Pond Management have been tested and demonstrated in the villages. In addition to these activities, micro enterprise development has been encouraged among the SHGs. It is hoped that these activities will lead to the emergence of biovillages in coastal areas.

Ecoaquaculture: The project began during 1993-94 with the objective of demonstrating and extending an environment-friendly, coastal aquaculture model in Pondicherry. However, due to various legal and social issues, the project changed its focus to fresh water aquaculture in Tamil Nadu in 1996. At the same time, the project looked into certain problems of coastal aquaculture, such as white spot syndrome virus (WSSV).

A sustainable fresh water prawn culture technique was demonstrated at Keela-

manakudi village of Cuddalore district, through a participatory approach. Using the concept of Low Intensive Sustainable Aquaculture (LISA) the model stressed on rainwater harvesting, integration with agricultural livestock and organic management. The village community concurrently evaluated the various dimensions of the project such as its impact on the environment, financial viability and labour were studied during this period. This demonstration has been concluded with the farmers replicating similar models in the region and the submission of the final report to the DBT.

Studies on the outbreak of WSSV in the region were also conducted. It was observed that poly-culture, particularly with milkfish, could help in reducing mass mortality due to white spot virus. Using controlled experiments, observation of various ponds and PCR techniques in the laboratory, a method for WSSV management was established. Table 3.2 summarises the production details of fresh water prawn culture during the last five years. Some of the important findings of this project are:

- Area has a significant negative relationship with productivity; in other words, smaller ponds are more efficient in productivity than larger ponds.
- Stocking density and total days of culture have a positive relationship with productivity. In a system where rain water is the only water source, these two factors are crucial variables.
- Using tiny scampi harvested in the earlier culture for the subsequent culture helps to reduce the losses and maintain the required sex ratio.
- In spite of rain water harvesting and other sustainable management practices, the ponds cause salinization in neighbouring fields.
- The financial viability depends on productivity, which again depends on total days of culture. However, the viability can be improved with a proper crop-mix in the bunds.
- The labour absorption potential in the fresh water prawn system can be equivalent to

Table 3.2: Production details of fresh water prawn

Year	WSA (ha)	Production (kg)	Production (ton/ ha)	Culture Days	ABW	Density m ²	FCR	Survival %
1997-98	0.4	230.0	0.575	160	29.60	3.0	1.32	74.10
1998-99	0.5	512.0	1.024	195	36.83	5.0	1.50	57.72
1999-2000	0.5	201.5	0.403	140	19.31	4.3	1.79	43.13
2000-01	0.5	180.0	0.360	150	13.73	5.0	2.43	51.69
2001-02	0.5	342.9	0.686	180	17.34	5.0	1.70	64.41

WSA: Water Spread Area in ha, ABW: Average Body Weight (in gm) - during harvest, FCR: Food Conversion Ratio

the agricultural sector if a proper linkage between agriculture and aquaculture is established.

- In the agricultural regions, aquaculture may restrict the scope of absorbing women labourers as the owners as well as the labourers feel that women cannot work in the aquaculture production system.
- An environment-friendly hatchery is possible with proper re-usage of water.
- Aquaculture models should be environment, labour and gender sensitive.
- More studies need to be conducted on the linkages between aquaculture and agriculture, particularly in terms of crop-mix.
- Studies should be conducted on pond structure and other structural interventions for reducing salinization in neighbouring fields.

These findings have helped in developing a proper perspective for developing and imparting the necessary training and extension programmes. Between 1996 and 2003, more than 1,400 men and women farmers, labourers, officials of government departments and students were trained in various aspects of pond management, hatchery management and marketing management. More than 60% of the participants were women, since it was felt that women should play an active role in various aspects of aquaculture. The capacity building process has helped in establishing and consolidating nearly 25 ha of ponds in

Cuddalore district. The training has helped a farmer near Chennai to establish his own hatchery. Some of the students who were trained are employed in hatcheries and ponds.

An attempt was made to revive the implementation of the model in the Karaikal region of Pondicherry during 1999 - 2000. Land allotment and clearance from the Aquaculture Authority of India were obtained. However, since the project was coming to an end in September 2002, it was decided not to establish the ponds. During this period the villagers were mobilized into associations and SHGs and they are now involved in mangrove forest management and micro enterprises through various other projects (reported in SPA 204).

This demonstration has now been concluded with the farmers replicating similar models in the region and the submission of the final report to the DBT.

Integrated Intensive Farming System: This project was implemented to demonstrate an alternative farming system of agriculture in a region dominated by mono cropping and application of a large dosage of chemical fertilizers and pesticides. The project has demonstrated that without using chemical fertilizers or pesticides, integrated farming can help in providing better returns to the farmers. The project has been monitoring 32 randomly selected farm households with about 80 acres of paddy fields. Farm level data was collected regularly since the inception of the project in 1997. The results of the studies have been presented in previous reports. As seen in Figure 3.1, at Keelamanakudi the net income per acre

of IIFS demonstration farm is higher than that of a conventional farm. IIFS has shown an

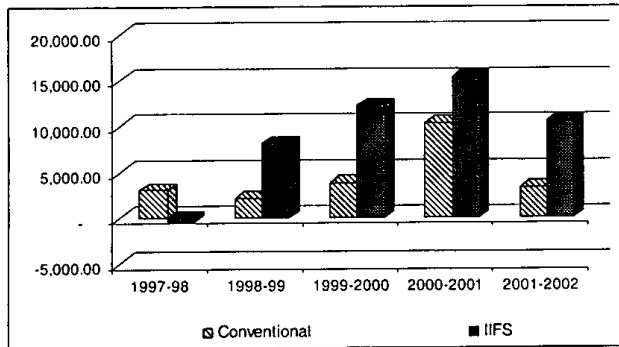


Figure 3.1: **Comparison of net income per acre between conventional agriculture and IIFS**

ability to withstand the vagaries of nature being experienced in the region such as unseasonal rain and drought. The positive aspects that have been noticed in IIFS are that it gives better returns than conventional farming, reduces the risk related to unpredictable monsoons, offers opportunity for employment throughout the year and provides income that is distributed throughout the year. The experiences of IIFS during 1996-2003 are being consolidated. The data on soil, water, labour etc is being analysed and a monograph will be published during 2003-2004.

As a part of the activities related to IIFS, training was continued in the areas of precision farming and rural entrepreneurship development. 3,004 trainee days were completed for 127 women and 157 men. Members of *Thenkoodu* SHG Federation were trained in gherkin cultivation, as part of the effort to encourage cultivation of alternative crops with market linkages. 20 farmers from five villages have cultivated gherkin in 12 acres,

under buy-back arrangements with Indian Tropical Agro Products Pvt. Ltd. (ITAP), Thuthukudi. 10 farmers have replicated various dimensions of IIFS in their farming. The encouraging results of farm ponds in IIFS have motivated nearly 400 farmers in this region to approach the government for financial support for constructing farm ponds.

To develop and strengthen grassroot institutions in the region, 37 new SHGs have been formed, taking the strength of SHGs to 77, with a total turnover of Rs 26 lakhs. 21 SHGs were linked with nationalized banks. To provide networking and support to the local community, activities have been initiated along with Sethiyathope Anaicut Farmers Welfare Association, in the Manikollai revenue village, situated at the tail end of Manampathan Channel. The Federation of Manikollai Small Farmers' River Lift Irrigation comprising 14 SHGs, has been formed in the region. The project will provide the necessary technical support and facilitate the farmers in the region to gain access to credit support from nationalized banks, for development in the region. The activities planned for the region include developing suitable IIFS farms, undertaking sustainable water management practices, encouraging community nursery and cooperative farming.

301.1.2 Pondicherry

The concept of biovillage was initiated in three villages of Pondicherry during the years 1991 to 1993, with the support of Asian Development Bank. The Biovillage Programme was later extended to 19 more villages with

the support of UNDP. Since 1999, the JRD Tata Ecotechnology Centre has been implementing the Biovillage Programme in Pondicherry. The Biocentre in Pillayarkuppam village has been functioning as a service and information centre, providing necessary facilities for the effective functioning of the Biocouncil, which consists of SHG members representing different areas. The Biocentre has also been focusing on training the Biocouncil members as well as other SHG members and facilitating linkages with government departments and nationalized banks.

During the year, training was imparted in various activities such as mushroom production, fodder production, horticulture and floriculture practices, credit management and vermicompost production to members of SHGs. Training was given for a total number of 3,676 trainee days, with more than 80% of the training being devoted to women. Of late, a larger number of men are showing an interest in undergoing training and many men groups have received training. Out of the 3,676 trainee days, 650 trainee days have been devoted to SHGs from other parts of Tamil Nadu and Pondicherry. 2,850 trainee days were organized specifically on the subject of micro enterprises *i.e.* on planning, implementing and monitoring new enterprises.

During the course of the year, the Biovillage Programme has been initiated in yet another village, Kodathur, in collaboration with SBI and SBIRD. SBI has shown an interest in integrating biovillage concepts in its rural credit programme. The experiences gained in

Kodathur will be used in large-scale replication all over the country. Members of the Biocouncil have been actively involved in enabling the community to develop an action plan for a credit-linked biovillage programme in the village. They have received training in conducting PRA.

22 SHGs were formed during the year in Pondicherry and new enterprises were started. A new micro enterprise initiated this year is the operation of an eco-friendly transport vehicle by a SHG. Another SHG has started a cattle feed shop as an enterprise. Another group has started a terracotta unit.

A trial on System of Rice Intensification (SRI), was conducted at the Biocentre. This system is said to be relatively less water-intensive, compared to the traditional cultivation practice and therefore environmentally more sustainable. More than 50 farmers participated in the trial, which is being continued for the second season. The Biocentre produced 15,000 crossandra seedlings, which were sold to nearly 200 villagers. Each of these villagers replicated the concept of floriculture in 10-15 cents in their backyard. Similarly, about 1,500 kg of vegetables have been produced at the Biocentre and nearly 180 villagers replicated the concept of nutritional garden. The production of mushroom and spawn at the Biocentre is soon to be handed over to a SHG.

Other Activities: The Biocouncil celebrated an annual meeting-cum-festival called *Aadiperukku vizha*. Around 800 members from the 152 SHGs participated in the celebrations.

More than 500 school children from different schools had a one-day exposure programme at the Biocentre. The villagers trained 10 college students in various microenterprises. The financial turnover of the SHGs has reached more than Rs. 1.5 crores, which includes their savings, loans and business.

301.1.3 Gayaspur and Mallikapur in Orissa

In Gayaspur village of Kendrapara district and Mallikapur village of Jagatsingpur district of Orissa, the emphasis was on developing the ability of the communities in disaster management and sustainable development. These two villages were badly affected by the cyclone in 1999.

The activities of the Centre in Mallikapur were confined to the construction of the cyclone shelter whereas in the group of villages surrounding Gayaspur, the Centre focused on implementing the biovillage concept. In villages such as Pada Gayaspur, Manitri and Niyamitpur, 13 SHGs, including four men groups, were formed with a total enrolment of 186 members, with 156 women and 30 men. A base line survey was conducted in Manitri village. PRA were conducted in all the three villages. The SHGs have made transactions worth Rs 2.15 lakhs.

The PRA defined the following activities as crucial for implementing the biovillage concept:

- Village sanitation, which includes sanitary latrines, roadside bathrooms, safe drainage

system and cleaning of village ponds

- Enhancement and promotion of livelihood through possible micro enterprises, including on-farm and off-farm activities
- Literacy, particularly women's education and empowerment for decision-making and management
- Human health and animal health care

On-farm activities

Demonstration and training in seasonal vegetable production in kitchen gardens, effect of micronutrients on winter vegetable production, IPM on field crops and vegetables and vermicompost production were some of the important training activities. Resource personnel from Government Departments and KVK imparted training.

Following the training on growing vegetables, the SHG members have grown winter vegetables individually in their respective kitchen gardens and in groups in common plots. Vegetable seeds (tomato, chilli, amaranthus, greens, bitter gourd, beans, cauliflower, brinjal, cow pea, ladies finger, radish, pumpkin, cucumber, watermelon and ribbed gourd) were distributed. The annual *moringa* variety PKM-1 has also been introduced. Three SHGs were given 1,000 seeds each. In a region dominated by the monocropping of paddy, the introduction of horticultural crops is an important step towards achieving the objectives of the biovillage.

Off-farm activities

Training and demonstration in mushroom production, backyard poultry, apiculture, pisciculture and vegetable and fruit preservation (processing) were conducted in the villages for 133 participants (55 women and 78 men). The following off-farm activities were taken up by the SHGs after receiving training:

Oyster mushroom: Training and demonstration in oyster mushroom cultivation was conducted. Following the training, 33 SHG members have purchased 68 spawn bottles. They have spent about Rs 20 per bottle as production cost and have harvested around 1 to 4.8 kg of mushroom per bottle, thereby earning about Rs 40 to Rs 190. The cost benefit ratio was 1.1 to 8.5. Notably some of the farmers trained last year imparted training to other farmers.

Backyard poultry: Sixteen members of SHGs purchased 200 chicks and reared them. Some of the chicks are about 1 to 1.25 kg in weight now. The farmers became interested in this enterprise after finding it profitable. The experienced farmers have transferred their knowledge and experience to others.

Fruit and vegetable preservation: A programme was organized to impart training to 11 members of SHGs on preservation of fruits and vegetables and preparation of tomato sauce, chilli sauce, green tomato pickles, papaya jam, green *moringa* pickles and lemon squash. These trainees in turn have already started imparting training to other members of the SHG as

participants-to-participants or horizontal transfer of knowledge.

Capacity building and skill empowerment

Training by Bank Managers: The Asst General Manager of NABARD, Manager, Bank of India and Chief Manager, SBI, Kendrapara advised the SHG members on linkage with banks. They also imparted training on management and maintenance of records. They have also assured them loans, if they are well organised and fulfil the norms and come up with suitable proposals for micro enterprises. 122 trainee days (77 women + 45 men) were achieved.

Exposure visit: On 18th January, 2003, an exposure visit was organised for SHG leaders. About 40 members (18 men and 22 women) visited Kantigadia Gram Panchayat where 26 women SHGs have done some significant work. They saw the various activities of the SHGs and the records maintained by them and interacted with them on various points relating to management. This exposure visit had a tremendous effect on the SHGs.

Safe grain storage: On 19th February, 2003, a 10-day long training programme on safe grain storage was organised. The resource personnel were from the Save Grain Campaign of the Ministry of Food and Consumer Affairs, Govt. of India. 551 trainee days (206 men and 345 women) were achieved. At the end of the training, certificates and storage bins were distributed to the participants.

Advocacy

- On 14th February, 2003, a galaxy of resource personnel, including the Chief Manager, SBI, Asst Manager, NABARD, Manager, Bank of India, Asst Project Director, DRDA, District Social Welfare Officer (DSWO), Block Development Officer (BDO), Sarpanch, an engineer of UNDP, and journalists participated in a forum with all the SHG members and village leaders. The interaction was mainly on skill empowerment, capacity building and various micro enterprises, for which the banks and district and block level authorities would provide loans.
- The Collector, ADM, Panchayat Samiti Chairman and Sarpanch of Kendrapara visited Kharda Sahi and Pada Gayaspur on 5th July 2002 on the occasion of *Vana Mahotsav*. They planted coconut seedlings and avenue trees in these villages. They visited the community grain banks and interacted with the villagers.
- The BDO Mahakalpara and Project Director, DRDA, Kendrapara also visited Kharda Sahi and Pada Gayaspur and spoke to the people on various welfare schemes.

301.2 Hill Region

Activities in this category were concentrated in Thonimalai, a region where tribal communities live.

301.2.1 Thonimalai

Thonimalai, behind Kannivadi, is situated 1,200 meters above mean sea level in the Western

Ghats. Though it is a hill region, it falls under Reddiarchatram block. Tribal communities like Paliar and Pulaiar and other groups such as Mannadis, live in Thonimalai. During the early part of 2002, the Centre entered these inaccessible areas and began to mobilize the communities towards the biovillage concept. Decline in the plantation economy and poor education and health facilities are some of the major problems of this area.

The Centre mobilized two women SHGs during 2002-2003. These SHGs have started assuming responsibilities like building schools and roads, in addition to the conventional ones of thrift and credit. They have constructed a building for the primary school, where nearly 50 children are studying, with financial support from DRDA. Malaiyarasi and Alagu women's SHGs have completed the task with the support of the other villagers who contributed free labour. The school management committee is planning to construct a small building for children who have dropped out of school. The two SHGs are also conducting adult literacy programmes in the village, using modern ICT facilities, including video conferencing. Studies were conducted to identify nutrient deficiencies and it was found that children and women are suffering from lack of micronutrients.

Organic farming: Efforts were made to link products like lemon, pepper and coffee with organic markets. The quality of the products was analyzed at food laboratories in Chennai. Discussions are continuing to link the farmers

with certifying and marketing agencies. A joint plan has been developed with the villagers to improve the agro-biodiversity in the region by reviving some of the disappeared crops like small millets and grain legumes. The revival of these crops could help to overcome protein and iron deficiencies.

The Paliyar foragers of the region are being helped to obtain community certificates from the district Revenue Department.

301.3 Semi-arid Region

Increasing the yield and providing economic opportunities for livelihood are the major concerns in the semi-arid regions.

301.3.1 Kannivadi

Kannivadi region, located in Reddiarchatram block, Dindigul district, Tamil Nadu, is a semi-arid region cultivating horticultural crops. The total cultivable area is around 2,27,900 hectares. A majority of the farming households are small and marginal landholders. A substantial number of households in the region are landless. The mission of Kannivadi biovillage is *value addition to time and labour*. The Foundation continued training and capacity building, field demonstration, participatory research and networking and also started a few new activities. As in the previous year, the focus continued to be on strengthening the existing grassroot institutions and making them more active and autonomous for facilitating developmental activities in the region.

Grassroot institutions as development agencies

Reddiarchatram Seed Growers Association (RSGA): The Association is developing the necessary skills for taking the lead in the activities in Kannivadi region. Nuzivi Seed of Hyderabad, SIMA (South Indian Millers' Association) of Coimbatore and Horticulture College and Research Institute, Periyakulam, are some of the companies with which the Association is collaborating. The Association also played a vital role in supplying good quality seed and proper follow-up after sowing. Last year the failure of the monsoon affected the seed production activity.

The successful completion of a project on Sustainable Agriculture and Value Addition for Horizontal Transfer of Knowledge, supported by COL, Canada, helped RSGA to get the second phase of the project approved. During the first phase of the project, computer-based multimedia folders were developed for all the 60 crops cultivated in the region and training given to the tune of 4,000 trainee days. In the second phase, the organization is training farmers in the neighbouring block of Athur. Information on other dryland crops like minor millets and legumes cultivated in this block was added to the database. The farmers, students and NGOs in the region use the CD and booklets on the local crops extensively. Due to the training programme, the utilization of biofertilizer has increased substantially. RSGA worked with the local agriculture department and developed a plan to meet the demand of the local farmers.

15 youth from Kannivadi region underwent residential training in the fabrication of agricultural implements, tools and machinery in collaboration with Farm Implements & Machinery, Zonal Research Centre, TNAU, Coimbatore. They are now negotiating with local banks to start micro enterprises in their respective villages.

Seithi Solai, a local fortnightly newspaper, is being published to cater to the information needs of the different sections of the society. RSGA has been managing the *Ooddanchatram market.com* and is negotiating with the commission agents for sharing the responsibility of managing the website. RSGA is also managing a self-running computer centre to help school children become computer literate. The person in charge of the centre gets his remuneration from the nominal charge collected. Last year alone the centre trained more than 150 children.

RSGA had also trained farmers and representatives from other NGOs in sustainable agriculture and grassroot institution building by sharing their experiences.

Kulumai Federation of SHGs: *Kulumai* has formally emerged as a 'community bank' with its own office space and necessary institutional arrangements. The strength of *Kulumai* federation has increased from 90 to 104 SHGs. Apart from thrift and credit at the SHG level and depositing the monthly savings of each SHG to *Kulumai* common account, the federation has begun to deal

directly with local banks for organizing financial support to member SHGs. The banks disbursed around Rs 9 lakhs as assistance to initiate new activities for income generation. Their good performance and prompt repayment resulted in the local banks extending further support to the SHGs. *Kulumai* is also active in monitoring the enterprises managed by some of the SHGs. The total amount of money used by SHGs for internal credit during the year was Rs 24 lakhs. Around 47.5% of the internal credit was spent on agriculture. Children's education, cattle management and initiating new income generation activities were the other major areas of expenditure. *Kulumai* played an active role in helping the SHGs to develop and screen proposals. *Kulumai* monitors most of the ecoenterprises in Kannivadi.

Paper and board from banana waste: The Jhansi Rani women SHG has developed its capacity to sustain the production and marketing of its products. Based on the skill and capacity of the individual member, a system has been evolved to ensure the smooth functioning of the unit. External consultants are helping the unit in quality improvement and product diversification. The business turnover for the year is around Rs 4 lakhs and the SHG repaid a loan of Rs 65,000 to Canara Bank, Kannivadi, as per the repayment schedule. The unit was able to generate 1,500 labour days for the year. The SHG members underwent training in screen-printing, which helps to add value to the products of the unit. They are

making efforts to explore the niche market outside India. The unit is also preparing to apply for ISO 9002 certification. It has been certified by the TNPCB as an eco-friendly unit.

Ornamental fish culture: The SHGs involved in ornamental fish culture were able to get a higher income, compared to the previous year. They established market linkages with two groups in Madurai and shifted over to high value species like golden fish. Training was conducted in the construction of small ponds, water management, feed preparation and distribution, fish harvesting and fish transportation. The group is planning to upscale the activity.

Trichogramma biopesticide production: Three women SHGs, namely *Poomani* at Reddiarpatty, *Kavikuil* at Dharmathupatty and *Chinnammal* at Velechervakaranpatty, have been continuing *Trichogramma* production. These groups managed to produce around 4,000 cc, which covered nearly 320 acres. A market linkage has been established between these three groups and EID Parry, a corporate company. Their capacity has been increased from producer to trainer. They trained women SHGs from Kolli Hills and Pudukottai. Other NGOs like Social Women Association, Sanarpatty, Dindigul, and women SHGs from Madurai and Thuthukudi have approached these groups for training. Due to the increasing demand, the groups have planned to scale up the production capacity. The *Poomani* Women's SHG was awarded \$1,000 as the *YES Innovators*

during the YES held at Alexandria, Egypt, in September 2002.

Other activities: Due to poor monsoon and water scarcity new greenhouses were not constructed as planned. Two SHGs involved in stall-fed goat rearing have managed to make a profit. Other enterprises like production and marketing of idly powder, backyard poultry etc helped some of the SHGs and individual members to get additional income. *Kulumai* is lending money from its own fund to these groups.

Village knowledge centres - knowledge management for livelihood security

The hub of the village KCs, located at Kannivadi, has become an active point for information access and computer-based training on sustainable agriculture. The information database, covering various aspects, was updated periodically in all the four KCs located in the region. The number of visitors has almost doubled in Kannivadi and T Pudukottai centres. Apart from the data shared by the hub with other centres, each centre has started a village-specific database to meet the information need of the local villagers. In 15 villages, the market price from Oddanchatram vegetable market, Nilakkottai and Dindigul flower markets, and Neikaranpatty market are displayed every day. The monthly meetings of the VKC Management Committee help to evolve a monthly action plan and review performance.

Computer-based functional literacy: The role of ICT in literacy is perceived as an instrument which would help to create dynamic, location-specific, learner-defined learning materials. Learning through modern ICT at Samiarpatty, T Pudupatty and Thonimalai villages has helped 50 participants in each hamlet to improve their skills in reading and writing. The use of touch screen computers, electronic tablets, CDs and digital camera converted the learning exercise into fun. The facilitators of these centres have got adequate training in computer operation to prepare learning materials using power point, voice and multimedia folders. They also helped the participants to learn basic numerals and simple mathematics. The support extended by the learners' families and the village community was vital for the success of the project. The centres have produced extensive reading materials with visuals, covering various topics like agriculture, floriculture, cattle management, traditional medicine and folklore. The centres are maintaining a small library, which helps the people to develop the reading habit. The State Resource Centre, Chennai, trained the facilitators to develop a tool to assess the impact of the reading materials. An external evaluator has evaluated the project and the report is under preparation.

Experiments and new initiatives

Village level Trichoderma viridie biofungicide production: *Trichoderma viridie* is a green - coloured fungal species that acts as a fungicide and plant growth promoter. It is a fast-growing, beneficial fungus and has multiple

uses in crop production. The leaders of *Elaya Thendral* women SHG of Shokalingampudur were trained in the production and marketing of *Trichoderma viridie* biofungicide by the Centre for Plant Protection, TNAU, Coimbatore. As an outcome, the group set up a production unit with technical support extended by the same department. The group has entered into an agreement with Evergreen Agro Biotech Pvt Ltd Trichy, for marketing for the next three years. The group has applied for registration to the Directorate of Plant Protection, Faridabad. The unit was able to generate 1,000 labour days last year and provide an additional income of around Rs 1,000 per month per head to the participants.

Capacity building, grassroot institution building and sustainable development: After the evaluation of the project on sustainable agriculture and value addition, COL has sanctioned the second phase of the project. It focuses on horizontal transfer of knowledge for sustainable agriculture and household food security. The project is being implemented through RSGA, which is responsible for organizing the ICT-based training programme for farmers and farm labourers. Local farmers, extension department officials and subject experts were the resource persons.

System of Rice Intensification: A joint experiment with RSGA is in progress on testing the SRI techniques using ADT- 39 paddy variety at T Pudupatty. 30 farmers have been selected as observers of the experiment. Factorial Randomized Block Design (FRBD) is followed with five replications, focusing on the age of

the seedlings, spacing and water management. The trainee farmers were taken to Pondicherry Biocentre where a similar experiment was at the completion stage. The visit helped the farmers to clarify their doubts and also to witness the fields in the biocentre.

Replication of Variable rate Application Technology (VAT) in pulse village module: 23 farmers have been selected at (Sriramapuram) village for pulse production by applying VAT. As a part of this activity, the remote sensing technique has been used as a tool for monitoring the dynamics of soil fertility. Soil samples were collected with grid reference with the help of Global Positioning System (GPS). This information was incorporated into the Geographic Information System (GIS). The isoline maps of soil variability were generated using spatial analysis extension of Arc View GIS software. The map formed the basis for recommending fertiliser application in the farmers' fields. Another study was based on the use of remote sensing data of IRS 1D LISS III (December 2002) to prepare a crop classification map of Reddiarchatram block, Dindigul district, using digital analysis. The vegetation area was extracted from the whole image and the forest vegetation was removed from the extracted image so as to avoid misclassification of the crops with the forests. This extracted portion was classified using supervised classification with the ground truth information of different standing crops like maize, coconut, cowpea, sugarcane and vegetables. Different vegetable crops could not be classified as the cropping was done in very small areas of less than 3 hectares.

Drip irrigation: Drip laterals were installed in 1.25 acres of jasmine crop at Samiarpatty village, to help the farmer to manage with 33% of the quantity required for regular flooding.

Localized weather and climate forecasting system: The project on developing a localized climate and weather system at the village level was initiated in September 2002. In order to receive the site-specific forecast, a 'B' type meteorological observatory was established at Kannivadi with technical support from the Dept. of Agrometeorology, TNAU, Coimbatore. Efforts have been taken to provide location-specific, downscaled weather and seasonal forecast.

At the outset, the needs, constraints, opportunities and farmers' indigenous coping strategies were chronicled, using participatory appraisal techniques. Traditionally, local weather and climate are also assessed, predicted and interpreted by locally observed variables such as wind, cloud, moon position and halo, animal, bird and insect behaviour and social events. A farmer's traditional knowledge is structured into three basic groups: the first set follows certain universal principles and logic, the second set is based on correlation and the third set is based on local experience, without any scientific basis.

The scientific forecast at 10-20 sq km radius is made available to the farmers by establishing institutional linkages with National Centre for Medium Range Weather Forecast (NCMRWF), New Delhi. RSGA is managing the observatory and recording the

data as per the norms of the Indian Meteorological Department. Fifteen different meteorological variables are recorded every day and sent to NCMRWF through fax. NCMRWF uses Global Spectral Model (T80) and evolves Direct Model Output forecast at medium range (4 days interval) on the variables such as precipitation, cloud cover, wind direction, wind speed and maximum and minimum temperatures. The forecast information is provided by NCMRWF at biweekly intervals i.e on Tuesday and Friday every week in real time through fax to RSGA, Kannivadi.

RSGA is the nodal point which receives the generic information and adds value by converting it to locale - specific information by translating it into the vernacular. Then the information is communicated to the other two villages through local area network and bulletin boards, the local community newspaper and posters to the farmers. While converting the generic information into locale-specific information, a farmer's perceptions on climate and weather are taken into account for effective communication of scientific forecast.

Efforts have been made to predict location-specific seasonal climate (3-6 months) for the coming southwest and northeast monsoon seasons with technical support from International Research Institute for Climate Prediction, New York, USA and Indian Institute of Tropical Meteorology, Pune. The weather information is disseminated to other villages through the Village KCs network. Three villages

have been selected for the study and a group of farmers and agricultural labourers are the main stakeholders.

Intensive training programmes are part of the project to build the capacities of farmers for effective use of forecast information, made available to the farmers from November 2002.

Food and nutritional study: A study on the nutritional status of the children and women was conducted as a part of the project, supported by COL in two villages, Samiarpatty, a hamlet located in the plains, and Thonimalai in the hilly tribal region using tools such as interview schedules, biochemical analyses and dietary assessment. It revealed certain distressing results such as lack of appropriate weight for height and lack of sufficient protein, calcium, iron and mean calorie intake to meet the Recommended Dietary Allowance (RDA). In both the villages, people have negative energy balance. The nutritional status of the children belonging to Thonimalai was lower when compared to children belonging to Samiarpatty. Poor purchasing power, heavy physical activity, low consumption and decreased availability of quality food were the reasons for these deficiencies.

Zero energy cool chamber: Since Dindigul district is one of the largest producers of vegetables in Tamil Nadu, India, storage of fresh vegetables for a few days is a serious problem. The low cost cool chamber developed by Indian Agricultural Research Institute, New Delhi, was demonstrated in the area to test its suitability. It is an on-farm storage chamber, working on the principle of evaporative

cooling. It is constructed with locally available materials like brick, sand, bamboo, straw and gunny bags. A thatched shed was constructed over the chamber in order to protect it from direct sun or rain. Vegetables such as eggplant, okra, tomato, cluster beans, carrot and beans were harvested from the field and 2 kg of each was stored at room temperature and in the cool chamber. The stored vegetables were evaluated daily for weight loss and quality for 8 days. Vegetables stored at room temperature were virtually unmarketable after 2-3 days whereas the cool chamber-stored vegetables were fresh looking, firm and attractive.

Silage unit: Green fodder plays an important role in supplying feed for livestock. During the rainy season, green fodder is available in plenty, whereas in summer it is not available. The available green materials like grasses, weeds, and agricultural and horticultural crop residues on the farm are very limited during the dry season. The storability of fresh materials is being tested through silage techniques.

Insurance: MSSRF has facilitated discussions between *Kulumai* and various insurance companies like HDFC, LIC and National Insurance Corporation. Based on the discussions, the members of SHGs decided to have a link up with HDFC, which is more beneficial than the other companies. As a first step, 70 members have taken an annual policy.

301.4 National Network on Biovillages and Community Banking

The programme continued its activities, laying emphasis on conservation and enhancement

of natural resources and poverty eradication, based on a pro-nature, pro-poor and pro-women orientation to technology development and dissemination, with emphasis on job-led economic growth through micro credit and micro enterprises. Adding economic value to the time and labour of men and women living in poverty is the major pathway adopted for promoting sustainable livelihoods.

During the year 3,600 trainee days were organized on micro enterprises, accounting, leadership, group management and banks schemes, for SHGs, Government officials, NGOs and field Staff of MSSRF.

The total financial transaction of these groups has reached Rs 3.5 crores (Table 3.3). This includes their cumulative savings, loans and business turnover. More than 70 SHGs undertook different micro enterprises, which gave them an alternate source of livelihood to earn additional incomes. 22 new micro enterprises were initiated, benefiting 362 SHG members. These enterprises were evaluated in terms of economic viability, availability of resources and market linkages.

Community banking was introduced in many project areas. 13 micro enterprises were started by the SHGs at Wayanad, Kudankulam, Vettaikkaraniroppu, Jeypore and Pudukottai.

As a part of the community banking Programme micro credit was extended to the SHGs in Bhuj, which was greatly affected by the earthquake that shook Gujarat in January 2001, with the help of Vikram Sarabhai

Table 3.3: **Financial transactions of SHGs during the year**
(Amount in Rs Lakhs)

Project area	Number of SHGs	Total savings	Loans and grants	Internal lending within groups	Business turnover
Pondicherry	152 (2100)	34.22	121.27	54.00	24.00
Kannivadi	104 (1500)	11.44	46.36	24.00	14.00
Chidambaram	67 (985)	7.55	7.05	8.70	2.03
Kendrapara (Orissa)	13 (186)	0.50	0.36	0.20	0.76
Total	336 (4771)	53.71	175.04	86.90	40.79

The figures in parenthesis indicate the number of individuals in the groups.

Centre for Development Interaction (VIKSAT) Ahmedabad. From the funds provided by Friends of MSSRF, Tokyo, as many as 16 micro enterprises were started by SHGs.

301.5 Chennai

The ecotechnology laboratory at Chennai conducts research in exploiting pesticide plants and engages in training the farmers based at field sites on IPM and plant protection.

The major high lights of the year are listed below: Identification of the active principle responsible for pesticidal activity in *Dodonaea angustifolia*. The hexane fractions of *Dodonaea angustifolia*, which showed stimulation and reduction in egg laying, were eluted and purified through TLC, HPLC, IR, NMR and Mass spectrometry. The molecular structure of the constituent responsible for insecticidal activity, using the data of $^1\text{H-NMR}$ and $^{13}\text{C-}$

NMR was identified as a cardiac glycoside, oleandrin ($\text{C}_{32}\text{H}_{48}\text{O}_9$), which is reported in *D. angustifolia* for the first time.

Control of Helicoverpa armigera on rose: The number of eggs gradually declined and reached 0-0.2 at the end of the sixth spray of hexane extract, acetone extract, and water extract, which were on par with chemical and NPV treatments. The water extract resulted in zero larvae after six sprays which was on par with the chemical. The percentage of damage to buds and flowers was also considerably reduced from 33-56% before spray to 3.6-19.7% as against 41.3% in unsprayed plot with hexane extract being superior over others (3.6%) at the end of six sprays. In addition, after two to three sprays, predatory spiders sprang up, which acted as a catalyst and this shows the safety level of plant extracts.

Efficacy of crude extracts of D. angustifolia against Earias vitella on cotton in field condition: The number of larvae and percentage damage of squares and bolls were less in the case of extracts compared to chemical and unsprayed (control), though it was on par with the neem product. Petroleum ether extract was on par with neem product with a resultant damage percentage of 0.1, which is distinguished from the unsprayed plot reaching 11.9% damage (Figure 3.2).

A study to understand the effect of crude extracts of *D. angustifolia* on the soil nutrient and biota status before and after spray is underway.

No inhibition was observed when crude

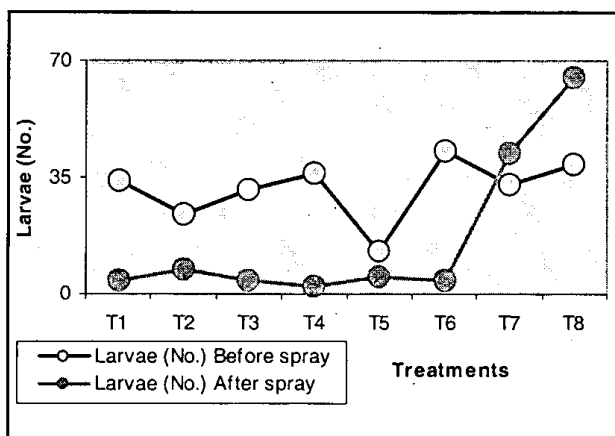


Figure 3.2: ***Efficacy of D. angustifolia against Earias vitella on cotton***

T1-Hexane extract; T2-Acetone extract; T3- Petroleum ether extract; T4-Chloroform extract; T5-Neem product; T6-Water extract; T7-Chemical (Endosulfan); T8- Control (Unsprayed).

extracts of *D. angustifolia* was tested at three different doses (5,7.5 and 10 mg) against a few beneficial microbes such as *Bacillus*, *Pseudomonas*, *Azospirillum*, *Bradyrhizobium* and *Trichoderma viride*.

Soil, water and plant analysis: The laboratory in Chennai also supports the field activities by analysing the samples from the trial plots in the IIFS and SRI activities and helps in incorporating the nutrients required for specific crops with the prevailing soil conditions. This year, 575 soil samples from various field sites were analysed for macronutrients and 61 test plant samples were checked for total NPK.

Overview

It was a year of consolidation of grassroot institutions in JRD Tata Ecotechnology Centre. An explicit shift has taken place from a project mode to process mode. The Centre's role has been transformed from project implementer to facilitator. The grassroot institutions have developed their capacity to define the appropriate pathways for sustainable development in their respective agro ecological zones. Need-based activities, horizontal transfer of knowledge and sensitivity to social and economic issues are the fundamental principles on which they operate. Other developmental agencies like government extension departments and commercial banks have started accepting these institutions as their local collaborators for implementing developmental activities.

Sub Programme Area 302

Sustainable Management of Natural Resources for Food Security

Sir Dorabji Tata Trust Fund for the MSSRF-Ohio State University (OSU) Project on Sustainable Management of Natural Resources is being implemented in farmers' fields through demonstration and spread of improved agricultural land and water management practices that would enhance food security and environmental quality. The project covers the red soils in Pudukottai, the black soils in Narsinghpur and Hoshangabad districts of Madhya Pradesh and alluvial soils in Nawanshahr and Faridkot districts of Punjab. The activity in Madhya Pradesh is coordinated by Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur and in Punjab by the Punjab Agricultural University, Ludhiana

302.1 Pudukottai, Tamil Nadu

Although rainfall during the year was deficit to the extent of 40% (508 mm) evaluation of the cropping system demonstrated the suitability of red gram plus groundnut, groundnut as pure crop and red gram plus green gram followed by horse gram which gave the highest gross returns of Rs 7,562, Rs 6,528 and Rs 2,994 respectively. Minor millet (*Varagu*) *Panicum milliare* tolerated the water stress well and gave gross returns of Rs 5,128/ha.

The land treatment of ridges and furrows, along with mulching with groundnut haulms, conserved more moisture and gave significantly higher yields of cowpea (732 kg/ha) as against the farmer's practice (571 kg/ha). Application of enriched compost made from crop residues and agro-industrial by-products, press mud, rock phosphate, zinc sulphate, phosphobacteria and *Trichoderma* gave as much yield of cowpea (758 kg/ha) as that obtained after application of recommended fertilizers. At Pudukatti, the application of enriched compost for okra yielded 17.6 t/ha as against 15 t/ha in a farmer's practice plot.

Benefit under the wasteland development project was extended to 35 ha in the village, which were planted with sapota and mango. Moisture conservation measures such as pitcher irrigation and mulching for the establishment of the saplings are being demonstrated.

Four SHGs promoted by the project are functioning in Ariyamuthupatti, Mudalipatti and Maringipatti. One of the SHGs has scaled up the production of *Trichogramma* parasite cards upto 1,000 cc per month, with a marketing tie up with EID Parry for supply to sugarcane farmers, coming under its purview.

Training: 20 training programmes were conducted on different topics such as water harvesting, dryland horticulture, IPM, Trichocard production, dairying, turkey rearing and entrepreneurship, by resource persons drawn from TNAU, TANUVAS, Departments of Agriculture, Horticulture, Agricultural Engineering and MSSRF. In all, 493 trainees

attended the programmes and 506 trainee days were achieved. Soil testing was organized with the assistance of the Soil Testing Laboratory, Kudumianmalai on 23rd July, 2002 and soil samples of 50 farmers in the project site were analyzed. Soil Health Cards were issued. They were taught to understand the soil quality estimations included in the card and the need for periodically testing and monitoring the soil health of their farms.

302.2 Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur

Although the vertisols of Central India receive more than 1,000 mm of rainfall, land and water management problems affect crop production to a great extent. The project interventions in the farmers' fields of Narsinghpur district, where the trials were conducted by the scientists in collaboration with the farmers, demonstrated the superiority of improved land management and agricultural practices. An average of 8 trials showed that the Integrated Plant Nutrient (IPN) application gave an increased 60% yield of wheat (30.7 q/ha) over the farmers' practice (19.1 q/ha) which is invariably sub optimal application. Similarly the yield of gram under IPN was 73% more (22.2. q/ha) as compared with the farmers' practice (12.8 q/ha).

The raised-sunken bed system, which facilitates good drainage for upland crops, encourages *in-situ* rain water conservation and minimizes soil erosion, has been demonstrated in farmers' fields. The system consists of an array of raised and sunken beds of 8m width with an elevation difference of 30 cm.

Integrated Nutrient Management (INM): 15 trials on farmers' fields at Narsinghpur indicated significant higher yield of soybean obtained from IPN application (24.7 q/ha) as against farmers' practice (14.4 q/ha).

In 11 field trials on IPN application vs farmers' practice with soybean, the yield obtained under IPN treatment was 17 q/ha as against 8.7 q/ha under farmers practice at Hoshangabad.

Incorporating fish culture in the traditional 'Haveli' cultivation: In major black soil areas under 'Haveli' cultivation, the fields are kept impounded with water during the kharif season and after draining, wheat or gram crop is grown in the rabi season. With the collaboration of the Regional Centre of the Central Institute for Fisheries Education, the practice of fish culture during kharif is being encouraged. Three species of fish, mrigal, rohu and katla, were stocked and provided additional income to the farmers.

In the Tawa canal command area in Hoshangabad district, promotion of improved agricultural land and water management practices were attempted under the *Kisan Bandhu* model, where progressive farmers were trained and could extend the training to fellow farmers.

Ten trials were conducted on wheat (DL-788-2) with a standard package of improved practices. These demonstrations showed the potential of the yield gap that exists in the district. The yield obtained under full package trial was 40 q as against 14 q under farmers' practice.

Land Management: In 6 trials, the superiority of planting in the ridge and furrow system over the flat system was demonstrated with soybean. The yield obtained under the system was 16.7 q/ha as against 8 q/ha under the flat system. 15-20 cm high ridges were made with 0.5 % grade.

Four abandoned ponds were renovated for water harvesting. The stored water was used for irrigation at the grain formation stage of soybean. With such life-saving irrigation the yield obtained was 21 q/ha (average of 4 trials) as against the yield of 14 q/ha in the control plot.

Fish-wheat/gram system: Two old community ponds were cleaned and renovated for fish culture. After harvesting fish, the water was used for pre-sowing irrigation and wheat and gram crops were sown subsequently.

Irrigation management in paddy: Substantial saving of water by avoiding continuous flooding in paddy cultivation has been demonstrated. One trial on irrigation management of paddy was laid out in which three treatments, continuous flooding, irrigation at tillering, flowering and grain filling stages and control, were tested. It was

observed that irrigation only at the three stages is superior to continuous flooding in terms of crop yield and also saving in water (Table 3.4).

Inter-cropping of soybean with pigeon pea: One trial on inter-cropping of soybean with pigeon pea was laid out in a farmer's field. Four lines of soybean and two lines of pigeon pea were sown. In a predominantly mono culture area with soybean, inter cropping of soybean with pigeon pea is being promoted.

Training: A total number of 750 trainee man-days were achieved during the year, covering various aspects of improved agricultural and land and water management practices.

302.3 Punjab Agricultural University, Ludhiana

The improved agricultural land and water management practices demonstrated in the alluvial soils of Punjab covered alternate cropping system for rice and wheat, residue management in rice and wheat systems, drip irrigation in vegetables, inter cropping, fish culture.

The experiments in farmers' fields at Langroya and Faridkot demonstrated the possibility of

Table 3.4 - *Effect of irrigation management on yield of paddy*

Treatment	Paddy yield (q/ha)	% increase
Check	16.20	-
Continuous flooding	35.00	116.04
Irrigation at tillering + flowering + grain filling stages	37.50	131.48

having maize-wheat, maize-cabbage-mustard as alternate cropping system for rice-wheat in Langroya and cotton-wheat and cotton-gram as alternate system for rice-wheat in Faridkot.

Trials on residue management in rice -wheat systems indicated that incorporation of rice/wheat straw is better than burning of rice/wheat straw, as revealed by field trials at Faridkot. The results at Langroya were inconsistent.

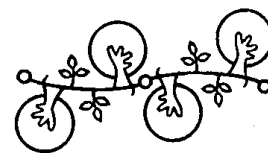
A farm demonstration on the use of drip irrigation for tomato in rabi season and bittergourd in kharif season has been initiated. Irrigation for the bittergourd crop was regulated at the rate of drip discharge of 2.0 L/hour for 30 minutes/day in August and 20 minutes/day from September onwards. The yield of tomato crop was 5,250 kg/ha and that of bittergourd was 8,750 kg/ha. This site is being

used for spreading awareness to farmers of the best water-management practice through drip irrigation.

Inter-cropping trials in sugarcane at Nawanshahr district showed the possibility of having peas (for green pod) and cabbage-mustard as suitable intercrops. Similarly, green gram could be an ideal intercrop in the initial stage of poplar trees in the agro-forestry system.

Inland fish culture is not largely adopted in the state of Punjab. A demonstration on fish culture in a farmer's field has been initiated under the project at village Nathawala Nawan in Faridkot district. During the last one year 23.4 q of fish was harvested from a pond of 1 ha area.

Training at Langroya and Faridkot: Eight training programmes were conducted.



Reaching the Unreached

The UDRC for Gender and Development continued its work of mainstreaming gender within the Foundation and addressing the gender dimension in agricultural education, research, training and biodiversity as part of its external mandate. Voicing Silence completes ten years of work in gendered theatre this year. Kulavai 2003 featured nine women solo performances, including Panit-thee the production of Voicing Silence. Dr A P J Abdul Kalam, the President of India, released the Food Insecurity Atlas of Urban India in October 2002.

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Sub Programme Area 401

Uttara Devi Resource Centre for Gender and Development

The main area of focus of the external mandate of the centre is gender in relation to agricultural education, research and training and biodiversity, while the internal mandate is to mainstream gender in the Foundation. With the appointment of a well-qualified Social Science professional as full-time Coordinator in mid-year, the pace, extent and quality of work in both areas have started showing significant changes for the better, and several new initiatives have been taken.

401.1 External Mandate

From the limited domain of the curriculum for students of agriculture, the focus broadened to include the gender dimension in extension workers and researchers, as also in field interventions.

Agricultural curriculum

Engendering the curriculum continued this year in partnership with the Centre for Studies of Gender Concerns in Agriculture (CSGCA) Kerala Agricultural University (KAU), with whom MSSRF has been working since 2000. From the outset of this collaborative programme with KAU, the need has been felt for a generic short course on gender in agriculture at the undergraduate level, where

the basic attitudes are formed, in addition to engendering the discipline-specific courses and the practical aspect Rural Agriculture Work Experience (RAWWE). So UDRC took the lead and invited Dr Sara Ahmed, a distinguished academic with considerable teaching and field experience in Gender and Development, to be a Visiting Fellow at MSSRF for 2003 and to develop such a module. The module, which is to be a two-credit, one-semester compulsory course for undergraduates, is being developed with the support of KAU, as an innovative contribution to agricultural education and for eventual use by all agricultural universities. The Visiting Fellow made an initial orientation visit to KAU to review the existing curriculum at the level of both theory and practicals, and understand the needs and perspectives of both faculty and students through interaction with them. The module is expected to deal broadly with gender concepts, which can later be applied and utilized in the discipline-specific courses being developed by the agriculture specialists, so that both dimensions are enriched. When the module is ready, and has received initial feedback and peer critiquing, Dr Ahmed will offer a one-week orientation course to teachers of KAU, who will then field-test it for one semester before final revision and publication. The module is expected to be ready for field-testing by September 2003.

Building a gender perspective

Technical support was provided to CSGCA to develop and conduct a ten-day course on "Gender Perspectives in Research, Extension and Education for Agricultural Development"

with the financial support of ICAR in October 2002. The 23 participants were drawn from mid-level Faculty of State Agricultural Universities in the ICAR system, representing disciplines such as Agriculture, Fisheries, Veterinary Sciences and Forestry. The objective was to initiate the building of a gender perspective and to offer orientation and some skills in gender analysis. UDRC contributed to the design and planning of the course and gave technical support through Resource Persons, including Ms Mina Swaminathan and Drs Bala Ravi, Sudha Nair and Meera Devi from MSSRF. Documentation of the entire course was also carried out by a consultant identified by MSSRF, with a view to preparing the base for a training module for future use. The course dealt with basic concepts and gender analysis frameworks and approaches, gender issues in agricultural policies and programmes, the gender impact of technologies and approaches to integrate gender into agricultural education, research and extension. Most of the participants were keenly interested in the extension aspects, while very few were concerned with research or teaching. The first week was devoted to general discussions of concepts and issues, illustrated with examples and field visits and supported by guest lectures; on the last three days, case-studies were taken up by the Faculty of KAU on integration of the gender dimension into research, education and extension. On the last day, individual action plans prepared earlier as assignments by each of the participants were critiqued by the Resource Persons.

Exposure for project workers

In February 2003, an exposure visit to MSSRF was arranged for a group of nine persons from the State Institute of Management of Agriculture, Lucknow (UP) implementing the UNDP-supported project entitled SAWERA the aim of which is to promote the empowerment of rural women through sustainable agriculture. The objective of the visit was to study at first hand some of the gender-sensitive field interventions of the JRD Tata Ecotechnology Centre of MSSRF and to obtain orientation in the underlying objectives, approaches and strategies. After an introductory session at Chennai on the first day of the visit, receiving orientation on strategies, concepts, gender framework and approaches, the team spent two days at Kannivadi, where several field interventions to provide alternative livelihoods for women are being carried out. The team interacted both with the MSSRF field staff and with the villagers to gain an insight into their activities, outcomes and approaches. On their return, an entire day was spent in feedback, clarification and further discussions on gender analysis. At the end, the team provided feedback in the form of individual evaluations of MSSRF's field interventions at Kannivadi in terms of two criteria: women's empowerment and sustainability. These were found to be useful and have been communicated to the project leaders at the JRD Tata Ecotechnology Centre.

A proposal is being developed for a study of the extent of women's empowerment through

agricultural technology in Kolli Hills, in partnership with existing projects there for ecotechnology applications and conservation of neglected but nutritious millets. Other new developments in the latter part of the year include both initiatives and invitations to develop concept papers, assist in developing gender impact indicators, participate in the training of field workers, partner research studies and contribute publications.

401.2 Internal Mandate: Mainstreaming Gender

Mainstreaming, inevitably a slow and delicate process, continued through diverse approaches, combining successful earlier strategies with new approaches chalked out last year. Some responsibilities, such as library services, were transferred to other units, while with the appointment of a full-time professional Co-ordinator, others, such as orientation/training of staff and collection/development of resource materials are now seen to be the role of UDRC itself. Some new initiatives were also taken during the year.

Research

The study of Wild Foods Management is a good illustration of intra-institutional collaboration between the UDRC and the CAbC at Wayanad. Though the staff member appointed to carry out the wild foods study at CAbC, supported by UDRC, has no specific training in gender, the introduction of the gender dimension in the study has sensitized both him and others in the unit and working with

gender consultants linked with UDRC has opened up new channels for gender mainstreaming the activities at CAbC.

The study has now been completed and the draft report has been prepared after some delay due to the wealth of data collected and constraints of time. After a critiquing and feedback meeting of the Advisory Committee held in February 2003, which included colleagues and resource persons from several disciplines (Anthropology, Ecology, Gender Studies, Biodiversity and others) the report has been finalised. The main findings are summarized and presented in the section on CAbC (SPA 201.2).

Gender equity in law

UDRC has also been actively involved with the project "Biodiversity Conservation, Natural Resource Management and Poverty Eradication" (supported by SDC) since its inception in 1998. This year, a series of in-house workshops relating to "Emerging gender issues in indigenous knowledge and IPRs" was jointly designed and facilitated in July - August, 2003. These workshops enabled the participants (the core staff of the SDC project from all the field sites) to understand the different domains of knowledge and how to account for gendered knowledge. A need to introduce the gender dimension in both the PPVFR Act (2001) and the BD Act (2002) was felt and an external consultant, Ms Mahalakshmi Parthasarathy, was asked to develop a paper titled 'A gender critique of the PPVFR Act, Draft Rules and related legislation'.

A national-level workshop on “Farmers’ Rights and Biodiversity Acts : A Gender and Community Perspective” was jointly organised in February 2003 to educate different stakeholders on the implications of the Acts and action needed to introduce a community and gender perspective. In addition, UDRC has been engaged in the field workshops held to document case studies on gender roles and gendered knowledge in terms of conservation, cultivation and sustainable use of biodiversity, including agro-biodiversity. Following the workshops, suggestions for gender-sensitive rules have been framed and have been sent to the Government of India for inclusion in the Rules. This process of mainstreaming has strengthened not only the gender perspective but also the analytical skills of the whole biodiversity team.

Capacity building

Responding to the need expressed last year for basic orientation on gender concepts for all staff members who have not had any such formal exposure, a one-day orientation was arranged in August 2002. The workshop was designed and conducted by the Hon Director of UDRC with the help of Dr P Tamizholi, the current Convenor of the Gender Concerns Forum and facilitated by six of the more experienced staff. Surprisingly, there were 54 participants, most of them from the field centres, revealing that a large number had not received any previous orientation to gender concepts. The workshop was planned so as to present basic concepts and then offer exercises in the application of those concepts. An

opening game designed to introduce the concept of gender stereotyping and create self awareness about gender led to reflections about the unequal gender relations in our society and was followed by a presentation on some of the main concepts used in gender analysis, along with a glossary of gender terms and references. Then the participants worked in eight groups, applying the concepts. The day concluded with a guest lecture by Ms Sheela Rani Chunkath, a senior woman administrator, on the theme: *SHGs and Women’s Empowerment – Threats and Opportunities*. No further general training was conducted during the year, though intensive group discussions were held in the course of other workshops, meetings and consultations.

Gender policy

Another strategy introduced this year was to explore the possibility of strengthening the proportion of female staff, especially in the field, by providing adequate support services for women professionals. The opportunity to take the first step in this direction came when, in consonance with the newly developed Personnel Policy, the Executive Director set up a Task Force to study and report on the issues of support services required to sustain:

- women professionals, especially in the field and
- skilled personnel working in difficult circumstances, especially in remote areas.

The Task Force used various strategies to collate information, from questionnaires to a series

of informal meetings exclusive to women, and with staff at different levels, both in Chennai and at field sites. One of the key findings of the Task Force related to gender ratios at various levels of staff, is shown in Table 4.1

It was also found that women professionals were not many at the field level (7 out of 13) while in Chennai, of the 44 women staff, 48% were administrative and support staff and 52% were professionals. Very few women were found to be in leadership positions.

The Task Force felt that the challenge was not only to attract and retain more women professionals, but also to enable them to work in the field, and to exercise leadership more effectively. The Task Force suggested some steps to this end, namely

- Changes in recruitment policy and innovative support services
- Support services like accommodation, security and transport to be provided according to need, to women working in the field

- Fostering a woman-friendly atmosphere in the work place by formal or informal institutional mechanisms

The recommendations were submitted to the Executive Director and later a special Staff Council meeting was convened in January 2003, to discuss the areas of concern and seek practical solutions for policy reform. The Staff Council suggested some changes in policy and management practices, which the management has approved:

- Employment policy – encourage women professionals by making it explicit in job advertisements and by offering flexible options / timings
- Support services (evolve practical mechanisms) like accommodation, security and transport
- Gendered work culture and behavioural norms - actively promote a woman-friendly work place and work culture and set up an informal three-member gender cell which

Table 4.1: *Gender ratio of staff at Chennai and Field*

Place	Women (%)	Men (%)	Total (%)
Chennai	44 (36)	77 (64)	121 (100)
Field	13 (12)	92 (88)	105 (100)
Total	57 (25)	169(75)	226 (100)

Of the 57 women staff, 77% are in Chennai and 23% in field offices. The ratio of men staff is 46% in Chennai and 54% in field offices

can be approached in situations of gender harassment or victimization.

Planning for the future

A two-day Strategic Planning Review was organized in March 2003 for the entire Staff Council at MSSRF to evolve a collective approach towards the vision and mission of the Foundation and to identify the critical areas of concern that need to be strengthened. The group realized that one of the mandates of the Foundation, 'pro-woman', implied that all projects and programmes must incorporate the gender dimension, which can become possible only through partnerships. Further, institutional mechanisms have to be evolved to integrate the gender dimension, from the formulating stage through the capacity building of the team, to monitoring and evaluation through appropriate indicators. This is now ideologically accepted by the group and can be seen as a step forward in gender sensitization in all programmes. Tools like the check list and guidelines for gender sensitivity which are already in existence, have now received a fresh impetus.

Sub Programme Area 402

Voicing Silence

The project *Women's theatre for women's development*, launched in early 1993, completes ten years of work in gendered theatre in 2003, and can look back at a range of activities in

performance and interaction, all using theatre as a tool to give voice to women. Aiming to be a catalyst in the process of women's awareness and empowerment, *Voicing Silence* has combined three main strands: developing plays on women's issues or gendered themes from a feminist perspective; organizing collective sharing of experience at women's theatre festivals, bringing together cultural workers, theatre persons, social activists and NGOs; and working with different communities of women, supporting them to use theatre as a tool of self-expression and empowerment.

Empowering women through theatre

Continuing its work with women performing artists in traditional Tamil theatre genres, *Voicing Silence* broke new ground this year by experimenting with a new form, the solo performance. The approach has been to use traditional forms to explore/express feminist interpretations of myths, epics and classics by traditional artists, and this year was no different, except that only one woman was on stage. Scripted and directed by A Mangai, with songs by A K Selvaraj, and performed by S Usha Rani, one of the most talented women performers of the group, the play *Panit-Thee* (Frozen Fire) is the story of Amba of the *Mahabharata*, the story of a woman who struggled to become a man in order to seek justice in a man's world. The play is set in the idiom of *isai natakam* and *koothu*, since Usha Rani is a performer trained in both. The story of Amba - Shikhandi, told with the help of mime, music, dance, song and poetic speech, does not unfold as a linear narrative, but in a

series of episodes. *Maleness* and *femaleness* are projected as qualities, while the transformation of male and female roles, revealed in costume, make-up and performance styles, offers a parallel text. As Shikhandi the warrior, in full *koothu* regalia, sheds his garments to emerge as Amba, the beautiful woman, the play arouses disturbing emotions about gender identity. At the climax, Amba, a woman constrained beyond endurance by patriarchal norms, protects herself as frozen fire, flowing forever, a mountain stream. For Usha, a consummate artist of great power and intensity, this was also the first experience of solo performance, which helped to enrich her skills. The play, which was the contribution of *Voicing Silence to Kulavai 2003*, has been very well received by audiences ranging from rural women to college students. It has already had seven performances as shown in Table 4.2 and the response indicates that more can be expected later in the year, when the women are relatively free from their regular performance schedule.

While the new play featured only one artist with three accompanists, the all-woman group of twelve continued to receive invitations to perform last year's play *Manimekalai*, a dramatised version of the great Tamil epic and literary classic. Written at the height of the struggle between Brahmanism and Buddhism in that historical period, its approach to issues of caste and gender gives it powerful contemporary relevance. The play is hence in demand from different kinds of audiences for different reasons – some for its Buddhist message, the protagonist being a Buddhist nun,

others for its anti-caste stand, most for its value as a Tamil classic, and also for the unusual piquancy of an all-woman group. Hence invitations have come from Tamil departments at Universities, Tamil literary conferences and cultural festivals and Tamil diaspora in other parts of India, as well as Buddhist, Dalit and radical groups more concerned with content than form. For all of them, the popular performance style is one of the main attractions. There were seven performances this year (Table 4.3), bringing the total to sixteen and more are expected later in the year.

The last four years' experience with this group of women has slowly brought the realization that the dream of helping the women to set up an autonomous group may be impossible to realize at present, because of the financial, managerial and social problems related to this genre. Even the possibility of a winter season company, performing at rural and urban festivals as well as social occasions and educational institutions, seems remote. *Voicing Silence* has hence had to withdraw from this objective, while continuing to offer support in other ways, for performances of the plays developed so far.

Kulavai 2003

To mark the completion of ten years of *Voicing Silence*, it was decided to hold another interactive women's theatre festival, *Kulavai*, though these have been earlier held only in alternate years. Fifth in the series initiated in 1996, *Kulavai 2003*, held on February 9, was

Table 4.2: *Performances of Panit-Thee, 2002 - 03*

Date	Place	Sponsoring	Occasion Organization	Audience
22.12.2002	M O P Vaishnav College for Women, Nungambakkam, Chennai	M O P Vaishnav College for Women, Nungambakkam, Chennai	Occasional cultural event	Students & Faculty of the College
22.01.2003	Dr. MGR-Janaki College of Arts & Science for Women, Greenways Road, Chennai	Dr. MGR-Janaki College of Arts & Science for Women, Greenways Road, Chennai	Occasional cultural event	Students & Faculty of the College
23.01.2003	Department of Tamil, University of Madras, Chennai	Department of Tamil, University of Madras, Chennai	Seminar on Tamil theatre	Students & Faculty of Tamil Departments
09.02.2003	Alliance Francaise, College Road, Nungambakkam, Chennai	M S Swaminathan Research Foundation, Chennai	<i>Kulavai</i> 2003	General Public
10.02.2003	Stella Maris College, Cathedral Road, Chennai	Stella Maris College, Cathedral Road, Chennai	Occasional cultural event	Students & Faculty of the College
08.03.2003	Guduvancheri	Roshini	International Women's Day	Rural women members of the NGO
14.03.2003	University of Madras, Chennai	Department of Tamil, University of Madras, Chennai	Endowment seminar on Malaysia-Tamil Nadu Cultural Relations	Students and seminar participants

Table 4.3: *Performances of Manimekalai, 2002 - 03*

Date	Place	Sponsoring	Occasion Organization	Audience
20.07.2002	Don Bosco Higher Secondary School, Egmore, Chennai	International Tamil Conference	International Tamil Conference	Conference participants
26.10.2002	R.S. Puram, Coimbatore	Tamizh Tamizhar Iyakkam	Annual Cultural Festival	Members & general public
22.12.2002	Ambedkar Academy, Anna Nagar, Chennai	Buddha's Light International Association, Chennai	Annual Day	Members
29.12.2002	Islamia College, Vaniyambadi	Dept. of Tamil Islamia College, Vaniyambadi	College Day	Students and Faculty
25.01.2003	Mumbai Tamil Sangam Auditorium, Sion, Mumbai	Indian Penpals' League	Regular members' programme	Tamils in Mumbai
26.01.2003	Navi Mumbai Tamil Sangam Vashi, Navi Mumbai	Navi Mumbai Tamil Sangam	Regular members' programme	Tamils in Mumbai
26.01.2003	National Education Society College Auditorium, Bhandup, Mumbai	Maharashtra Tamil Writers' Association, Mumbai	Annual Day	Tamils in Mumbai

also different from earlier ones in being a mini-festival, lasting only one day. Each *Kulavai* is devoted to a special theme, and this time the focus was on women solo performers. Nine women solo performers, both traditional and contemporary, representing different regions

and languages of India and different styles of theatre (purely dance and musical forms were excluded) responded to the invitation to perform at the festival. Each was given 30 - 45 minutes, so that performances could start on the hour through the day, and asked to

have not more than three accompanying or supporting artistes. The choice of theme or content was left entirely to the participants, but most of them chose to perform on some gender or woman-related theme. Three performers used traditional genres and stayed strictly within the bounds of the forms; of the remaining six, one was a mixture of both traditional and modern, while the remaining five expressed themselves in purely contemporary forms. Themes also varied considerably – from reinterpretation and feminist readings of myths, epics and other classical sources to communal violence in Gujarat and biting satire on present social reality, from larger-than-life tragic heroines to stand-up comedy, but the overall mood was affirmative, indicating a celebration of womanhood. The nine performances ranged over the entire gamut of human emotions, tapping the *navarasa* (nine moods as defined in classical treatises on performing arts) and the rich diversity was welcomed by the audience. The Festival was hosted and co-sponsored by the Alliance Francaise in Chennai.

At the venue of the one-day Festival, time and space were provided for the audience and the media to interact with the performers, though the emphasis of the festival was on performance. Food and beverage stalls set up at the venue enabled the audience to witness performances throughout the day, besides lending a carnival ambience to the occasion. Adequate though low-cost pre-publicity ensured an unexpectedly large audience at the

festival, with a full house even before the curtains came up at 10.00 am, overflowing at times during the day, and an enthusiastic crowd filling the house till the last show ended at 9.00 pm. This kind of *all-day theatre* was a novel theatrical experience for the organisers, performers and audience, and elicited a good response from the critics. Both the English and regional language press provided coverage, previews and favourable reviews, under such headings as *classic protest theatre*, *theatre as woman's tool of expression*, *nine women voicing silence*, *identifying women's theatre* and similar statements in Tamil, the regional language.

Documentation

The first draft of the documentation of the ten years' work of *Voicing Silence* by a young writer is now ready, and is likely to be completed this year. The video / CD-ROM of *Kulavai 2002* has had a good demand and 40 copies have been distributed, including 10 at the Asian Women's Theatre Festival held in Delhi in January 2003. The new play *Panit-Thee* has also been documented as a video film and is available on CD-ROM. *Kulavai 2003* has been well documented in photographs, but shortage of funds did not permit video documentation.

Voicing Silence is now ready to enter its final phase of reaching out to women in new ways, through emphasis on training and networking, moving away from performance and festival modes, so as to broaden and strengthen the original impetus into wider pathways.

Sub programme area 403

BV Rao Centre for Sustainable Food Security

The BV Rao Centre for Sustainable Food Security continued the research on food security and field level intervention on developing models for decentralized storage and management of food and feed.

The Food Insecurity Atlas of Urban India was released by the President of India, Dr A P J Abdul Kalam in New Delhi on 23rd October, 2002. State consultations on the food security situation in Gujarat, Rajasthan, Madhya Pradesh and Orissa were held between April 2002 and April 2003 in the capitals of the respective States. MSSRF prepared the lead paper on the food security situation in the State, for discussion at these consultations. A Consultation on *Towards hunger free India- Countdown from 2007* was organized by WFP, FAO and MSSRF at New Delhi on 4th and 5th April, 2003. A paper on *Policy Implications and Programme Implications of the Rural and Urban Atlases on Food Insecurity* was prepared and presented. A project on the food insecurity situation of Jammu and Kashmir, with special reference to the Ladakh region, has been initiated in May 2003.

403.1 Atlas on Sustainability of Food Security in India

The Atlas of Sustainability of Food Security in India is a publication under preparation and will be released later this year.

Background: The Atlas examines the ability of the nation and the individual states to maintain the agricultural food production system, food access and food absorption in perpetuity, *i.e.* in a sustainable manner for all times to come. The onus of producing enough food, providing employment to a majority of the population continues to remain with agriculture, inspite of the diversification of economic activity. India has to pay attention to expansion in food grain production with concurrent attention to the nutritional quality of the food produced, and livelihood access to rural masses, if it is to meet the dietary nutritional requirements of its population of over one billion.

Understanding sustainability: A sustainable agricultural system is one that yields more, maintains productivity of land, is sturdy enough to survive the vagaries of climate and at the same time, conserves natural resources such as land, water and biodiversity. Conserving and improving the ecological foundations of agriculture to provide sufficient employment to rural people are vital for sustainable food security.

But the trials of the past have shown that intensive agriculture, without concurrent attention to ecological foundations, has caused severe mining of the natural resource base. Land and soil degradation has threatened to reduce the productivity of good and arable land. Soil erosion has created irreversible damage to the fertility of land. Overexploitation of water resources has led to the receding of the water table. Degradation of the protective vegetation has triggered many

disasters like landslides, flashfloods, silt formation downstream etc.

Quick profit and current production have become more important than long-term sustenance. Traditional practices and skills are ignored and forgotten even when they are relevant. Unsustainable exploitation of natural resources for commercial use and consumption patterns that are heavily dependent on degradation of resources, have resulted in environmental and social instability. All these have slowly but steadily contributed to growing food and livelihood insecurity among poverty groups in urban and rural India. This is evident in agricultural production all over the country, which has begun to plateau in the recent years. It is important to have a judicious mix of eco friendly modern technology and traditional knowledge to reverse these trends and ensure sustainable production. The aim of the proposed publication is to highlight the capacity of the individual states to sustain food production, food and livelihood access and environmental hygiene for a healthy living.

Sustainability of food security: Sustainability of food security includes the 3 components of availability, access and absorption.

- *Sustainability of food availability* is a function of agricultural production through the sustainable use of the natural resource base;
- *Sustainability of food access* is a function of purchasing power, arising from livelihoods created in agriculture and natural resources;

- *Sustainability of food absorption* into the body is a function of health, sanitation, environmental hygiene and safe drinking water.

Thus the Atlas focuses on the ecological foundations or the natural resource stock necessary to bring about this sustainability. It provides a long-term perspective of the situation. It also makes valuable policy recommendations and programme recommendations to attain long-term sustainability in food production, food access and food absorption. The proposed publication details the sustainability of the food security situation across the 25 states and gives a state-wise comparative analysis. It also presents a series of attractive maps that makes people comprehend the relative position of the states. The Atlas combines the components of sustainability and food security in a meaningful manner to arrive at a composite index. A final map of sustainability of food security represents this index.

The methodology of indexing and mapping: Indicators that best describe each of the key issues relating to the sustainability of food availability, access and absorption were chosen from the available secondary data sources. The selection of the indicators has been limited by the secondary data and its applicability in the current study of sustainability. The method of indexing and the calculation of the composite index, using appropriate weights, helped in the process of aggregating the information. More weight has been given to sustainability of food production from the

existing natural resource base of the state. The composite index only looks at the future as it appears today. The assumption of *ceteris paribus*, every thing else being the same, applies.

The index has no value judgment on the sustainable development path as such. The index only shows the unexploited stock of the natural resource base of a state, relative to the population dependent on it. But the index is a valuable guide to choose the path of sustainable development, indicating policies and programmes that lead to sustainable development and sustainable food security. The states which are termed as unsustainable are those which cannot sustain the present levels of food security, let alone enhance the food security in future. The states that are in the sustainable category are the states that have sufficient resources to continue the present level of food security.

Maps have been used as a visual tool to identify the relative position of the states with respect to each indicator. Separate maps have been prepared for each indicator, as well as some of the composite indices. In the maps, the states have been categorized into five groups, based on the natural breaks thrown up by the Arc-View software in the GIS lab of MSSRF. This method uses the natural breaks to categorize the states into five groups.

List of indicators selected for sustainability of food security: Choosing the indicators has been largely driven by the availability of secondary data across the states and elimination of interdependencies within the group.

The indicators thus chosen are listed below:

Sustainability of food availability

- Weighted net sown area
- Percentage change in net sown area
- Per capita food grain production
- Per capita forest cover
- Unutilized surface water
- Unutilized ground water
- Percentage of degraded land to total geographical area
- Percentage of leguminous crops to gross cropped area

Sustainability of food access

- Percentage of population below poverty line
- Percentage of non-agricultural workers to total workers
- Percentage of landless labour households
- Instability in cereal production
- Percentage of population in non-crop agriculture enterprises
- Average size of land holdings
- Dense forest area per person

Sustainability of food absorption

- Percentage of households with access to safe drinking water
- Infant mortality rate

The justification for the inclusion of these indicators is discussed in detail in the book. The map on the cover page deserves special attention. This map shows the *Sustainability of Food Production*. This is based on a composite index of two aspects: the existing capacity of

the state to produce food and the natural resource endowments that can sustain food production in future. The first aspect is given a weight of 25 percent and the second aspect is given a weight of 75 percent. The index considers some key environmental factors such as fertility of the croplands, forest cover and available water resources.

Major findings: Arunachal Pradesh and Madhya Pradesh (including Chattisgarh) come out as states that appear to have sustainable food security. It is because both the states produce at least enough staple food required by the population and also have a large potential for future production. These states would be shown in deep green in the map. The reasons for sustainability are not the same in both the states. More of forest and fewer people dependent on natural resources make Arunachal Pradesh sustainable. Madhya Pradesh emerges as sustainable as it has more unutilized water sources and more sustainable crop pattern with legumes. These states are capable of sustaining the present level of food security as well as livelihood access to their population. This reflects the high levels of natural resource capital that can be sustainably tapped in the future. Future availability of ground water and surface water and adequate forest cover have tilted these states towards sustainability. Thus the state of Madhya Pradesh, endowed with natural resources, has to work towards enhancing its livelihood security and alleviating poverty through a systematic programme of sustainable development by increasing yields and encouraging eco enterprises.

The most unsustainable situation is found in the state of Manipur. The major problem here is land degradation. This state would be represented in deep red in the publication. The next set of states is also fairly unsustainable. This category includes Nagaland, Sikkim, Tamil Nadu and Orissa. These states would be represented in dark brown. The low level of sustainability is caused by different reasons in these states. For example land degradation due to water erosion and lack of adequate vegetative cover on the hill slopes are the problems of some of the northeastern states. The major problem of Tamil Nadu has been scarcity of surface water as well as ground water, compared to its requirement and population pressure. Very little is available for future use. Hence Tamil Nadu should change the development pattern and shift to less water-using activities. The path towards sustainable development differs from state to state. Poverty alleviation of the rural poor, using the existing potential, is the key issue for Madhya Pradesh and removing pressure on land and water is essential for Tamil Nadu. The proposed publication thus gives a series of maps along with a detailed account of policy shifts required and programmes needed to achieve the goal of an evergreen revolution. The proposed publication is named an Atlas as it contains a series of maps that explains the situation graphically.

Conclusion: It was proved conclusively during the Green Revolution that for great ideas and appropriate technology to be effected on a large scale and to benefit thousands of people across

the country, they must go hand in hand with national policy initiatives. The same is also true for sustainable development. Although there have been several initiatives at the grassroots level towards natural resources management like watershed management, community forest regeneration, etc., they have not really caught up nationwide as a massive political agenda requiring immediate attention. Political will and massive social action are missing from these strategies.

The Atlas on Sustainability of Food Security highlights the importance of the life support systems of land, water, forest, flora, fauna and the atmosphere, in bringing about sustainable development. It also points out the basic direction in which future policy actions must be oriented to effect sustainability. This Atlas, along with the earlier publications, *Food Insecurity Atlas of Rural India* and *Food Insecurity Atlas of Urban India* makes valuable policy and programme recommendations to attain short-term and long-term sustainability in food production, food access and food absorption. The three Atlases are the first step in moving from analysis to action.

403.2 Resource Centre for Community Food and Feed Banks

The Resource Centre coordinated the setting up of Community Food Banks (CFB) at the field level and liaised with state Governments and NGOs on the importance of, and strategies for decentralized storage and management of food and feed grains. The Centre participated in a consultation of NGOs in Hyderabad, to

discuss the sustainability of community food grain banks and the need to develop a set of best practices. It is also working towards building a database of the experience of different NGOs in the country in implementing CGBs and documenting initiatives on the Right to Food.

403.2.1 Community food banks

During the year -

- Pilot Projects of CFBs were initiated in seven villages in Koraput district, Orissa and in two villages in Kolli Hills block of Namakkal district, Tamil Nadu. The projects have been implemented by the field offices at Jeypore (Orissa) and Namakkal (Tamil Nadu).
- The State Planning Commission of Tamil Nadu identified Villupuram district for the implementation of the pilot project of CFB, based on the life cycle approach to food and nutrition security. Initial survey of a few villages in Kulverine tribal block of the district was completed
- MoU was signed with two local NGOs in Orissa for further expansion and spread of the CFB activity, with funding and technical support from MSSRF

Criteria used in selecting villages for project implementation:

- Food insecurity is prevalent in the village.
- The majority of the villagers do not have a regular source of income.

- Overall economic development of the village is minimal.
- The majority are small and marginal farmers.
- The majority belong to backward castes.
- There is only limited access to the Public Distribution System and other government programmes.
- Villagers are willing to work with our team

The activities included:

- Entry point activities – e.g. check bunding to increase water availability in Maliguda and Chamiyaguda villages in Koraput, Zero Energy Cool Chamber for vegetable storage in Nariankadu and cleaning of the village well in Avurikadu in Kolli Hills
- Building the initial corpus of foodgrains through voluntary contribution of food grains and institutional contribution
- Setting up Community Seed Banks
- Formation of CFB Management Committee
- Designing operational methods and registers
- Distribution of foodgrains
- Construction of CFB storehouse
- Creation of Village Development Fund
- Formation of SHGs
- Capacity Building and training programmes

Organizations: Village Development Committees, CFB Management committees and SHGs have been formed and training in capacity building for operation and maintenance of registers given. Care was taken to ensure representation of women in the CFB Management Committees. Only in Avurikadu, the SHG is an all-male youth SHG. The terms of operation, distribution, period, rate of interest etc. have been decided by the CFB Management Committees.

Capacity building: Workshops on food security issues, problems and solutions, CFB concept, training under Save Grain Campaign of the Government of India for the villagers, brainstorming on Entitlement Cards with local NGOs and government officials in Kalahandi, Orissa, and examining aspects of livelihood security and initiating measures for promoting the same, were conducted.

Work in Orissa focused more on ensuring basic food security. Simple, natural resource management measures like check-bunding have led to increased water availability for vegetable and crop cultivation.

In Kolli Hills, due to a relatively better food security situation and better literacy levels, it has been possible to move at a faster pace and undertake activities for nutritional security. This was attempted through the distribution of saplings of vegetables, fruits and medicinal plants for backyard gardening after orientation and training on their nutritive value and maintenance. A model kitchen garden was developed on land taken on lease and the SHG

trained to manage it. But the output was below expectation due to poor rains. A preliminary survey in Nariankadu where the zero energy cool chamber was set up, revealed that household consumption of vegetables has increased with easier access. It is also developing as an income-generating activity for the SHG managing the cool chamber.

A training manual in Tamil, on the concept, operation and management of CFB, the nutritive value of different fruits and vegetable and basic principles of health, sanitation and hygiene, has been compiled by our Namakkal site office.

Grain collection and distribution: In Koraput it was decided to store rice, ragi and pulses in the food bank for distribution. The villagers contributed rice ranging from half quintal in one village to two quintals in another. The number of households benefited ranges from 9 in the hamlet of Chamiyaguda to 122 in Balia village. The contribution of villagers was insisted upon to increase their sense of ownership in the CFB. MSSRF's contribution of rice to the initial corpus ranged from 1.5 quintals to 6.5 quintals, depending on the size of the village. The initial contribution of both ragi and pulses was totally by MSSRF. While that of ragi ranged from 1.5 quintals to 3 depending on the size of the village, a uniform amount of 25 kg of pulses (*arhar*) was distributed in each village. The decision to distribute ragi and pulses was taken with a view to impress upon the people the importance of cultivating and consuming these crops which have nutritive value. While rice

and ragi are being returned in kind, it has been decided that in the case of pulses, the borrowers may either return the local variety of pulse that they grow or repay in cash, which can be used for the purchase and distribution of pulses by the CFB committee, if they decide to do so. Some CFB members have started contributing paddy this year.

In Kolli Hills, the SHG members contributed 75 kg and 80 kg of paddy in Avurikadu and Nariankadu villages respectively, while MSSRF initially contributed 10 kg of ragi and 12.5 kg each of *samai* and *thinai* rice in both the villages. This was distributed among the SHG members managing the CFB. Subsequently in view of the drought situation, MSSRF made a further contribution of 1,125 kg of paddy to the CFB in both villages in March this year. This has been distributed and 17 households out of 40 in Nariankadu and 18 households out of 50 in Avurikadu have benefited. The SHGs formed in the two villages comprise people who face the problem of food scarcity. In addition, a few vulnerable households in the village, identified by them, have been given foodgrain. Repayments are expected in October.

Seed bank: In Kolli Hills, a common Seed Bank was established for the two villages. A *thombai* was constructed in Nariankadu for the purpose, with MSSRF bearing the construction cost and the SHG members contributing a day's labour. MSSRF made an initial contribution of the following seeds: Maize - 20 kg, *Senthinai*-50kg, *Malliya-samai* - 50 kg, Castor - 30 kg, QPM- 2kg, and *Ragi* - 25 kg.

It is expected that the members will add to this initial stock. In Koraput, the importance of seed storage has been discussed. The seed bank will also be housed in the grain bank storehouse and will function from this year.

Storage: The traditional *thombais* lying vacant have been renovated and taken on lease for the Grain Banks. The lease was met by MSSRF in the first year. In Koraput, buildings have been constructed with storage space in *kothis* with two or three partitions, constructed under the guidance of the Save Grain Campaign. The villagers expressed a desire to have an area that could also serve as a common space for meetings, drying grain, etc. So a room has been built adjacent to the *kothis* for this purpose. The villagers contributed voluntary labour. In some villages, they also made the bricks. MSSRF met the cost of the construction material.

Going forward: Only the first round of lending has taken place in both places. Foodgrain repayment has commenced in Orissa while it will be delayed in Kolli Hills due to drought. So sustained effort and monitoring are continuing in supporting the CFBs. The livelihood security aspect is being given more attention now in Koraput with the formation of SHGs and discussions on the economic activities that they would like to undertake for income generation are being held. Ensuring livelihood security is crucial to the sustainability of CFBs. The CFB is seen as the nodal point for development activities in the villages.

403.2.2 Community Feed Bank for poultry development for strengthening nutritional security in Namakkal district

Many small-scale poultry units in Namakkal District have become defunct in the 1990s due to the high cost of poultry feed. Making good quality feed available at an affordable price to small producers is the prime objective of this project. Promoting local cultivation of feed grain crops, developing low cost feed mix and setting up Community Feed Banks, which backyard poultry nurturers and small-scale units can access for good quality feed at low cost and repay on realization of the proceeds, are the other project objectives.

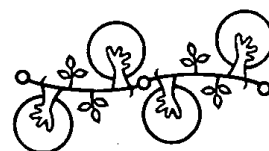
Sites selected: Four villages in Chittoor Nadu and Bail Nadu panchayats of Kolli Hills block viz. Navakadu, Poosanikuzhi, Avurikkadu and Ekkampali, were selected for backyard poultry development and for strengthening nutritional security. Tholur and Parali Panchayats in Mohanur block were selected in the plains for focusing on small-scale poultry.

Work during the year included the following:

- Baseline Survey and informal focus group meetings with the stakeholders to understand field level problems
- Survey of 21 defunct poultry units based on an interview of their owners
- Organizing the stakeholders, marginal farmers, especially women, and owners of defunct small poultry units

- SHGs have been formed in all the villages. An association of defunct poultry unit owners has also been formed in Namakkal.
- Curry leaf and papaya seedlings were distributed to all the members of SHGs for initial rapport building. Giriraja chicks were distributed for initiating backyard poultry after orientation on hygiene and proper feeding.
- Maize seed was distributed for cultivation, after impressing on the farmers the use and value of the crop and its importance in poultry feed.
- Training in *Trichogramma* production was given to members of Navakkadu SHG. An experiment is underway to establish its effectiveness. This will help to arrest the incidence of pests in beans, pulses and maize and will help the group to take it up as a micro enterprise.
- Two half-acre plots were taken on lease for cultivation of Quality Protein Maize (QPM) and soybean by women SHGs in Tholur and Parali. The maize yield was 250 kg/qtr acre and that of soya was 115 kg/qtr acre.
- One plot in Kondichettipatti was put under maize cultivation on demonstration basis. The projected average yield in the plot shows that maize can give a yield of 1.5 tons per acre.
- For soybean, rhizobium culture was used. Training was given to one project staff at the lab in Chennai on the preparation of rhizobium culture.
- Training was given to SHG members on preparation of feed mix.
- An exposure visit was arranged for group members to an integrated poultry and feed manufacturing unit and Veterinary College
- 2,000 pamphlets, stressing the importance of promoting maize cultivation and giving details of seed companies who sell maize seed, were distributed. Posters have also been put up on use of maize, soya and minor millets in feed mix.
- Poultry farmers of defunct units in Tholur have expressed willingness to revive their units if proper training is given and they get some financial support.

The next phase: Various possibilities are being explored to increase local cultivation of feed crops and establish viable linkages between poultry units, feed mix units and feed banks to benefit the small farmer. Backyard poultry promotion in Kolli Hills is being tried with both giriraja and country chicks to determine the better breed.



Education, Communication, Training and Capacity Building

The social sustainability of the Rural Knowledge Centres Project continued to receive international commendation. Eight documentaries were produced by THMRC. The Bioinformatics Centre developed a new Gene Bank software to protect the IPR of rural and tribal people. The library installed a new user-friendly web enabled software. The 2003 Annual Dialogue was on the Legacy of Watson and Crick, to commemorate 50 years of the discovery of the double helix structure of the DNA molecule.

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Sub Programme Area 501

Knowledge System for Sustainable Food Security

Interest in ICT-enabled development is increasing and a number of projects are coming up, but only a few projects have actually delivered. "Only one out of every one hundred telecentres is really useful for the local community where they have been set up, in terms of supporting development and social change", says Alfonso Gumucio-Dagron, Development Communicator Extraordinaire, Guatemala in *Prometheus riding a Cadillac? Telecenters as the promised flame of knowledge*. "There is one thing that we cannot separate from any ICT project in Third World countries: the development of local databases and local web pages that are relevant to the people and that take into account their daily needs, their culture and their language. If this is not embedded into a project, I doubt it will have any positive results for the community. This is why the Village KCs in Pondicherry (M S Swaminathan Research Foundation) are such an important and coherent experience. While most telecentres that have failed to deliver are like Cadillacs in rural areas, the Swaminathan 'knowledge centres' are like barefoot doctors and the Green Revolution, both of which have delivered and are appropriate to their contexts".

MSSRF recognized early that the future of food security in the developing world, especially South Asia, was dependent less on resource-intensive agriculture and more on knowledge intensity. The important step in the use of

ICTs in sustainable agricultural and rural development is the value addition made to generic information to render it locale-specific. Rural families, particularly marginal farmers and the assetless, can act on such information to improve productivity. It is on this premise that the informatics division started the *Information Village Research Project (IVRP)* in the Union Territory of Pondicherry in 1998, with the support of IDRC, Canada. Subsequently, the CIDA came forward to support this project on electronic delivery of information to the poor. At present, 12 villages are linked by a hybrid wired-and-wireless network. This project provides information on such aspects as crops, market information, education, health, employment news, government entitlements, weather and fishing conditions. Using new technological tools to bridge the social and economic divide between the haves and have-nots, this project is empowering everyone with knowledge and opportunity by an inclusive use of local language and multimedia format. However, it is not technology which is the key to the success of the project; rather it is community ownership and participation by the local communities. This programme works on a hub and spokes model and forms the nucleus of a virtual university that can bring together scientists and rural poor to create agrarian prosperity.

Namma Ooru Seithi (News of our village) - community newsletter

Namma Ooru Seithi, a community newspaper, was started on 18th February, 2002. The newspaper is published twice a month and is distributed free. It carries information that

people can use in their daily life. Reaching the unreached is the concept behind this newspaper, run exclusively for people in rural areas around Pondicherry. 7,500 copies are distributed by local volunteers in 31 villages. The reporters are mostly volunteers who contribute information about job opportunities, agricultural inputs, traditional health care and other local news.

In August 2002, a readers' opinion survey was conducted by students of Community College, Pondicherry, under the National Service Scheme, in eight villages. 800 people were polled. Results show that 23% like agricultural information, 31% look for employment opportunities, 15% concentrate on education, 5% are interested in training news, and 6% seek health information.

Success stories

Here is what Alfonso Gumucio-Dagron wrote: "For many the criteria for evaluating telecentres until now seem restricted to the financial "success". The bottom line being if a telecentre or radio station makes money, then it is sustainable. No consideration about social sustainability or the impact on social change. Why do we measure social communication projects established to contribute to community development with the same criteria we measure commercial cyber-cafes?"

Sustainability deals with a wider range of issues. Let us look at ownership, for example: community ownership is a key to the sustainability of a community communication

project. However, this ownership can have multiple facets. Having a legal title to the facility is one of these, but it is not sufficient to guarantee sustainability. Having managerial responsibility, control over content, and a say in the project's future are equally important. Sustainable community ownership requires that the community has legal ownership, and is prepared to take responsibility for the project because it has internalized the sense of ownership." We are happy to report that this is indeed happening now in Pondicherry.

Influenced by Gumucio's article, the project is collecting success stories from the villages to learn how the knowledge centre helps to bring about social change.

Embalam village volunteers applied for loan under the *Swarna Jayanthi* scheme with a write-up of what they have been doing in the last four years in the KC. What is more important is that these volunteers also persuaded and helped the Eachankadu SHG to apply for the same scheme. Incidentally, it was the Embalam volunteers who helped to form the SHGs and micro enterprises in Eachankadu. In February 2003, two information village knowledge centre groups in Embalam and Echankadu were selected under this scheme and each received a grant of Rs 3.75 lakhs. Two women from Embalam village received widow and remarriage loans through the government entitlements database and have started a dairy unit and a provision store. More than 40 women received training in tailoring because of the information in the Newsletter and have started

tailoring units. Some of them were given government subsidies for training as well as starting units. A few women received the girl child deposit amount from the government. Many women formed SHGs through village KCs and have started several micro enterprises such as incense stick manufacturing, soap production, phenyl production, ornamental artifacts from shells, pickle production, etc. Below poverty line database helps SHG members to get subsidies from the district rural development agencies. One woman volunteer in Kalitheerthalkuppam has formed a thrift society with a group of 200 members.

Several farmers get a good price for their produce through market information. Information provided on various farming techniques and pest control methods helps the rural community extensively. Many farmers get information on inter-cropping and multi-cropping and implement it in their fields. Most people are using the animal husbandry database, doctors' addresses and wireless phone (in emergencies) facility. One autorickshaw driver analysed market information for a month and submitted a proposal for supplying vegetables to a beach resort. He got the order and now supplies vegetables regularly to the resort.

Teachers are using the educational CDs to teach science/arithmetic. They also prepare question papers using the computers in the KCs and issue printed sheets to the students. The local school headmasters use the centre for typing certificates and letters. Many people are being trained in MS Office, Adobe PageMaker and AdobePhotoshop. Educated

youth surf the net and develop market linkages with several companies making milk powder, fruit juice, etc. Through the Internet, many students get examination results, course details, software development details, entrance examination results, medical and engineering counseling details, etc. Many college students and research students are preparing their project reports in the KCs. Many students use the computer dictionary.

Panchayat (local body) leaders use KCs for keeping accounts and typing letters. Resource persons of the DRDA and Small Scale Industries Corporation of Pondicherry use the centres for preparing course material, training guides, lists of trainers, summary report of the training, etc. Some old people share their knowledge of traditional medicine and make it available for all the networked villages. Through the centres, the villagers have got many basic needs fulfilled like roads, streetlights, drainage, bus facility and a compound wall for a crematorium. The weather report is very useful for farmers, brick manufacturers, fishermen and others.

Workshop on "Nature Cure and Herbal Remedies" (traditional knowledge of herbal medicine for human and animal health)

A workshop on *Nature Cure and Herbal Remedies* was held in collaboration with SEVA, Madurai, on 3rd July, 2002. Traditional medical practitioners and students from two schools participated in this workshop. Since then, traditional healers are being contacted regularly about traditional herbal medicine. So far, more than 600 herbal remedies related

to human and animal health have been documented.

Rural Yellow Pages

Rural Yellow Pages have been developed for 11 villages with more than 3,500 addresses, classified into different categories, according to their occupation. It is even possible to find out who is renting out a tractor and at what price.

The volunteers have acquired enough business skills to help make the centre financially self-sustaining.

Multimedia micro enterprises training

At present, the banks and the DRDA in Pondicherry provide loans to start dairy units. Most of the rural community is not aware of other micro enterprises. MSSRF's biovillage programme and a few individuals have set up several micro enterprises. The biovillage programme helps the villagers to use the available resources in a sustainable manner as an additional source of income. *Informatics* has developed a multimedia CD, giving information on how to start micro enterprises such as preparation of soap, pickles, phenyl and ornamental artifacts from coconut shells.

Computer training (software & hardware)

From the beginning of the project, MSSRF has provided training to volunteers in MS Word, MS PowerPoint, MS Excel and MS Access. The volunteers felt that if they had a proper certificate after completing the training, it would help them get jobs. Training was

arranged through a private software company. After the training, each village volunteer submitted project reports and brochures. Now the villagers are qualified to take up jobs such as designing of wedding cards, invitations and typing reports for college students. They are also teaching students to work on computers, conduct examinations and issue certificates. Thirukanchipet KC and Adult Literacy Movement jointly conducted free computer training for socially underprivileged women this year.

The IVRP provides training in basic system maintenance and trouble shooting to the village volunteers through a private company. This is helpful to them in maintaining the systems in the KCs.

World Fishermen's Day

Every year the Government of India bans fishing in the sea between 15th April and 30th May, to allow fingerlings to grow. During the 45-day ban, the engines of most of the mechanized boats are damaged. The wooden plates break due to exposure to the sun. The nets are damaged because of non-use. During these days the fishermen face serious livelihood problems as well. They can buy food from the local shops on loan. But they are not able to meet the medical and educational expenses. The Government provides 90 kg of rice and Rs 300 per family as compensation, which are not sufficient for them. The IVRP is working in three fishing villages. After several meetings, Mr M Ramanujam, a fisherman of Veerampattinam, wrote an article in *Namma*

Ooru Seithi about the problems faced by the fisher folk (November 2002).

A workshop was organized on 21st November, 2002, on the eve of World Fishermen's Day. Both men and women representing the fishing villages participated in this workshop and pointed out the major problems faced by the fishing community.

A village level meeting was organized with officials of NABARD, at which information was provided on how to start a SHG, open a bank account and maintain accounts. In December 2002, 13 women SHGs were formed in the two villages of Veerampattinam and Nalavadu.

After several meetings and surveys, it was found that there was scope for making ornamental artifacts from shells. The initial investment is only about Rs 200 for buying shells. An expert from Thankatchimadam (near Rameswaram) provided training on making artifacts from shells, to members of Embalam and Veerampattinam SHGs. After completion of the training the Embalam SHGs provided training to the Nallavadu SHGs. Now the village women make curtains, lampshades, garlands, flower vases and other objects from different kinds of shells.

Training was provided in making camphor, candles, soap and phenyl during March - April, 2003. The members sell their products through the KCs, at government exhibitions and temple festivals. Efforts are on to create market linkages with other parts of India. Training programmes are planned for more low-cost

micro enterprises. The next training will be on screen-printing. These small-scale cottage industries will strengthen the KC activities in the form of e-rural commerce with some revenue accruing to the KCs.

Sub Programme Area 502

The Hindu Media Resource Centre for Sustainable Development

The Hindu Media Resource Centre for Sustainable Development was established in August 1998, with a generous endowment from Kasturi & Sons Ltd, Chennai, to create informed public opinion and enable the understanding of science through various communication systems. It organizes media workshops, millennium lectures and tours. Table 5.1 summarises the activities undertaken during the year.

Media workshops

The workshops are popular among media personnel, as they offer opportunities for intensive interaction with experts on important scientific issues. Six media workshops were organized this year, on diverse issues like agri-clinics, agri-business, future of biotechnology partnerships and challenges of water emergency.

Agro-exports and the promotion of agri-clinics and agri-business centres are major thrust areas in the next phase of agricultural restructuring. In order to widen the livelihood

base of the rural population, information on on-farm and off-farm employment opportunities is to be disseminated. A panel discussion on *Prospects of Agro-Processing, Agri-Business and Agro-Exports* was organized, at which Mr Ajit Singh, Hon'ble Union Minister for Agriculture; Mr Anil Swarup, Chairman, APEDA; Mr Sudhir Kumar, Managing Director, SFAC; Dr V Prakash, Director, CFTRI; Mr Y L Sapra, Chief General Manager,

NABARD and Dr Arun Wayangankar, Manager, NDDB, were the panelists. Prof M S Swaminathan was the moderator. The meeting was well-attended by the regional media. Detailed information about agro-processing and agro-exports was given wide coverage in the media reports.

On the eve of the WSSD, Johannesburg, *The Ecology of Hope Initiative* was launched by His Excellency the Governor of Tamil Nadu, Shri

Table 5.1 *Activities during the year*

Activity	Date	Details
Media Workshop	03 Jun 2002	<i>Prospects of Agro-Processing, Agri-Business & Agro-Exports</i>
Media Workshop	20 Aug 2002	<i>Ecology of Hope Initiative</i>
Media Workshop	05 Sep 2002	<i>Eastern Ghats: The Hills of Hope</i>
Media Workshop	04 Dec 2002	<i>Beyond Rome and Johannesburg: Towards a Better Common Present</i>
Media Workshop	12 Jan 2003	<i>Future of Biotechnology: Partnerships and Public Acceptance</i>
Media Workshop	16 Apr 2003	<i>Jal Swaraj: Facing the Water Emergency</i>
Millennium Lecture	01 Dec 2002	<i>Eradicating Rural Poverty: Lessons Learnt and Way Forward</i>
Special Lecture	28 Feb 2003	<i>Gender Diversity of Biodiversity Conservation</i>
Public Fora	02 Dec 2002	<i>The Right to Food: Ethical Dimensions</i>
Public Fora	09 Jan 2003	<i>The Legacy of Watson and Crick: 50 Years Later</i>
Public Fora	04 Mar 2003	<i>Towards Freedom from Hunger and Malnutrition</i>
Media Tour	02 Feb 2003	Inauguration of Artificial Coral Reef Society and Fish Pickle Unit at Thuthukudi in commemoration of World Wetlands Day
Documentaries Produced	2002-2003	The Eastern Ghats: Hills of Hope Community Agro-biodiversity Centre Touch and Smell Garden Biotech Park for Women Kulavai 2002 Gulf of Mannar Millets for Better Health MSSRF: A Mirror

Ramamohan Rao. The media workshop discussed livelihood security based on eco-jobs and eco-entrepreneurship to reach the goal of a hunger-free world. The panelists included Prof M S Swaminathan, UNESCO Chair in Ecotechnology & Chairman, MSSRF, Dr K Balasubramanian, Director, JRD Tata Ecotechnology Centre, MSSRF and others. Mr N Ram, Editor, *Frontline* was the moderator. The media found the workshop useful, since the presentations were made by a team of experts who participated in the WSSD.

To commemorate the International Year of Mountains, a Workshop on *Eastern Ghats: The Hills of Hope* was organized. It focused on conservation of genetic resources, strengthening sustainable livelihoods and health and nutritional dimensions in the Eastern Ghats region of India. The panelists were Dr Divakar Rao, Geologist, NGRI, Hyderabad; Prof K V Krishnamoorthy, Bharathidasan University; Ms Girija Vaidhyanathan, Secretary, Health and Family Welfare, Government of Tamil Nadu; Dr Sowmya Swaminathan, Deputy Director, TRI and Dr S Balaji, Director, Department of Environment, Government of Tamil Nadu. Mr B R Kumar, Deputy Director General, South Zone, All India Radio, Chennai, moderated the workshop.

The media has an important role to play in reporting hunger, food crises and anticipated famines and highlighting the need for sustainable development. To keep hunger on the agenda of our leaders, the media workshop *Beyond Rome and Johannesburg: Towards a Better Common Present* was organized. The

panelists were Swami Agnivesh, activist, Mr Kamal Hassan, film personality; Ms Sivasankari, writer; Mr Andras Erdelyi, Hungarian journalist and writer, Mr Sudhangan, electronic media, Dr Asha Krishna Kumar, *Frontline*, and Ms Jennifer Arul, NDTV. Mr Sashikumar Menon, Chairman, Asian Media Foundation, Chennai, moderated.

This is the 50th year of the discovery of DNA Double Helix. Several major discoveries and achievements in science over the last five decades have created a major impact on food, health, nutrition and water security. Clarifications and interesting information on these issues were provided at the workshop, *Future of Biotechnology: Partnerships and Public Acceptance*, which was held as part of the annual dialogue (reported in detail in SPA 506). The panelists included Prof M S Swaminathan, Chairman, MSSRF; Dr S R Rao, DBT, Government of India; Dr Purvi Mehta-Bhat, Science Ashram, Baroda; Dr Latha Rangan, Norman Borlaug Institute, UK; Dr Krishna R Dronamraju, President, Foundation for Genetic Research, USA; and Dr Devinder Sharma, President, Environmental Journalists Forum, New Delhi.

Realizing the need to harness our water resources to meet the demands of the domestic, agricultural and industrial sectors, a media workshop on *Jal Swaraj: Facing the Water Emergency* was organized. Harnessing rain water, treated effluents and seawater for effective water supply augmentation, water saving measures including low water requiring toilets

and more crop per drop for efficient demand management, bioremediation and other technologies to improve quality of water were the topics discussed. Mr Suresh Prabhu, Chairman of the Task Force on the Interlinking of Rivers, Government of India; Thiru R Jeevanantham, Hon'ble Minister for Agriculture, Government of Tamil Nadu; Dr Dyno Keatinge, Deputy Director General, ICRISAT; Prof Ramasamy Sakthivadivel, IWMI; Dr K Palanisamy, Director, Water Technology Centre, TNAU; Mr A C Kamaraj, Chairman, National Waterways Development Council, Madurai; and Ms Sumita Dasgupta, Centre for Science and Environment (CSE) were the panelists. Mr N Ravi, Editor, *The Hindu*, moderated the workshop. The panelists clarified to the journalists that ecological, economical, technological, environmental and social issues are given due attention in the proposal to create links. Detailed studies would continue and even ISRO would be requested to provide satellite images to facilitate implementation. Mr Prabhu further clarified that the objectives of the proposal included achieving water security, food security and energy security while enlarging the forest cover. More than 30 print, electronic and online media journalists covered the workshop, as it was a topical and controversial national issue. The media expressed a desire for more such workshops.

Millennium lectures

Experts with an excellent understanding of food security, sustainable development and poverty alleviation issues at the global and national level are invited to deliver the Millennium Lectures.

Eradicating Rural Poverty: Lessons Learnt and Way Forward: Mr Lennart Båge, President, IFAD, Rome, said in his lecture that there was a high concentration of hunger and poverty in Asia and the Pacific. International agencies and developed countries have committed themselves to end poverty in the next 25 years and agreed to mobilize funds for poverty eradication programmes in developing countries. In addition, issues related to gender and biodiversity are being paid more attention. He added that IFAD has been extending assistance to rural poverty alleviation programmes in developing countries and its programmes have so far reached 500 million poor people.

Public fora

Taking advantage of the presence of leading scientists and development thinkers in Chennai, MSSRF organizes public fora at a location accessible to common people, students and the media on topics of social relevance. The Public Forum is much appreciated as it provides an opportunity to interact with experts and get clarifications on the spot. Three public fora were organized this year.

Right to Food - The Ethical Dimensions: The crucial importance of food security to world peace and economic development demands that the international community take collective responsibility and initiative to eradicate hunger and famine on a global basis while individual countries deal with it domestically. In this context this forum brought Mr Martin Lees, Rector, UN University of Peace, Costa Rica; Mr KHJ

Wijayadasa, Advisor to the Prime Minister of Sri Lanka on Sustainable Development; Dr Varsha Das, former Director, National Book Trust, New Delhi; Mr Pedro Medrano, Country Director, UNWFP and Dr Ashgar Ali Engineer, Founder & Chairman, Centre for Study of Society and Secularism, Mumbai, as panelists.

The Legacy of Watson and Crick—50 years later: Against the backdrop of fresh studies in human cloning and innovations in agriculture and biotechnology, experts participated in this public forum on new technologies, focusing on ethics and reach. The question of how we can develop a situation of win-win to benefit everyone, while emphasizing the need for social inclusion, was addressed. Dr G S Kush, World Food Prize laureate, Dr Frank Rijsberman, DG, IWMI, Colombo and others enlightened the audience. Prof M S Swaminathan moderated the forum.

Towards Freedom from Hunger and Malnutrition: Food and water occupy the first position in the hierarchical needs of human beings. International goals set by the UN and FAO stipulate that the number of malnourished and under-fed children, women and men, should be reduced by half in every country by the year 2015. This public forum was organized, taking advantage of the visit of world leaders in the area of nutrition on the occasion of the 30th session of the UN Standing Committee on Nutrition (SCN). Ms Catherine Bertini, United Nations Undersecretary-General for Management and

Chair, SCN of UN; H E Specioza Wandira Kazibwe, Vice President of the Republic of Uganda, Bishop Dom Mauro, Nutrition Advocate from Brazil and many others participated. Mr N Ram, Editor, *Frontline*, moderated.

To commemorate World Wetlands Day, it was decided to conduct a media tour to Thuthukudi, where Prof M S Swaminathan inaugurated the Artificial Coral Reef. Its significance is that it is a unique project, undertaken for the first time in India on a large scale. The GoM region is known for its corals, which are being exploited to a significant extent, threatening the existence of corals in the region. To ensure the health of the corals that support the livelihoods of a large number of people of the region, an artificial coral reef programme has been launched. The journalists witnessed the deployment of the artificial reefs.

THMRC produced eight documentaries/short films this year.

Sub Programme Area 503

Design and Development of Databases and Provision of CD-ROM Services

The Informatics division has been working to enhance capacity building and information networking by collecting, collating and

disseminating actionable information through database services at different levels. Most of the databases are in the public domain. It shares technical resources with universities, research institutions and individuals.

Global Mangrove Database and Information System (GLOMIS)

MSSRF has been identified as the resource centre for South and South-East Asia for the GLOMIS. The other centres are in Brazil, Fiji and Ghana. This database contains four categories namely, bibliographic references, experts, institutions and projects. The ITTO and ISME support this project. 800 bibliographic references, as well as information on 150 experts, 35 institutions and 20 projects, were uploaded in the GLOMIS web site. All the records are related to Indian Ocean Rim Countries.

Most of the bibliographic references were collected from *CAB Abstracts*. As the GLOMIS format is different from the CAB format, a special software was developed for converting CAB text files to the GLOMIS format. Nearly 600 experts were contacted for updating information, but only 10% of them replied. Information on other experts was collected from web search engines and web sites of mangrove journals. Information on the people was collected from the mangrove-email discussion list organized by Western Australian Mangrove Page and through ENDNOTE software, which links several universities and major libraries.

SCOPE volumes converted into web form

The Scientific Committee on Problems of the Environment of the International Council of Science, France, has commissioned MSSRF to convert their publications into HTML files for wider distribution through the web. This year five volumes were converted into web form and they are available in the SCOPE web site (www.icsu-scope.org) under the Virtual directory section. All the books can be downloaded free of cost. These books deal with environmental issues, the greenhouse effect, climate changes, biological invasion, dynamic changes in the ecosystem, biochemistry of world rivers, sulphur cycling of wetlands and effects on coniferous forests and grasslands.

The following books were converted this year:

The Global Carbon Cycle, edited by B Bolin, E T Degens, S Kempe and P Ketner, 1979, John Wiley & Sons. SCOPE 13

The Major Biogeochemical Cycles and their Interactions, edited by Bolin and Robert B Cook, 1983, John Wiley & Sons. SCOPE 21

Climate Impact Assessment, edited by Robert W Kates, Jesse H Ausubel and Mimi Berberian, 1985, John Wiley & Sons. SCOPE 27

Method to Assess Adverse Effects of Pesticides on Non-target Organisms, edited by Robert G Tardiff, 1992, John Wiley & Sons. SCOPE 49

Radioecology after Chernobyl, edited by Sir Frederick Warner and Roy M Harrison, 1993, John Wiley & Sons. SCOPE 50

Bioinformatics Centre and CD-ROM Library

The Bioinformatics Centre, supported by the Department of Biotechnology, Government of India, serves as a vehicle for access to and dissemination of databases. This is one of the 61 centres established in India. This year the Bioinformatics Centre has developed a new Gene Bank software. The main aim of the database is to protect the intellectual property rights of tribal people. It provides information on seed collection date, collection number, family, genus, species, cultivar name, regions explored, village, taluk, district, state, latitude, longitude, date of showing, date of harvesting, cultivation practices, nature of disease, disease susceptibility, habitat, frequency, soil type, soil colour, soil texture, land aspect, slope, topography, agronomic score, photograph, farmer's attribute, farmer's name, ethnic group, address of the farmer, collector's name and address.

The Centre also supports a CD-ROM library, which offers *CAB Abstracts* free of cost. The following databases are being maintained : AGROSTAT & FAO STAT (1961 - 1996), SOFA '93 & SOFA '95 (Time series analysis), World Resources Data (1995 - 1996), Commonwealth Agricultural Bureau (1984-2002), Spectrum CD, AGECON CD, BEAST CD, CABPEST CD, Crop CD, E-CD, Hort CD, Plantgene CD, Soil CD, Tree CD, VET CD. This year 650 researchers from 14 universities, 16 research institutions and 41 colleges used the CD-ROM library.

Sub Programme Area 504

Scientometrics/Literature Analysis Group

New biology research in the two most populous countries of the world, India and China, has been mapped, based on publications and citation data. Papers indexed in three databases, viz. compact disc versions of *Biochemistry and Biophysics Citation Index*, *Biotechnology Citation Index* and *Derwent Biotechnology Abstracts* in the three publication years 1992, 1995 and 1998, and citations to papers published in 1995 as seen from the CD edition of *Science Citation Index 1995-2000* formed the basis of the analysis. Institutions publishing a large number of papers, cities and states contributing the papers, journals which publish the papers, highly cited papers and internationally co-authored papers were identified. The journals are classified by subfield, journal country and impact factor (as recorded in *Journal Citation Reports 1997*). China has overtaken India in the past few years in the number of papers published.

New biology is the area which receives the most funds and which accounts for the majority of the publications in the advanced countries such as the G7 countries. According to NSF's *Science and Engineering Indicators 2002*, life sciences account for more than half of the publications in the G7 countries as well as in Sweden, The Netherlands, Australia, New Zealand, Switzerland, Israel and Spain.

However, life sciences research accounts for less than one-fourth of the scientific research papers from both India and China. China is particularly strong in Mathematics and Chemistry and accounts for about 10% of the world's literature in these subjects. India publishes more than 5% of the world's agricultural research, but otherwise its contribution in most fields is around 2%. India's share of papers indexed in *BBCI* amounts to 1.3 to 1.7% of the world's publications, while China's share has increased from 0.56% in 1992 to 1.34% in 1998. Unlike advanced countries, both India and China have not taken many patents. Only five US patents each were recorded in 1998.

More than 800 Indian institutions have contributed to new biology research. Indian Institute of Science, Bangalore; Banaras Hindu University, Varanasi and University of Madras, Chennai, have published the largest number of papers from India. In all, new biology research papers in India come from 224 cities, with seven of them (Delhi, Chennai, Bangalore, Hyderabad, Kolkata, Mumbai and Lucknow) publishing more than 100 papers in each of the three years. Among the 28 Indian states publishing papers, seven published more than 200 papers each year. About 60% of Indian research papers come from academic institutions. Universities contributed 45% of the total research output in the three years. Research organizations and central government departments contributed 29.6%.

Of the 2,686 papers published from India in 1995, only 1,935 were cited at least once up to

2000 and in all they received 8,209 citations as seen from *Science Citation Index* (CD edition). Thirty Indian papers were cited more than 25 times, of which six were cited more than 50 times. Of the 1,448 Chinese papers published in 1995, only 578 were cited at least once up to 2000. In all, they were cited 3,151 times. Of these, 17 papers were cited more than 25 times and four were cited more than 50 times.

About 13% of Indian papers have resulted from international collaboration as compared to 32% of Chinese papers. India collaborated mostly with the USA, followed by Germany, Japan, UK and France and 65 other nations in new biology research. Half of the highly-cited Indian papers are written in collaboration with authors from abroad. China is collaborating mostly with the USA, Japan, Germany and UK. The number of countries China collaborated with rose from 43 in 1995 to 48 in 1998.

Sub Programme Area 505

Library and Information Services

The library has a collection of 17,500 books, 44 journals, 1,450 back volumes, project reports of the Centre and about 180 dissertations.

This year, more than 700 users from both national and international institutions accessed the Boothalingam Library. A new software called *AUTOLIB* was installed to facilitate speedy library operations. This is a multi-user and web-enabled software. Users

can access the catalogue from their desktops. All library documents have been completely bar-coded.

E-mail-based alerts are regularly sent to in-house users. These alerts, which are gathered from the Internet, contain information relevant to the needs of individuals in the Foundation.

Sub Programme Area 506

Workshop, Conferences and Training Programmes

Several workshops, conferences and training programmes were held during the year, as listed below and in Tables 5.2 to 5.5.

Seminar on Enlarging Agro-processing, Agri-business and Agri-exports: Role of Agri-clinics and Agri-business Centres (3rd June, 2002)

The Indian Association for Agri-business Development (IAAD) and THMRC organized a seminar on enlarging agro-processing, agri-business and agri-exports at MSSRF, Chennai, on 3rd June, 2002. The aim was to create an awareness among agri-processing entrepreneurs and agriculture university graduates about the opportunities and potential as well as the changes in developing the food processing sector in the post WTO scenario.

The programme was organised in collaboration with NABARD, SFAC, SBIRD, APEDA and

MANAGE. Experts from Government and NGOs, representatives from agro-processing, agri-business and agri-export industries, faculty and students from leading agri-universities and representatives from various commodity boards attended the meeting. Shri Ajit Singh, Union Minister for Agriculture, Government of India inaugurated the meet.

International Workshop on Forest Science and Forest Policy in the Asia-Pacific Region: Building Bridges to a Sustainable Future (16th-19th July, 2002)

The Science/Policy Interface Task Force held its Second Regional Workshop at MSSRF, Chennai, from 16th - 19th July, 2002. The workshop was sponsored by the USDA Forest Service, with support from Seoul National University, CIFOR and FRIM. 38 delegates from eight Asian nations (India, Nepal, Sri Lanka, Malaysia, China, Mongolia, Republic of Korea, and Japan), the United States and organizations like CIFOR and FAO, attended the meeting.

The workshop was inaugurated by Thiru P Mohan, Minister for Forests & Environment, Government of Tamil Nadu. Prof M S Swaminathan delivered the keynote address on *Forest Science and Policy for Sustainable Food Security*. The technical sessions included presentations, reports and open discussions of 18 papers over a 3-day period. A field trip to Chidambaram, Pichavaram, and Pondicherry highlighted some of the pioneering, community-development activities of MSSRF and its collaborators.

The expertise, interests and experiences of the participants spanned national and regional issues relevant to the theme of the workshop, from community-based forest rehabilitation and management and industrial forest plantation development to national and international forest policies. The diversity of their backgrounds and perspectives and the wealth of experience that they brought with them to the workshop resulted in dynamic, thought-provoking discussions on the roles and interactions of local communities, NGOs, the private sector, international organizations, government agencies and policy-makers in the development of forest policies and management practices in the complex settings that characterize the region. All the papers presented at the workshop will be made available as a web-based publication on the Task Force website (www.iufro.boku.ac.at).

ICT Enabled Development: South-South Exchange through Travelling Workshop (21st-28th October, 2002)

The objective of this international workshop was to facilitate an exchange of development perspectives between village communities in Tamil Nadu and Pondicherry in Southern India and representatives from developing countries, with specific focus on ICT-enabled development.

The workshop was jointly organized by the JRD Tata Ecotechnology Centre and the Informatics group, with the support of the Humanist Institute for Cooperation with Developing Countries, IICD and IDRC of Canada.

Twenty participants from 13 countries (including Bolivia, Dar Es Salam, Honduras, India, Kenya, Malaysia, Mongolia, Nigeria, Philippines, Sri Lanka, Tanzania, Thailand and Zimbabwe) participated in the programme.

The participants visited the villages in Pondicherry and Dindigul District. The members of SHGs and farmers' associations made presentations and the interaction helped the participants to understand MSSRF's perspective in integrating ICT with overall knowledge management of the community. The ability of the village community to collect and consolidate information and convert it into knowledge is the prime focus of the knowledge management programme.

Consultation on Peace, Freedom from Hunger and Sustainable Development: The Ethical Dimensions (2nd-4th December, 2002)

The Consultation was organized with support from the IFAD. Organized in dialogue mode, the meet was inaugurated by Mr Lennart Båge, President, IFAD. Mr Pedro Medrano, Country Director, WFP, Mr Martin Lees, Rector, United Nations University for Peace, Dr A H Zakri, Director, United Nations University, Mr KHJ Wijayadasa, Advisor to the Prime Minister of Sri Lanka, Swami Agnivesh and Mr D R Karthikeyan, Former Director General, National Human Rights Commission, India, were among the distinguished participants. Representatives of all the major religions presented their views during the deliberations.

The core discussions at the meet centred on peace, freedom from hunger and sustainable

development. At the concluding session, the suggestions made by the participants were discussed to evolve a plan of action. The Proceedings of the meet are to be published.

Annual Dialogue on *The Legacy of Watson and Crick: Biotechnology for Food, Health, Nutrition and Water Security* (9th - 12th January, 2003)

The year 2003 marks the 50th year of the discovery of the DNA double helix, hailed as the most important biological work of the last 100 years and ranked as one of the greatest discoveries of all time. To commemorate the golden jubilee of the discovery of the DNA structure, the interdisciplinary dialogue this year was organized on the theme of the Legacy of Watson and Crick: Biotechnology for Food, Health, Nutrition and Water Security.

The dialogue provided an opportunity to assess the impressive progress made during the last 50 years and its implications for the future. The scientific and technical sessions deliberated on issues such as the role of biotechnology in productivity and nutritional enhancement in rice, the global initiative on rice genomics, salinity and drought stress, genetic modification, bioremediation, biotechnology and drug development, stem cell research and its implications, bioinformatics, DNA chips, gene discovery, international regulations, policy harmonization and regional priorities, collaborations and partnerships and public acceptance and social implications. Eminent experts from various sectors participated in the discussions.

The following conclusions emerged from the deliberations:

Scientific leap-frogging in both the theoretical and applied aspects of the new genetics will take place mostly in industrialized countries. India will experience a serious genetic divide in the absence of a well-defined and forward-looking national policy in the fields of food and agricultural biotechnology as also in the field of medical biotechnology, which involves ethical issues with reference to both human and animal experiments. The participants also agreed that India has made striking progress in both basic and applied biotechnology as related to medicine and agriculture. Having a reasonably well-developed infrastructure for biotechnology research and education, the country is in a position to move forward in mobilizing the power of biotechnology for strengthening the national food, water, livelihood and environmental security systems. The participants in the dialogue, therefore, felt the need for developing a National Food and Agricultural Biotechnology Policy through political consensus.

The participants also recommended that to build the national capacity in all areas of risk assessment and biosafety valuation and monitoring, it would be useful to set up a National Research Centre for the Safe and Responsible Use of Genetically Modified Crops. Such a Centre could provide the scientific and technical support needed by the proposed National Biotechnology Regulatory and Advancement Commission. The Centre should also maintain a global database on biosafety assessment procedures and legislation and

undertake training, capacity building and networking in the field of biosafety evaluation.

The recommendations of the dialogue "Chennai Declaration: Bridging the Genetic Divide", have been published in *Current Science* (84 (4) 494-496, 25 February 2003, www.ias.ac.in/currsci//feb252003/494.pdf)

Commemoration of World Wetlands Day (2nd February, 2003)

MSSRF has been working in the GoM region to develop marine-based, alternative livelihoods to reduce the dependence on marine resources. An Agar Production Unit and Artificial Coral Reefs have been developed in the region as part of the ongoing efforts. World Wetlands Day was celebrated with the official launch of the Agar Production unit and the Reefs in Thuthukudi. Members of the village SHGs, media persons, donors, local officials and MSSRF staff participated in the function.

30th Annual Session of the United Nations Standing Committee on Nutrition (UNSCN) (3rd-7th March, 2003)

The 30th Annual session of the UNSCN was held at the Industrial Consultancy and Sponsored Research (IC&SR) Complex of the Indian Institute of Technology, Madras. MSSRF was the local organizer of the meet which attracted more than 200 participants working in the area of nutrition from India and abroad. The highlight of the meet was a Symposium on Mainstreaming Nutrition to Improve Development Outcomes, held on

4th March. H E Dr Specioza Wandira Kazibwe, the Vice President of Uganda, gave the keynote address. Working Group Sessions were held on Nutrition throughout the Life Cycle, Nutrition in Emergencies, Nutrition and HIV/AIDS, Micronutrient Malnutrition, Nutrition, Ethics and Human Rights, Capacity Development in Food and Nutrition and Nutrition of School Children. Bishop Dom Mauro, Nutrition Advocate from Brazil, Ms Catherine Bertini, UNSCN Chair and UN Under-Secretary General, Mr Flavio Valente of the Global Forum on Sustainable Food and Nutrition Security, Dr Lawrence Haddad from IFPRI and Mr Venkatesh Mannar, President, Micronutrient Initiative, were among the distinguished participants.

Consultation on Towards Malnutrition Free Tamil Nadu (3rd March, 2003)

A one-day consultation on Malnutrition Free Tamil Nadu was held on 3rd March, 2003. Shri P S Ramamohan Rao, H E, the Governor of Tamil Nadu, inaugurated the Meet, organized with the support of UNICEF and the Department of Women and Child Development, Government of Tamil Nadu. A background paper, detailing the Food Security situation in the State and the prevailing health and nutrition status, a history of Government programmes for food and nutrition, strategies to address the lacunae and success stories, formed the basis for the deliberations.

Representatives from the Government of Tamil Nadu, including Nutrition Project Officers and Communication Officers from the

districts, participated in the Meet, besides experts from academic institutions, UNICEF and MSSRF.

Training Programme on Biodiversity Conservation and Prospecting (26th March - 2nd April, 2003)

This training programme on Biodiversity Conservation and Prospecting was organized by Honda Informatics Centre in collaboration with the Tissue Culture and Bioprospecting Laboratory of MSSRF, Chennai, with financial support from the Department of Biotechnology, Government of India.

The lectures addressed themes which are essential to a researcher in the area of conservation biology and provided the perspective that biodiversity conservation is no longer a "stand alone" area of research, where only botanists and taxonomists are actively involved, but one in which several disciplines are integrated and have become indispensable.

The practical sessions dealt with important modes of conservation and characterization of biodiversity, especially with *ex situ* methods of conservation (tissue culture in particular), molecular marker methods to characterize genetic diversity (RAPD in particular) and utilization of plant-based natural products for health and agriculture. The participants were taught to identify a lead molecule with pharmaceutical or agricultural value, validate traditional knowledge through functional analysis and other methods (like TLC and HPLC) to standardize herbal drugs.

Consultation on Towards Hunger-free India - Countdown from 2007 (4th-5th April, 2003)

The consultation was organized at the India International Centre Annexe in New Delhi by WFP, FAO and MSSRF. Mr K C Pant, Vice Chairman, Planning Commission, Government of India, inaugurated the meet. Discussions were held under the heads of The Challenge, The Response and The Way Forward. The proceedings of the meet are to be published.

A series of State Level Consultations were also organized by the BV Rao Centre for Sustainable Food Security, MSSRF and WFP (Table 5.2). Papers were prepared and submitted by MSSRF on the Food Insecurity situation of the respective states.

Vacation Training Programme for School Children on Bio-resources and Biotechnology (8th-27th May, 2003)

Perceiving the need to generate awareness about India's rich biodiversity and bioresources among all sections of society, particularly children, a three-week residential vacation training programme on Bioresources and Biotechnology was organized for students, with financial support from NBDB and DBT. Twenty-six children from different schools and from diverse backgrounds, were selected, one from each school to enable many schools to participate. Students were selected from Kerala, Karnataka and Tamil Nadu. There were lectures from experts on various topics

such as the Green Revolution, Environmental Education, Biodiversity Concepts and new and exciting developments in the field of biology. The course included a one week field visit to MSSRF project areas in Kannivadi, Thonimalai, Chidambaram, Pichavaram and Pondicherry, where the participants got first hand exposure to concepts of the Biovillage, Knowledge Centres, conservation of mangroves, intensive integrated farming models, integrated pest management systems, the benefits of organic farming and eco-friendly micro enterprises. The remaining two weeks were spent in hands on training in the laboratories, learning techniques in DNA isolation from plants and bacteria; monitoring ecosystem health using lichens, secondary metabolite profiling, tissue culture propagation methods and pest management. The students submitted a Project Report on the completion of the course.

Celebration of National Technology Day (11th May, 2003)

National Technology Day was commemorated at MSSRF on 11 May, 2003, with a programme on *Grassroot Women Leaders: Shaping Rural India's Technological Future*. The event showcased examples of the power of leadership

among grassroot women workers. Women leaders from MSSRF project villages presented their experiences on how the use of appropriate technology served not only to enhance their livelihoods but also transform their lives and that of the community around them. The women highlighted the benefits and the changes in their lives after the adoption of the *Trichoderma viride* production programme in Kannivadi, rural literacy programme at Samiyarpetti, the development programmes undertaken at Thonimalai, the use of information communication technologies in Pondicherry and the artificial pearl culture programme at Mandapam. These programmes have served to raise their self-esteem and social status and increased community participation. Tmt B Valarmathi, Minister for Social Welfare, Government of Tamil Nadu was the Chief Guest.

India Consultation on Evergreen Revolution, based on the findings of the Report: *Human Development in South Asia 2002: Agriculture and Rural Development* (16th May, 2003)

The UNDP and MSSRF jointly organised a one-day India Consultation and media launch of

Table 5.2: *State consultations on food insecurity*

State consultation on	Date	Venue
Food Insecurity Situation in Madhya Pradesh	3 - 4 April, 2002	Bhopal
Food Insecurity Situation in Orissa	15-16 May, 2002	Bhubaneswar
Food Security Situation in Rajasthan	25-26 June, 2002	Jaipur
Food Security Situation in Gujarat	10-11 April, 2003	Ahmedabad

the Report on Human Development in South Asia, 2002: Agriculture and Rural Development. This Report is the latest in the series of South Asia Human Development Reports published by the Mahbub ul Haq Human Development Centre, Islamabad, every year.

It highlights the fact that agriculture, the major source of livelihood for South Asia's population, as well as the backbone of the industrial and trading systems, has not been receiving as much policy attention as it deserves. The purpose of the Report is to assess the performance of agriculture and non-farm rural livelihoods and their impact on economic growth and human development in South Asia. The Report presents the experience of five South Asian countries, India, Bangladesh, Pakistan, Nepal and Sri Lanka, examining developments in the agriculture and rural sectors since the Green Revolution in the 1960s.

Discussions revolved around four thematic areas: Rural Employment, Food Security, Land and Water, and Globalisation and Trade. Academicians, bureaucrats, students and journalists participated in the Consultation.

Commemoration of World Environment Day (5th June, 2003)

The commemoration of World Environment Day each year on 5th June stimulates worldwide awareness of the environment and serves to enhance political attention and action. This year's theme was *Water - Two Billion People are Dying for it*. In an effort to empower and

enroll people to become active agents of sustainable and equitable development and to promote an understanding that communities are pivotal to changing attitudes towards environmental issues, MSSRF organized a presentation on Sustainability of Food and Water Security in India and launched the MSSRF Genome Clubs. Dr R Chidambaram, Principal Scientific Adviser to the Government of India & DAE- Homi Bhabha Professor, inaugurated the function. Prof M S Ananth, Director, IIT Madras and Dr Nanditha C Krishna, Director, CPR Environmental Education Centre, Chennai, participated in the event. Two publications, *Virtual University for Food Security and Rural Prosperity* and *Farmers' Rights and Biodiversity: A Gender and Community Perspective* were released on the occasion. Presentations by Panchayat leaders and school students (participants of the MSSRF vacation training programme) marked the launch of the Genome Clubs.

The Genome Clubs are a unique effort at empowering students and Panchayat members with basic knowledge on Genetics, the DNA molecule, genes and genomes, to understand the positive and negative implications of scientific advancements. This novel literacy mission will also provide exposure to Panchayat members on the provisions relating to two pieces of legislation by the Government of India, the PPVFR Act 2001 and the BD Act 2002. These clubs will help to create a genetic and legal literacy movement by spreading information and evolving informed public opinion on these issues.

EDUCATION, COMMUNICATION, TRAINING AND CAPACITY BUILDING □

Table 5.3: *Training programmes held at the JRD Tata Ecotechnology Centre*

Programme	Trainee Days		
	Women	Men	Total
Accounts & book keeping	742	360	1,102
Eco-entrepreneurship and micro enterprises	2,816	922	3,738
PRA, micro planning, gender and PAME	2,719	1,153	3,872
Precision farming	651	824	1,475
SHGs, federations and micro financing	3,527	1,319	4,846
Training for field officers and Government officials	75	240	315
Training for university staff and research scholars	120	45	165
Training organized by grassroot organisations in collaboration with MSSRF	6,830	3,926	10,756
Training to other NGOs	435	315	750
Village Knowledge Centre Management	275	150	425
Total	18,190	9,254	27,444

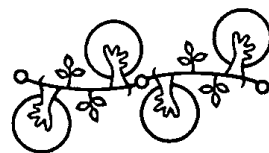
Table 5.4: *Training programmes held under Coastal Systems Research**

Topic	Site/Location	Participants
Leadership and participatory restoration	Project sites in 3 states	Members of VDMCs & SHGs
Community-based micro enterprises and alternative livelihoods	Project sites in 3 states	Members of VDMCs & SHGs
JMM and exposure to restoration technique	Tamil Nadu	TN Forest Department

* Reported in SPA 101

Table 5.5: **Training programmes held under Biodiversity Conservation, Integrated Natural Resources Management and Poverty Eradication**

Training and Capacity Building Activities at Kolli Hills, Wayanad, Jeypore and Chennai	Training period(days)	Women	Men
Participatory varietal selection of millets, Kolli Hills and Namakkal	27	73	20
<i>Trichogramma</i> training at Kannivadi and Kolli Hills	30	428	25
Malt preparation training at UAS Hebbal, Bangalore and MSSRF, Kolli Hills	61	73	13
Maize cultivation training	20	55	0
SHG formation and orientation, operation, management, micro enterprise, bank tie-up	23	198	182
Vegetable seeds distribution, training in home garden, improved method of vegetable cultivation, ginger and turmeric harvesting	203	231	48
COL - Functional Literacy training programme at Kannivadi and Kolli Hills	30	93	95
Training on Green Manure, Farm Yard Manure, Biofertilizer preparation and importance of its usage, intensive agripractices and Organic Farming	70	73	88
Biopesticide <i>vilarithzhai</i> (<i>Dodonoea leaves</i>) spray training (Kolli Hills)	12	20	31
Biodynamic compost preparation and demonstration, NADEP compost preparation and vegetable chamber for farmers	126	97	89
PPVFR Act and BD Act preparatory workshop and training	27	204	179
Training on medicinal plant nursery raising and cultivation techniques	214	240	34
Sacred grove survey and training	10		110
Workshop on Forest Resource Management and BD Act at Jeypore	2	5	12
Sensitization training for Pallikaranai wetland	15	45	28
Biodiversity conservation training at Kakinada	5	35	6
Orientation on Integrated Pest Management to field staff of Jeypore and Wayanad	2	5	13
Learning visit of farmers from Jeypore and Wayanad to MSSRF, Chennai and Pondicherry Biocentre	8	13	21
Inputs to Field Level Workshop on PPVFR Act and BD Act at Kolli Hills, Wayanad and Jeypore	6	143	123
Others (Exposure visits, training on various aspects)	27	493	652
Total	918	2519	1756



Special Projects

Three publications were brought out and a database of global initiatives on eco-jobs and eco-entrepreneurship was released at the launch of the Ecology of Hope Initiative at WSSD. The Message of Hope was spread at the Youth Employment Summit and the second GEF Assembly Meeting at Beijing. A project design workshop on Green Enterprises was organized for youth from the Asia Pacific region. A paper on Ethics of Economic Development is under preparation for UNESCO.

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Sub Programme Area 601

Launching of an *Ecology of Hope* Initiative at the World Summit on Sustainable Development, Johannesburg

Johannesburg, where WSSD was held, is a classic example of the many adverse effects of jobless economic growth. Thousands of jobless youth walk aimlessly in a state of despair on the streets of this city of gold mines. It has become increasingly clear in recent decades that without assuring the livelihood security of the people, ecological security cannot be ensured. This was reiterated in the Johannesburg Declaration on Sustainable Development, issued at the conclusion of the WSSD held in Johannesburg between 24th August and 4th September, 2002. The Declaration reiterated that eradicating poverty, changing consumption and production patterns and protecting and managing the natural resource base for economic and social development, continue to be the overarching objectives and essential pre-requisites for sustainable development. WSSD also recognized that sustainable development requires a long-term perspective and broad-based participation in policy formulation, decision-making and implementation at all levels, significant changes in day-to-day behaviour by producers and consumers and a need to increase income-generating employment opportunities if jobless economic growth is to be addressed.

It was against this backdrop that the *Ecology of hope Initiative* of the M S Swaminathan Research Foundation, with support from GEF, and Lemelson Foundation, launched on 30th August at the Liberty Theatre during the WSSD, received considerable appreciation.

While MSSRF has been promoting ecotechnologies or environmentally and economically sustainable technologies in order to convert natural resources into wealth and jobs since its inception, three specific activities were initiated towards the launching of the *Ecology of Hope Initiative* at the WSSD. As reported last year, the first step towards the message to be carried to WSSD, as part of the *Ecology of Hope Initiative*, was the international consultation held at MSSRF, Chennai, India, January 2002 on *New Technologies: Reaching the Unreached*, the theme being *New Employment Opportunities in the New Era and the New Economy*. The proceedings of the consultation were brought out as a publication titled *Opening the Windows to a World of Opportunity: New Eco-Friendly Jobs in the New Economy*.

The second activity which was initiated as part of the *Ecology of Hope Initiative*, was a Global Database on Eco-jobs and Eco-entrepreneurship in the form of a CD prepared in cooperation with Scope Marketing and Information Solutions Pvt Ltd headed by Mr Chandu Nair. This has been specially prepared to help planners, policy-makers, economists, entrepreneurs, researchers and job seekers, to initiate eco-enterprises. The initiatives described in the case studies are wide-

ranging in their aim, scale and methodology. They are job-focused, technology-based or both. They are small-scale or medium-scale, government-inspired or private-led and belong to both industrialized and developing countries. The type of employment provided is either direct or indirect. All the initiatives have an enabling and empowering character. There are more than 750 entries in the database which focus on initiatives between various partners and the application of innovative technologies towards the sustainable use of natural resources, biodiversity conservation and management, non-conventional energy, and land and water resources. This database forms a part of the second publication titled *Towards an Era of Eco-Jobs and Eco-Entrepreneurship: Challenges and Opportunities*, which was widely disseminated not only at WSSD but also at various other venues globally as part of various conferences/meetings to inform partners in government, non-governmental organizations, small business units and local groups about the different types of environment-friendly enterprises and eco-technologies.

The third publication brought out specially for the meet at WSSD was Prof M S Swaminathan's *From Rio de Janeiro to Johannesburg: Action Today and not Just Promises for Tomorrow*. Through this book he offers suggestions for immediate action to address unsustainable life styles and unacceptable poverty. The book carries suggestions specific to India in areas related to land, water, monsoon and climate

management and elimination of endemic, hidden and transient hunger. The book also provides a balance sheet of progress and setback since 1992 in preserving our blue planet as a happy home for present and future generations.

All the three publications were released at the curtain raiser to WSSD, which was held at the Foundation on the 20th of August, 2002, and the rationale for holding the Consultation on the *Ecology of Hope Initiative* was also presented. *The Hindu* Media Resource Centre organized this meeting and there was a wide write-up on this initiative in the media.

The Hon'ble Minister for Environment and Forests, Mr T R Baalu, inaugurated the half-day workshop on the *Ecology of Hope Initiative* at WSSD. After brief welcome remarks by Dr Swaminathan, Ms Julia Novy-Hildesley, Managing Director, Lemelson Foundation and Dr Gerry Salole, Resident Representative, Ford Foundation, SA, Dr Mohammed El Ashry, CEO of GEF delivered the keynote address. A detailed presentation of the database through case studies in the five areas based on the WEHAB (Water, Energy, Health, Agriculture and Biodiversity and Eco-system Management) model proposed at the Summit and videos on eco-jobs prepared for this occasion were presented by Directors of MSSRF Dr K Balasubramanian, Dr Sudha Nair, and Mr Chandu Nair, Director SCOPE, followed by a keynote address by Dr Julia Marton-Lefèvre, Executive Director of LEAD International.

One of the main recommendations of the workshop participants was that such an initiative should not be restricted to the CD format alone and should be made available on the web so that it will have wider outreach. The participants also felt that there was a need for a continuous updating of this database. All three publications, including the CD, were widely disseminated at the Convention Centre, Ubuntu village and Nasrec village, the different venues at which WSSD deliberations were held.

The activities undertaken under this initiative were also presented at the 2nd GEF Assembly meet held at Beijing from 16th-18th October, 2002, where the discussions focused on the way forward. With the support of GEF, note-pads prepared from the waste of pseudo stem of banana by the Jhansi Rani SHG were distributed to all the participants as an example of an environmental enterprise. Requests were made to upload the database on to the MSSRF web page so that the outreach will be far and wide, increase the entries in the database and also stimulate pilot initiatives on eco-enterprises especially related to land and water management. Based on the recommendations, the entries in the database were increased from the initial number of 500 to 750 and have been made available on the MSSRF web page.

To carry the initiative forward and involve more youth in this movement, MSSRF and Education Development Centre Inc., USA launched at the Youth Employment Summit held at Alexandria in September 2002, a Decade Campaign of Action aimed at generating sustainable employment

opportunities for youth (15 to 24 years) in developing countries, bound by their common goal of fostering job-led economic growth, based on enterprises which are environmentally benign, economically viable and socially equitable, particularly in gender terms, conducted a Project Design Workshop for young entrepreneurs on the design of economically viable green enterprises. It was a six-day workshop from 30th April – 5th May, 2003, conducted on a practical mode through field visits to study the eco-job initiatives at two sites namely, the GoM Region and the Kannivadi region and through interaction with the community, understand the processes of introducing the green enterprises concept. As part of the workshop, the participants from seven countries also identified the issues and the various important components which need to be part of the eco-job revolution. They also identified some projects, which could be taken up under the YES campaign in their respective countries.

Another important outcome of the *Ecology of Hope Initiative* was the decision of the Hon'ble Chief Minister of the Government of Tamil Nadu to set up an *Eco-enterprises Park* at Nilakottai in Dindigul district to provide opportunities to young innovators and entrepreneurs in the areas of horticultural and herbal technology, renewable energy, production of the biological software essential for sustainable agriculture and food processing. This Park, based on the principle of *Good Ecology is Good Business* will be managed by State Industries Promotion Corporation of Tamil Nadu (SIPCOT) Ltd.

Sub Programme Area 602

Ethics of Economics/Development

The Regional Unit for Social and Human Sciences in Asia-Pacific (RUSHSAP) UNESCO, Bangkok, organized a two-day consultation on *The Ethics of Science and Technology - Defining an Agenda for the Asia-Pacific Region* in October, 2002. The Foundation was represented at the meet.

As a follow-up to the discussions at the meet and in order to draw up a framework in this context for the Asia-Pacific region, RUSHSAP decided to commission papers on the aspects of Bioethics, Ethics of Nano-technology, Ethics of ICT and Ethics of Economics/Development.

MSSRF has been asked to prepare the paper on Ethics of Economics/Development in the Asia-Pacific Region. The paper is under preparation and will be discussed at a larger group consultation to be organized by UNESCO later this year.

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Anita, V. 2002. *South Asian Youth Forum*. The Ministry of Foreign Affairs, Tokyo, Japan. September 1-11.

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Resources, Traditional Knowledge and Folklore. School of Legal Studies, Cochin University of Science and Technology, Cochin. November 11-13.

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- Ganesan, M. 2003. *National Workshop on Natural Dyes*. Shri AMM Murugappa Chettiar Research Centre, Chennai. February 27-28.
- Geetha Rani, M. 2002. *Workshop on Patent Awareness for Women Scientists*. Department of Science and Technology, Government of India, New Delhi, Meenakshi College for Women, Chennai. September 5.
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- Nair, Sudha. 2003. *Workshop on Gender, Science and Technology Training Manual for Asia Pacific*. Jakarta. February 4-6.
- Nair, Sudha. 2003. *UNESCO-STEPAN Coordination Board Meeting*. New Delhi. April 16-17.
- Navamuniammal, M. 2002. *ISPRS Commission VII Symposium - Resource and Environmental Monitoring - Training on Coastal Wetlands*. National Remote Sensing Agency and Indian Space Research Organisation, Hyderabad. December 3-6.
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Parasuraman, N. 2002. *Youth Project - Thesatthircku Thol Kodungal*. Shanti Ashram, Coimbatore. November 23-24.

Parasuraman, N. 2003. *National Commission for Youth: Interactive Session*. Ministry of Youth Affairs and Sports, Government of India, Chennai. January 7-8.

Parasuraman, N. 2003. *State Level Workshop on Rural Water and Sanitation in Tamil Nadu: Moving Forward, Sharing of Experiences and Visions*. Director of Rural Development, Chennai. January 9.

Parida, A. 2002. *Task Force on Biotechnology and Biosafety*. FAO-RAP, Bangkok. July 9-11.

Pillai, Renjith R. 2002. *Intensive Course on Modern Analytical Techniques in Quality Control of Drugs and Pharmaceuticals*. National Institute of Pharmaceutical Education and Research (NIPER), Chandigarh. September 2-20.

Rajalakshmi, S. 2003. *Biovision 2003 and World Life Science Forum*. Lyon, France. April 7-11.

Rajamohan, K. G. 2002. *State Level Steering Committee Meeting for Greencorps Movement in Pondicherry*. Department of Education, Pondicherry. November 25.

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Rengalakshmi, R. 2002. *Online Course on Integrated Pest Management in Cotton*. Asia Pacific Regional Technology Centre - Professional Development for Agriculture. Chennai. June 24-August 2.

Rengalakshmi, R. 2002. *Workshop on Climate Variability and Food Security*. International Research Institute for Climate Prediction, University of Columbia, New York. July 8-26.

Sajeev, V. P. and V. Balakrishnan. 2003. *National Training on Local Level Innovation Documentation*. National Innovation Foundation, Ahmedabad. January 19-21.

Seenivasan, R. 2002. *Training Programme on Remote Sensing Application Tools in Precision Farming*. Space Application Centre (SAC), Indian Space Research Organisation (ISRO), Ahmedabad. September 23-October 4.

Seenivasan, R. 2002. *Seminar on Weather and Climate: Perspectives from Space*. Indian Meteorological Society, Ahmedabad. September 25.

Selvakku, M. 2002. *Symposium on Seaweed Research and Utilization*. Seaweed Research and Utilization Association (Mandapam), Bharathidasan University, Trichirappalli. August 16-18.

Selvam, V. 2003. *Regional Workshop on Global Programme of Action for the Protection of the Marine Environment from Land-based Activities*.

United Nations Environment Programme, Colombo. April 28-30.

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Velayutham, M. 2002. *FAO Consultant for Establishing Soil Testing Service in North Korea.* Democratic People's Republic of Korea. November 28-December 12.

Awards/Honours

Balasubramanian, K. 2003. *Member, Subcommittee on Economic Affairs and Taxation, Confederation of Indian Industry.*

Parasuraman, N. 2003. *World Youth Bank Ambassador to India.* World Youth Bank Network. Croatia.

Parasuraman, N. 2003. *International Student /Young Pugwash Board Member (Asian Representative).* International Student / Young Pugwash Board. Italy.

Rao, C. S. 2002. *CSIR Young Scientist Fellowship* to participate in the Symposium on Current Excitement in Biology at Centre for Cellular and Molecular Biology, Hyderabad. Council for Scientific and Industrial Research, New Delhi.

Swaminathan, M. S. 2002. *Indira Gandhi Gold Plaque* for significant contribution towards human progress. Asiatic Society, Calcutta.

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About the Foundation

M S Swaminathan Research Foundation (MSSRF) was registered in 1988 as a non-profit Trust, recognized 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 recognized the Foundation for receiving funds from sources abroad under the provisions of Foreign Contribution (Regulation) Act, 1976.

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Entomology Research Institute, Loyola College
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(ICEF assisted)**

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for Department of Atomic Energy
Supported Project on Nuclear and
Biotechnological Tools in Coastal
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Prof. P. C. Kesavan

Executive Director and DAE Homi Bhabha Chair

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Mr. K. Baranidaran**
Scientist

Coastal Wetlands Project**

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Scientist

Dr. V. Selvam

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Mr. R. Karthikeyan**
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(Associate Director - Andhra Pradesh, Orissa West Bengal)

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Dr. R. Ramasubramanian
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Ms. Evanjalini Jessie Beaula
Scientist

Mr. R. Gunalan***
Scientist

Mr. Md. Najeebullah Shariff*
Scientist

* Left during the year; ** Project ended; *** Passed away

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Orissa

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Scientist

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Scientist

Mr. Sathyashree Nayak
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Mr. Rabi Narayan Nayak
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Field Attendant

Mr. Pradeep Kumar Nayak
Administrative Assistant

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Nuclear and Biotechnological Tools for Coastal Systems Research

Dr. Ravi Kumar Gupta
Research Associate

Mr. M. Nageswaran
Scientist

Mr. P. V. David
Technical Assistant (Field)

Mr. R. Kalaimani
Technical Assistant (Field)

Mr. J. Chelladurai
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Mr. R. Sankar
Technical Assistant (Field)

Bioresources Board

Mr. K. R. Sivaprakash
Junior Research Fellow

Promotion of Alternative Livelihoods for the Poor in the Biosphere of Gulf of Mannar

Dr. S. Babu
Scientist

Mr. M. Selvakku
Scientist

* Left during the year; ** Project ended

Ms. S. Velvizhi
Scientist

Mr. A. Godwill John
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Mr. Ramanathan
Office Attendant

Mr. M. Srinivasan
Driver

**Programme Area 200: Biodiversity and
Biotechnology**

**Molecular Mapping and Genetic
Enhancement**

Dr. Ajay Kumar Parida
Director

Dr. S. Rajalakshmi
Research Associate

Dr. Gayathri Venkataraman
Research Associate

Mr. M. N. Jithesh
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Mr. Prashanth S. Raghavan
CSIR Senior Research Fellow

Ms. Preeti Angela Mehta
Junior Research Fellow

Ms. Suja George
CSIR Junior Research Fellow

Ms. Praseetha
CSIR Junior Research Fellow

Mr. M. Kadirvelu
Technical Assistant

Ms. Dilhara Begum
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Mr. M. Kannan
Lab Attendant

Biomonitoring Microbiology

Dr. Sudha Nair
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Dr. P. Loganathan
Research Associate

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Technical Assistant

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Lichens

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Mr. P. Balaji
Senior Research Fellow

Mr. Bharath Prithiviraj
Junior Research Fellow

Mr. R. Kathiravan
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* Left during the year

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CSIR Junior Research Fellow

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Technical Assistant

Mr. E. Siva
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Karaikal

Mr. S. Rajakani
Technical Assistant (Field)

**Biodiversity Conservation, Integrated
Natural Resources Management and
Poverty Eradication**

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Director (Biodiversity)

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Ms. M. Geetha Rani
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Dr. Uma Ramachandran
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Scientist

CABc, Kalpetta

Mr. V. M. Chandrasekaran
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**Enhancing the Contribution of Nutritious
but Neglected Crops**

Dr. S. Appa Rao*
Associate Coordinator

* Left during the year

Community Biodiversity Programme

Kolli Hills

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Senior Scientist

Mr. E. D. Israel Oliver King
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Ms. K. Chitra
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Mr. P. A. Rasheed
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Ms. Saraswathy
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Mr. K. G. Mani
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Mr. R. Balasubramanian*
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Ms. J. Latha Murugesan
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Scientist

Ms. Deepa Verma
Scientist

Mr. S. Krishnakumar
Scientist

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Technical Assistant

Mr. A. Sakthivelan
Secretary

Land and Water Care Movement **

Dr. S. Subramaniyan*
National Research Coordinator

Ms. A. Uma*
Secretary

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Ms. Sylvia Snehalatha
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Dr. M. Sakthivadivel
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Scientist

Mr. P. Sivakumar
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Mr. M. Kuppusamy
Library Assistant - CD-ROM

Mr. S. Gilbert Samson*
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Mr. K. Rameswaran
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Ms. K. Umarani*
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Pondicherry**

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Mr. R. Rajasekarapandy
Scientist

Mr. J. Gobu
Scientist

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Mr. G. Jayakrishnan
Technical Assistant

The Hindu Media Resource Centre

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Coordinator

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Prof. Subbiah Arunachalam

Prof. Joseph Hulse

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TATA Social Welfare Trust, Mumbai

UNDP, New Delhi

Donation of seed money for Micro credit Banks at village level (Commodity Banking)

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Mrs & Mr Bob Burkhead, Tokyo

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Mr V B Rupani, Tokyo

Mr Vachhani, Tokyo

Mr Sahini, Tokyo

Mr Ujjlal Singh, Tokyo

Mr Tim & Mrs Anna May Feige, Tokyo

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National

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Government of India, Mumbai
Ministry of Rural Development
Government of India, New Delhi

International

India-Canada Environment Facility
New Delhi
United Nations Development Programme
New Delhi

Programme Area 200 : Biodiversity and Biotechnology

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(ICAR), Jabalpur, Madhya Pradesh
National Bureau of Plant Genetic Resources
New Delhi
Indian Institute of Remote Sensing
Dehradun, Uttar Pradesh
Department of Agriculture
Government of Tamil Nadu, Sriperumbudur
Sugarcane Breeding Institute
Coimbatore
Department of Biotechnology,
Government of India, New Delhi

International

International Development Research Centre
(IDRC), Canada
The Summit Foundation, USA
Swiss Agency for Development and
Cooperation (SDC), New Delhi
International Fund for Agricultural Development
Rome
Centre for Collaborative Research and Education
USA

Programme Area 300 : Ecotechnology

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National Bank of Agriculture and Rural
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Council for Advancement of People's
Action and Rural Technology (CAPART)
New Delhi
Hindustan Lever Foundation, Bangalore

International

Volkart Stiftung, Winterthur
The Hunger Project, Japan
UNDP, New Delhi

SOURCE OF PROJECT SUPPORT □

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Pricewaterhouse, New Delhi	The Commonwealth of Learning, Canada
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Lovelock & Lowes Services Pvt Ltd, Bangalore	Food & Agriculture Organization of the U.N. New Delhi
Tata Education Trust, Mumbai	
Sir Dorabji Tata Trust, Mumbai	
Department of Biotechnology Government of India, New Delhi	

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Ministry of Tourism and Culture
Government of India
Venkateshwara Hatcheries Ltd, Pune
Tista Trust, New Delhi

International

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The Hunger Project
Country office, New Delhi
Ramon Magsaysay Award Foundation
Manila, Philippines
The American Express Foundation, USA
Royal Netherlands Embassy, New Delhi
World Food Programme, Country Office
New Delhi

Programme Area 500 : Education, Communication, Training and Capacity Building

National

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Women Ltd, Chennai
Small Farmers' Agri-Business Consortium
New Delhi
State Bank Institute of Rural Development
Hyderabad

International

Syngenta Foundation for Sustainable Agriculture
Switzerland
Volkart Stiftung, Winterthur
International Development Research Centre
Canada

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New Delhi

XV Genetics Congress Trust, New Delhi

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Ministry of Science & Technology, New Delhi

Department of Science & Technology
Government of India, New Delhi

Department of Science & Technology
Government of Pondicherry, Pondicherry

Indira Gandhi National Open University
New Delhi

Department of Space, Space Application Centre
Ahmedabad

Department of Biotechnology (Bioinformatics)
Government of India, New Delhi

Canadian International Development Agency
Canada

The Commonwealth of Learning, Canada

World Food Prize Foundation, USA

UN System Standing Committee on Nutrition
C/o World Health Organization, Switzerland

United Nations Educational, Scientific and
Cultural Organization (UNESCO), Paris

International Fund for Agricultural Development
Rome

One World International Inc., UK

International Institute for Communication
Netherlands

Food and Agriculture Organization of the
United Nations, Office of the FAO representative
in India & Bhutan, New Delhi

International Society for Mangrove Ecosystems
Japan

HIVOS, Netherlands

United Nations Educational, Scientific and
Cultural Organization (UNESCO), Paris

United States Department of Agriculture
Forest Service, Washington

Food and Agriculture Organization of the United
Nations Plant Genetic Resource group, Rome

World Bank, New Delhi

UNICEF, Chennai

Programme Area 600 : Special Projects

National

National Bioresources Development Board
New Delhi

International

UNDP - Global Environment Facility
New Delhi

Global Environment Facility, USA

The Lemelson Foundation, USA

United Nations Educational Scientific and
Cultural Organization (UNESCO), Jakarta

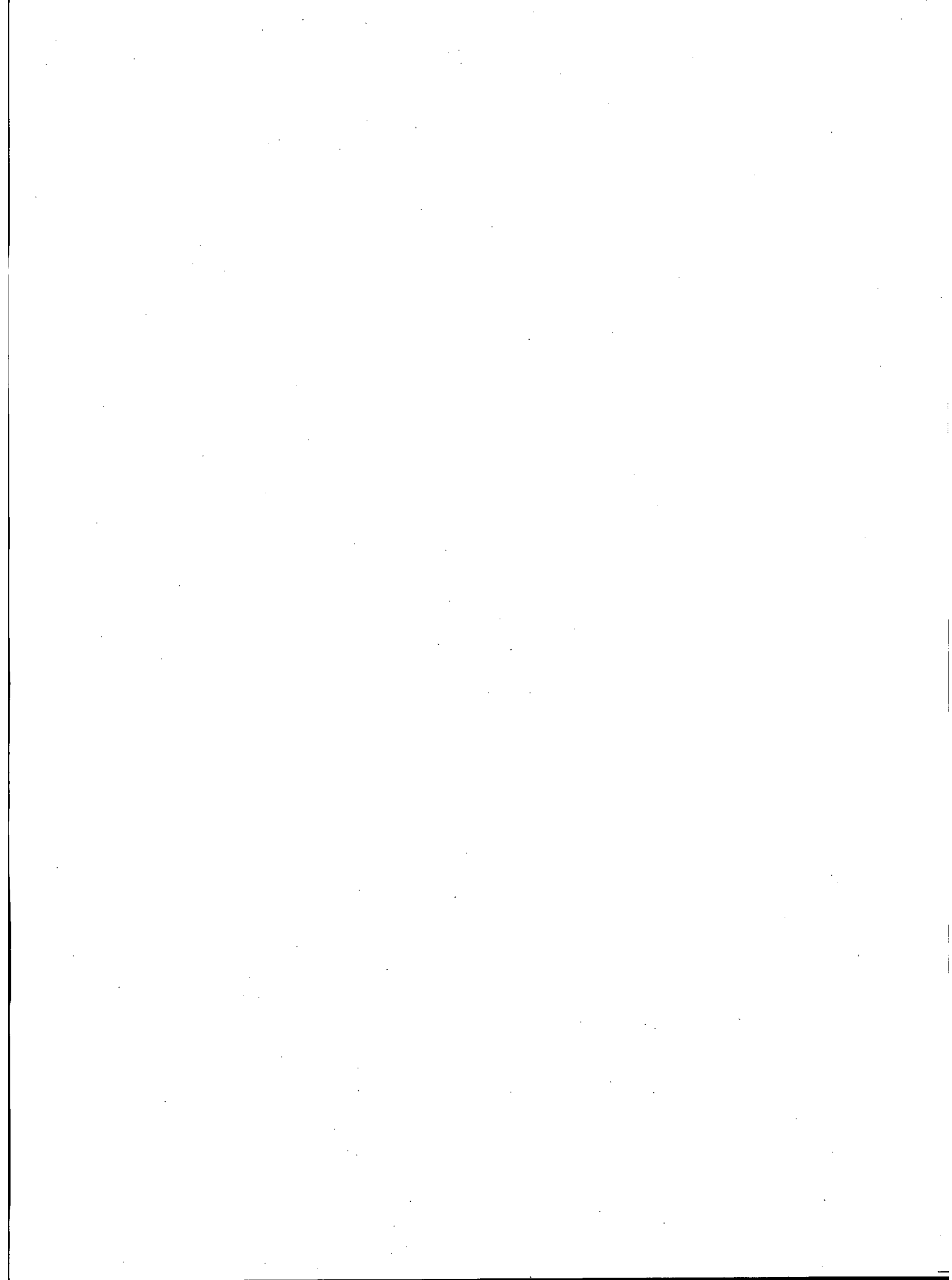
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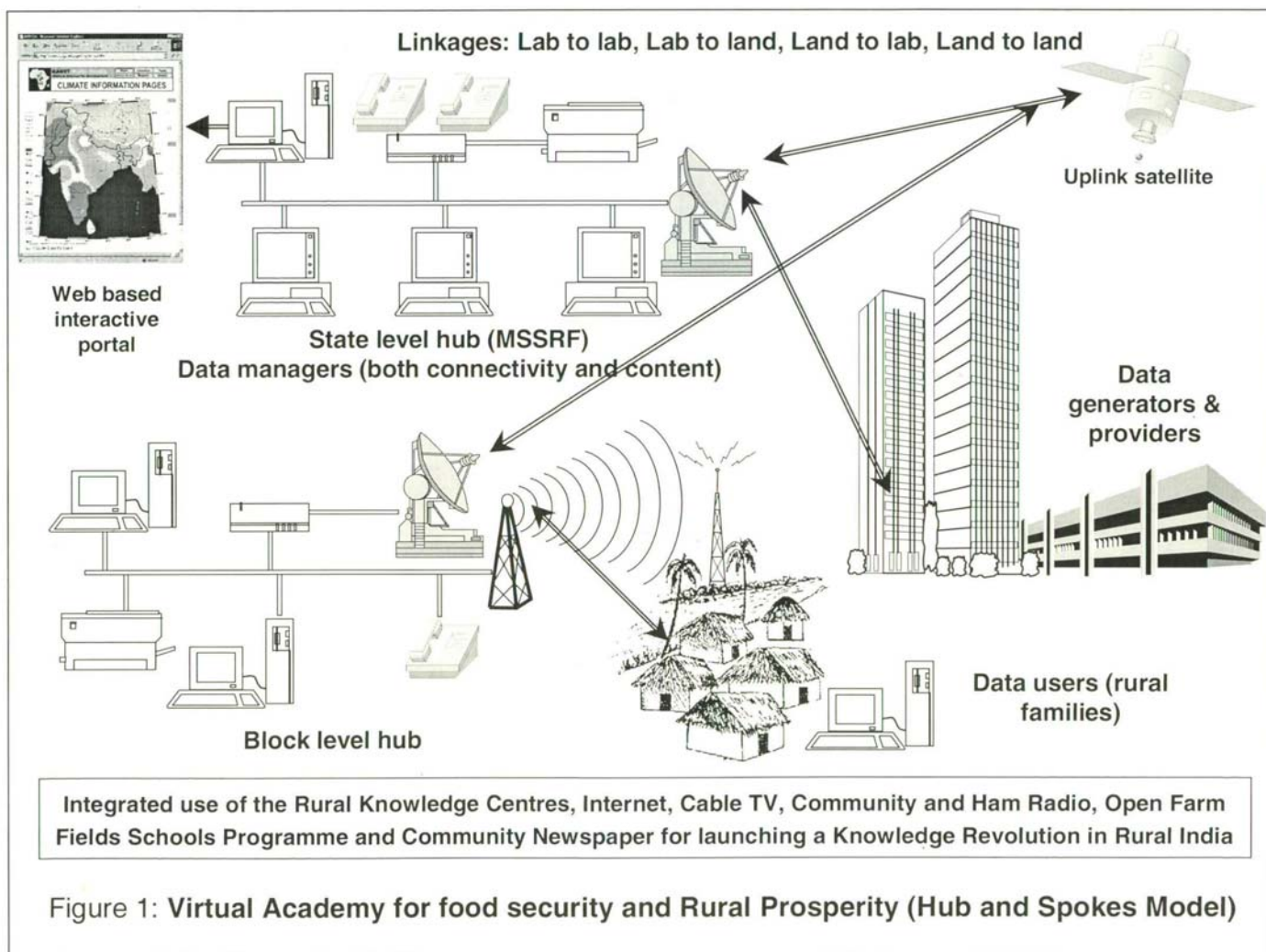
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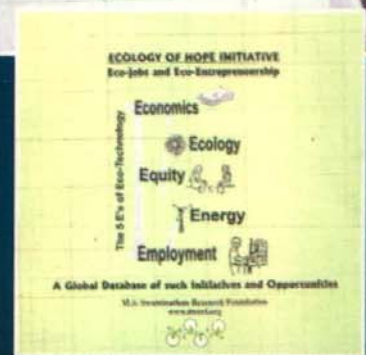
List of Acronyms

APEDA	Agricultural and Processed Food Products Export Development Authority
BARC	Bhabha Atomic Research Centre
CFTRI	Central Food Technology Research Institute
CIDA	Canadian International Development Agency
CIFA	Central Institution of Freshwater Aquaculture
CIFOR	Centre for International Forestry Research
CMFRI	Central Marine Fisheries Research Institute
COL	Commonwealth of Learning
CPCRI	Central Plantation Crops Research Institute
DANIDA	Danish International Development Agency
DBT	Department of Biotechnology
DFID	Department for International Development
DRDA	District Rural Development Agency
FAO	Food and Agriculture Organization
FRIM	Forest Research Institute Malaysia
FRLHT	Foundation for Revitalization of Local Health Traditions
GEF	Global Environment Facility
GLOMIS	Global Mangrove Database and Information System
HDFC	Housing Development and Finance Corporation
ICAR	Indian Council for Agricultural Research
ICEF	India Canada Environment Facility
ICRISAT	International Council for Research in Semi Arid Tropics
ICSU	International Council of Science Union
IDRC	International Development Research Centre
IFAD	International Fund for Agriculture Development
IGCAR	Indira Gandhi Centre for Atomic Research
IPGRI	International Plant Genetic Resource Institute

ISME	International Society for Mangrove Ecosystems
ITTO	International Tropical Timber Organization
IWMI	International Water Management Institute
MANAGE	National Institute of Agricultural Extension Management
NABARD	National Bank for Agricultural and Rural Development
NATP-PB	National Agricultural Technology Project on Plant Biodiversity
NBDB	National Bioresources Development Board
NBPGR	National Bureau of Plant Genetic Resources
NDDB	National Dairy Development Board
NEDCAP	Non-Conventional Energy Development Corporation of Andhra Pradesh Ltd.
NGRI	National Geophysical Research Institute
NPCIL	Nuclear Power Corporation of India Ltd.
NTFP	Non Timber Forest Produce
RSGA	Reddiarchatram Seed Growers' Association
SBIRD	State Bank Institute of Rural Development
SDC	Swiss Agency for Development and Cooperation
SFAC	Small Farmers' Agribusiness Consortium
SRI	System of Rice Intensification
TANUVAS	Tamil Nadu Veterinary and Animal Science University
TANWA	Tamil Nadu Women in Agriculture
TNAU	Tamil Nadu Agriculture University
TNEB	Tamil Nadu Electricity Board
TNPCB	Tamil Nadu Pollution Control Board
TRI	Tuberculosis Research Institute
TRIFED	Tribal Co-operative marketing development Federation of India Ltd.
UNDP	United Nations Development Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNICEF	United Nations International Children's Emergency Fund







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