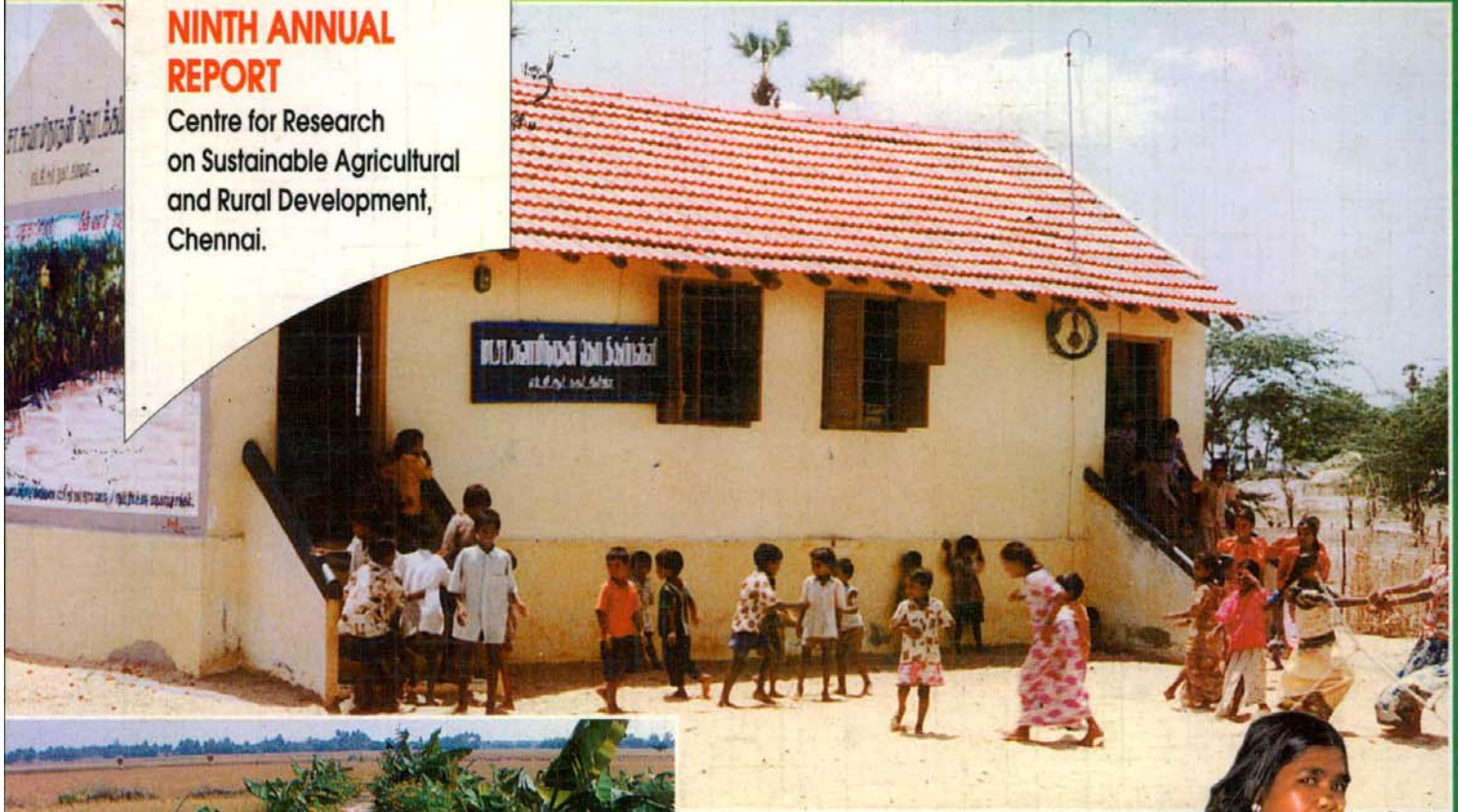


M. S. SWAMINATHAN RESEARCH FOUNDATION

1998-99
NINTH ANNUAL
REPORT

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



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Front Cover

- 1 First ever primary school for *Irula* children in a mangrove hamlet, MGR Nagar near Chidambaram.
- 2 Culture of *Azolla* in the field trenches : green manure for lowland rice culture. Keelamanakudi, Chidambaram.
- 3 Selection by a tribal young woman of earheads of Italian millet at Binnampatti village in Kolli Hills, Tamil Nadu.
- 4 Dry leaves of *Bauhinia vahlia* Wight & Arn. used as a rain coat by a tribal woman in Jeypore, Orissa.

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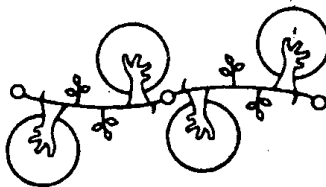
Back Cover

- 1 Members of the *Malayali* tribal community discussing the use of remote sensing data for biodiversity conservation. Kolli Hills, Tamil Nadu.
- 2 *Kulavai '99* - theatre for networking on gender, social issues and cultural activism.
- 3 A group of women volunteers who manage the Village Knowledge Centre at Embalam, Pondicherry.
- 4 A successful woman practitioner of mushroom cultivation imparting training to other women at the Biocentre in Pillayarkuppam village, Pondicherry.

Anita,
MSSRF, Chennai.

Ninth Annual Report

1998 - 99



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

M. S. Swaminathan Research Foundation

Centre for Research on Sustainable Agricultural and Rural Development

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

Telephone : +91 (44) 2351229
 +91 (44) 2351698

Fax : +91 (44) 2351319

E-mail : general@mssrf.org

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

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Chairman's Introduction

The 20th century will soon end with remarkable achievements in every area of science and technology. In addition to impressive progress in physical and life sciences, we are ending this century with significant accomplishments in social evolution. Particular attention may be drawn to the following:

- End of colonialism and spread of democratic systems of governance
- Growth of free and independent media
- Emphasis on human rights including the rights of the generations yet to be born
- Eclipse of skin-colour based apartheid
- National and International movements for gender equity and justice

Thanks to the knowledge and information revolution, there are now uncommon opportunities for providing every child, woman and man with an opportunity for a productive and healthy life during the 21st century. Accomplishing this task will not however be easy, since economic, social and gender inequity are not only widespread but also increasing. According to UNDP's *Human Development Report* (1999), the richest 200 people in the world have a net worth of \$ 1032 billion, the equivalent of the wealth of 41% of the global population. A yearly contribution of 1 percent of their wealth by these 200 persons alone would be adequate to give every child in the world free access to primary education.

Achievements during this century in improving human health and longevity, food

production and security indicate that progress in overcoming chronic social ills can be rapid, provided appropriate blends of political will and action, social mobilisation, and technology development and dissemination can be promoted. It is to foster such a movement at both the macro- and micro-levels that the M S Swaminathan Research Foundation (MSSRF) began its work ten years ago in the areas of strategic, participatory and anticipatory research, education and training, human resource development, information and skill empowerment, networking, policy advocacy and dialogues. The research and community development programmes of MSSRF were built on a pro-nature, pro-poor and pro-women foundation with a view to ensuring that development is not only environmentally sustainable but also socially equitable.

Nearly 2000 scientists from all parts of the earth, who participated at a World Conference on Science convened by UNESCO and the International Council for Science (ICSU) at Budapest, Hungary, from 26 June to 1 July, 1999, adopted a declaration which points the way to mobilising science and technology for meeting the basic needs of every single member of the human family. The Budapest Declaration on Science and the Use of Scientific Knowledge states, "We all live on the same planet and are part of the biosphere. We have come to recognise that we are in a situation of increasing inter-dependence and that our future is intrinsically linked to the preservation of the global life-support systems and to the survival of all forms of life. Science should be at the service of humanity as a whole, and should contribute to

providing everyone with a deeper understanding of nature and society, a better quality of life and a sustainable and healthy environment for present and future generations".

The Declaration further states, "Science and Technology should be resolutely directed towards prospects for better employment, improving competitiveness and social justice". The Declaration calls for special attention to the expansion of scientific literacy and skills among women and families living in poverty.

The Science Agenda-Framework for Action, adopted at Budapest calls for scientific advice becoming an essential factor in informed policy making. It also recommends that "all countries should protect intellectual property rights (IPR) and recognise that access to data and information is essential for scientific progress".

Thus, the World Conference on Science, while recognising the need for greater efforts in harnessing science for meeting basic human needs, also notes that the expansion of IPR-controlled science is inevitable. Proprietary science is expanding and research designed for public good and supported by public funds is shrinking. The earlier slogan, "publish or perish" is getting replaced by a new one, "patent or perish". The veil of secrecy in scientific work is getting rapidly enlarged. The scientific problems relating to the health and livelihoods of the poor may tend to get neglected under a market-driven scientific regime, where orphans are likely to remain orphans.

As a follow-up to the Budapest Conference, it is necessary for every nation and for the international scientific community to de-

velop some basic ground rules for ensuring that science serves public good in an era of expanding IPR. Such a paradigm shift from a materialistic to a humanistic scientific era will call for international cooperation in adopting a package of measures such as the following:

- Enhance support from public funds for research relating to basic human needs and environment protection.
- Make a distinction between *discovery* and *invention* with reference to patentability. For example, make patenting of DNA sequences in human and plant genomes ineligible.
- Introduce compulsory licensing of rights in the case of patents of relevance to the food and health security of the poor and the ecological security of the planet.
- Reduce the life span of patents particularly in the field of information technology.
- Revise the Trade-Related Intellectual Property Systems (TRIPS) component of the World Trade Agreement so as to harmonise the provisions of Article 27.3 (b) with those of the ethics and equity provisions of the Convention on Biological Diversity (Articles 8(j) and 15 of CBD). Such a revision of TRIPS will help to foster symbiotic biopartnerships and eliminate fears of biopiracy.
- Incorporate in the World Trade Agreement a provision which enables member nations to adopt import policies which will enhance and not erode the livelihood security of the poor.

For assisting governments to ensure that trade and development policies result in en-

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hancing ecological security and livelihood opportunities for women and men living in poverty, a *World Trade Agreement Contract Facilitation Service* comprising social scientists, gender specialists, environmental and employment experts should be established. Such an independent contract facilitation service should be mandated to assist in converting the "trade and not aid" concept of poverty alleviation from rhetoric to reality.

An ecology of hope movement will become a reality only if principles of ethics and equity govern all areas of human endeavour. Nowhere is this more apparent than in the field of life science industries. For example, what we now refer to as "medicinal plants" are the products of observation, selection and conservation by tribal and rural families over several centuries. Yet these primary conservers of material and holders of knowledge live in poverty, while those who use their knowledge and material in breeding and biotechnological enterprises become rich. MSSRF has been working with the Government of India (Ministry of Agriculture and Cooperation and Ministry of Environment and Forests) in the development of the following 2 pieces of legislation:

- Plant Variety Protection and Farmers' Rights Act
- Biodiversity Act

In the draft Acts prepared by MSSRF, the interests of both farmer-cultivators and farmer-conservers are protected. The draft Biodiversity Act provides for peoples' participation in biodiversity conservation and sustainable and equitable use through *Panchayat* level Biodiversity Councils and State Biodiversity Boards. A Voluntary Code

of Conduct was also developed to ensure that symbiotic biopartnerships, and not biopiracy, govern the relationships between the primary conservers and holders of knowledge and the commercial companies, who use their knowledge and material. A consultation was organised in September '98 to assist the World Intellectual Property Organization (WIPO) in developing methods for recognising and rewarding traditional knowledge, innovations and culture. If such steps are taken, conservation and commercialisation can become mutually reinforcing.

Article 27.3(b) of the TRIPS provision of the World Trade Agreement will be reviewed late in 1999. MSSRF has been actively advocating that the ethics and equity clauses of the Convention on Biological Diversity (CBD) (Articles 3, 8j, 10, 15 and 16) should guide the review process. If this is not done, the following objectives stated in Article 7 of the TRIPS agreement cannot be achieved:

"The protection and enforcement of intellectual property rights should contribute to the promotion of technological innovation and to the transfer and dissemination of technology, to the mutual advantage of producers and users of technological knowledge and in a manner conducive to social and economic welfare, and to a balance of rights and obligations". This is why the TRIPS review process should be used to integrate the ethics and equity concerns of CBD into article 27.3(b) of TRIPS.

Food insecurity at the level of the household is currently caused by inadequate purchasing power arising from limited livelihood opportunities in rural and urban areas. Hence, MSSRF has proposed that import policies should be based on a careful livelihood impact analysis. The livelihood

and food security of the poor should be the principal guiding factor in the formulation of policies for home and external trade.

Another area of concern, particularly for the future of the country, which received detailed attention during the meeting of the UN Commission on Nutrition held at MSSRF in November, 1998, is the multiple adverse impact of low birth weight (LBW) in children arising from maternal and foetal mal- and under-nutrition (Figure 1). Such LBW children constitute a third of all births in the country. The most serious of the adverse consequences of LBW is potential impaired brain development. This will deny the child an opportunity for the full expression of intellectual capacity in later life. In the emerging knowledge age and in an era of globalisation of economies, this will be a serious national tragedy.

Since the onset of the Industrial Revolution in Europe, technology has been a major source of economic inequity among nations and among communities within nations. If technology has been a cause of economic and social inequity in the past, *today we have an opportunity for making technology an ally in the movement of social, gender and economic equity*. Modern information technology provides this opportunity. Knowledge and skill empowerment can now be achieved at a fast pace. However, the technological and skill empowerment of the poor cannot be achieved through programmes designed on the basis of a top-down approach. The information provided should be demand- and need-driven and the knowledge centres should preferably be managed by women belonging to the socially and economically underprivileged sections of society. Our aim in the early part

of the coming century should be the initiation and spread of a Knowledge and Skill Revolution for ending economic and gender inequity. To assist in the process, MSSRF has initiated in villages in the Union Territory of Pondicherry a pilot project for establishing a *Virtual College* linking scientists and economically and socially underprivileged women and men. This programme has given valuable insights for designing Virtual Colleges linking scientists and the civil society based on a self-replicating and self-propelling momentum. Dr Bruce Alberts, President, US National Academy of Sciences, who visited the computer-aided Knowledge Centres in Pondicherry villages in January, 99 referred to the global significance of this initiative in the following words in his Presidential Address at the Anniversary meeting of the U S National Academy of Sciences on 26 April, 1999:

"By taking full advantage of new information technologies, the scientific community has an unprecedented opportunity to close the vast "knowledge gap" between all peoples. How might this be possible? I want to highlight a wonderful example that points the way forward. The M.S. Swaminathan Research Foundation has established an experimental network in India that will soon connect more than 20 isolated rural villages to a wireless Internet service. About half of the population in most of these villages has a total family income of less than \$25 per month. The project is designed to provide knowledge on demand to meet local needs using the World Wide Web, and *it does so through a bottom-up process*. The process starts with volunteer teams that help poll the villagers to find out what knowledge they want. Particu-

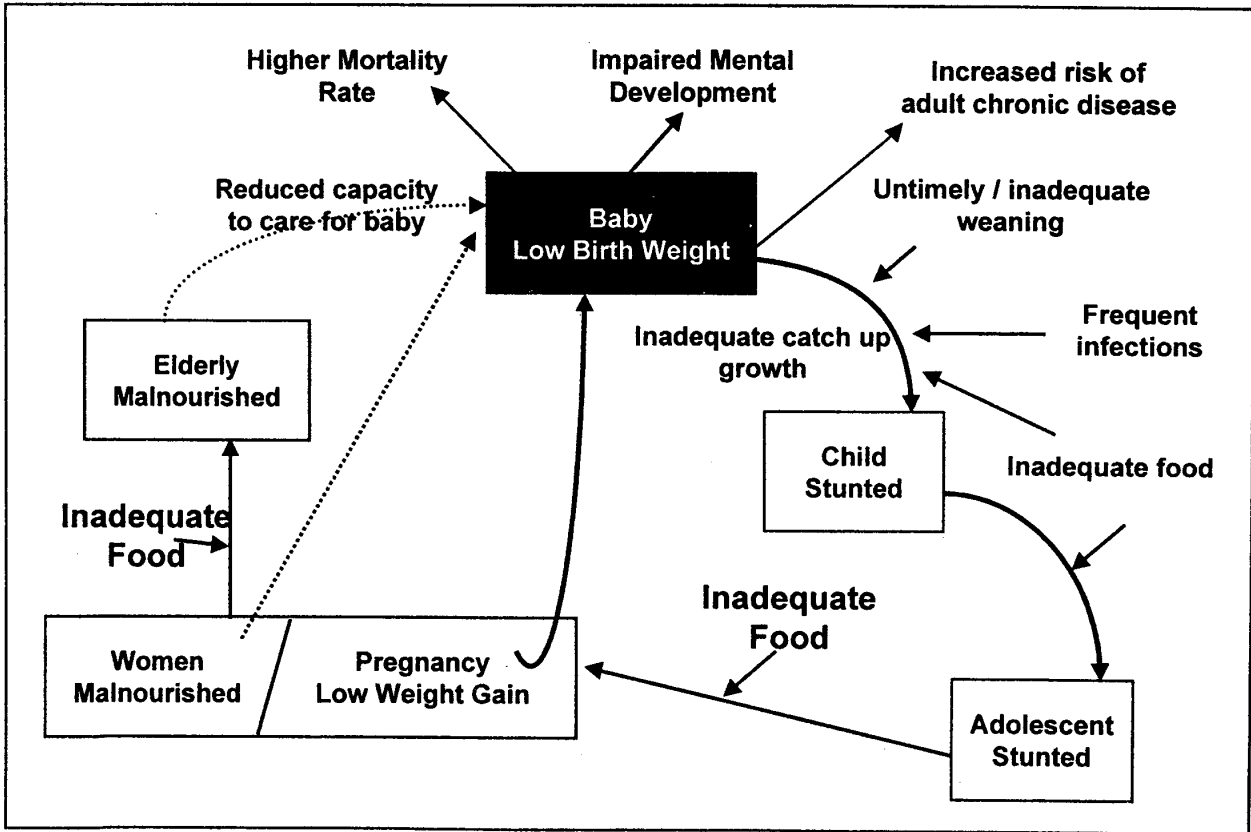


Figure 1 : *Lifecycle : the causal links*
(Source : UN Commission on Nutrition)

larly popular thus far are women's health information, advice on growing local crops and protecting them from diseases, the daily market prices for these crops, local weather forecasts, and clear information about the bewildering array of programs that are provided by the Indian government to aid poor families. To participate, each village must provide a public room for the computer system, as well as the salaries for a set of trained operators. In return, the village receives the needed hardware and maintenance for the communication system, specially designed Web sites in the local language that convey the requested information, and training programs for those villagers who have been selected to run their local knowledge system".

The MSSRF Virtual College, linking scientists with village women and men, which has been supported financially by the International Development Research Centre of Canada, will soon be expanded with the help of computers generously donated by Ms Geeta Mehta of Tokyo. Preliminary studies in the villages where this project has been operating for over 6 months reveal that the women operating such centres have gained enormously in self-esteem and confidence and social prestige. It is therefore proposed to establish women-operated knowledge centres in villages characterised by the high incidence of female foeticide and infanticide.

Among other significant major developments during this year, mention may be made of the inauguration of the building of the J R D Tata Ecotechnology Centre on 29 July, 1998 by H E The President of India, Shri K R Narayanan. This building whose construction was made possible through a generous

grant from Tata Trusts, also houses the CAPART Technology Resource Centre and the Dr B V Rao Centre for Sustainable Food Security. A special hall in this building has been dedicated to the memory of the late Dr Muthappa Attavar, father of Dr Manmohan Attavar, a friend and guide of MSSRF. The land for the building was generously provided by the Government of Tamil Nadu.

Other important developments are: first, the establishment of *The Hindu* Media Resource Centre for Ecotechnology and Sustainable Development and the NABARD Resource Centre for Precision Farming for Poverty Alleviation. *The Hindu* Media Resource Centre, established with a generous endowment by *The Hindu* Group of Publications, has filled a felt need in the links between scientists and the media. Among the several activities of this Centre during the first year of its existence, the Millennium lecture series and the media-scientists interaction on Genetically Modified Organisms (GMOs) have been particularly valuable.

The Hindu Media Resource Centre Millennium Lecturers included Sir John Maddox, Emeritus Editor of *Nature*, Dr Maurice Strong, Chairman of the Earth Council and of the U.N. University of Peace and Dr Jacques Diouf, Director General of FAO. The scientists-media interaction on GMOs inaugurated by Prof James Watson, co-discoverer of the double helix structure of DNA and moderated by Mr N Ram, Editor of *The Frontline*, helped to clear many concerns about the use of genetic engineering techniques in agriculture and medicine. The participants recommended that a multi-stakeholder *National Commission on Genetic Modification* should be established in every country with its membership cover-

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ing government regulatory agencies, academia, civil society and environmental organisations, farmers' associations, consumer and womens' groups, and print and electronic media. The governments of both UK and USA have recently established such broad-based consultative and policy guidance bodies.

In the coming decades, the farm families of India will have to produce more foodgrains and other agricultural commodities under conditions of shrinking per capita land and water resources and expanding biotic and abiotic stresses. The smaller the farm, the greater will be the need for higher marketable surplus to generate the income necessary for meeting basic human needs. The farming population of the early part of the 21st century will be predominantly young. They can be attracted and retained in farming only if agriculture becomes intellectually stimulating and economically rewarding. These are the conditions which modern precision farming technology satisfies. It has therefore been an act of vision on the part of the management of the National Bank for Agriculture and Rural Development (NABARD) to have decided to establish a Resource Centre for Precision Farming for Poverty Elimination. By linking precision farming with poverty alleviation, the emphasis has been placed on farming systems intensification, diversification and value addition. Also, an integrated approach will be developed to enhance opportunities for skilled on-farm and off-farm employment.

The NABARD Precision Farming Resource Centre will develop and test ecotechnologies and organise demonstrations and training programmes. A Steering Committee has

been set up for providing policy guidance and monitoring progress. Precision farming techniques which involve a shift from an area and field scale husbandry to plant scale husbandry, will be developed for small farm crop and animal husbandry, agro-forestry and aquaculture. Israeli scientists have considerable experience in enhancing income per units of land, water and nutrients. Hence, a collaborative partnership has been developed with the Arava R&D Centre in Israel for developing and spreading production technologies based on integrated natural resources management. An end-to-end approach will be developed involving concurrent attention to all the links in the production-processing-storage-marketing-consumption chain. Initially this programme will be confined to the Chidambaram and Dindigul areas of Tamil Nadu.

Under the B V Rao Centre for Sustainable Food Security supported by the Shri Ramakrishna Bajaj Fellowship for the sustainable end of hunger, an integrated Panchayat-led Hunger-free Area Programme was initiated during this year in collaboration with the Gandhigram Rural Institute (Deemed University). This programme is being implemented by several Panchayats in the Vendasandur Block of Dindigul District with the active support and advice of the faculty of the Gandhigram Rural Institute. This pilot project will be the precursor for a Panchayati Raj institutions led movement for achieving a hunger-free Tamil Nadu by 2010.

The Tamil Nadu Council for Sustainable Livelihoods, which is supported by Hunger Project, India, has decided to accord priority to the following four programmes during 1999-2000:

- A "children for happiness" movement with emphasis on the elimination of LBW among children through attention to the health and nutrition of pregnant women
- Total elimination of hidden hunger caused by deficiencies of micronutrients in the diet; a beginning will be made in the Dharmapuri district of Tamil Nadu with help from FAO and the Tamil Nadu Government
- An educational and advocacy campaign for gender equity and for knowledge and skill empowerment of women Panchayat leaders
- Expanding the Panchayat-led movement for achieving freedom from hunger

A detailed strategy was developed at a Consultation organised in April, 1999 in collaboration with the Global Hunger Project on the theme "Hunger-free India - the final milestone". This Consultation was inaugurated by Shri K C Pant, Deputy Chairman, Planning Commission. The gender dimensions of hunger were separately considered at a one-day workshop.

The Biovillage programme in operation in 19 villages in the Union Territory of Pondicherry with financial support from UNDP is reaching its final stage. An important feature in the design of this project is a strategy for sustainability beyond the life of the sanctioned programme. Sustainability is to be achieved through the formation of a Biovillage Society operating from a Biocentre, which is the hub of the biovillage movement. A Biocentre was inaugurated in the Pillayarkuppam Village in April, 99 by Dr Brenda Gael McSweeney, Resident Representative of UNDP. The Biocentre provides

facilities for training, input supply services, animal health care facilities and an information centre. The training programmes are conducted by the new leaders who have emerged in the villages since the beginning of the project. A Biovillage Council comprising one male and one female nominee from each of the 19 villages has been formed as a prelude to the formation of a Biovillage Society.

Another significant development during this year is the laying of the foundation stone for the Golden Jubilee Biotechnology Park for Women by H E The President of India on 29 July, 1998. This Park is sponsored by the Department of Biotechnology, Government of India and the Tamil Nadu Industrial Development Corporation (TIDCO) acting on behalf of the Government of Tamil Nadu. MSSRF serves as a Technical Resource Centre for this unique project designed to provide opportunities for remunerative self-employment to professionally qualified women entrepreneurs. The Government of Tamil Nadu has provided 8 hectares of land for the Park at Kelambakkam near Chennai. A Golden Jubilee Biotechnology Park for Women Society has been registered under the Tamil Nadu Societies Registration Act on 8 July, 1999. Several training programmes have been organised for the women entrepreneurs.

In 1994, MSSRF conducted a detailed study of the threats to the Gulf of Mannar Biosphere Reserve in Tamil Nadu, with financial support from the Rajiv Gandhi Foundation. This study ultimately led to the submission of a proposal for support from the Global Environment Facility (GEF) through UNDP by the Governments of Tamil Nadu and India. UNDP-GEF provided a project

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preparation grant in 1997 and MSSRF was entrusted with the task of preparing the project proposal by the Ministry of Environment and Forests, Government of India and UNDP. The project proposal was finalised in July, '98 and was considered by the GEF Council at its meeting held in May, '99. The GEF Council approved the proposal and commended it as a model project which deserves to be widely emulated by those preparing similar projects. The Scientific and Technical Advisory Panel (STAP) of GEF endorsed the project for approval with the following remarks:

"The project addresses a major challenge, namely the conservation of coastal biodiversity of the highest ecological value in a large area subject to considerable pressure from poor populations upon the sole resources that appear to be at their disposal. To meet this challenge, the project follows the only framework which can succeed, namely to combine the necessary protection of the threatened ecosystem and ecological processes with economic and social benefits which will meet the essential need of local people, through providing appropriate institutional, financial and managerial arrangements."

The GEF grant for this project is \$ 7.85 million. The management structure through which people and Nature will get united in the Gulf of Mannar area is the proposed *Gulf of Mannar Biosphere Trust*. Representatives of fishermen and rural communities as well as all the principal civil society stakeholders will, together with government representatives, form the members of the Trust. The Members of the Trust will hold this unique biological treasure in trust for present and

future generations. Considerations of intra- and inter-generational equity will guide the work of the Trust, which will provide a horizontal dimension to the numerous vertically structured activities undertaken in this area by both central and state governments and private sector organisations. It is hoped that the Gulf of Mannar Biosphere Trust, whose long term sustainability will be ensured with the help of a Trust Fund, will show the way for promoting a *management by partnership* system of governance in all the other Biosphere Reserves in the country.

MSSRF also assisted the Ministry of Environment and Forests, Government of India, in the preparation of a National Report on the implementation of Article 6 of the Convention on Biological Diversity for being presented to the Conference of Parties to the CBD.

Another important consultancy undertaken during the year relates to the preparation of an Agenda 21 for the north-eastern state of Mizoram. This agenda contains concrete action plans for strengthening the livelihood security of the people of the State in an environmentally, economically and socially sustainable basis. The Government of Mizoram has initiated steps to implement the action plan.

A major step was taken by the Department of Atomic Energy (DAE), Government of India, during this year to foster a new social contract between scientists and the rural communities living in villages adjoining nuclear power plants. For taking the benefits of nuclear science to rural families, DAE has created at MSSRF a chair in the name of the late Dr Homi Bhabha. Prof P C Kesavan is the first holder of this DAE-Homi Bhabha

Chair. In addition to the Chair, DAE has sponsored a collaborative research project between the Bhabha Atomic Research Centre (BARC) and MSSRF for harnessing nuclear tools in improving the productivity, profitability and sustainability of coastal agriculture and aquaculture. Under this project, a trial cum demonstration farm has been set up at the Indira Gandhi Centre for Atomic Research at Kalpakkam near Mahabali-puram. Integrated farming systems using new varieties of pulses and other crops developed at BARC are being evolved at the IGCAR Centre.

From 1990 onwards, the programmes of the Foundation have been organised under five major Programme Areas (PAs). The results obtained during the year in each of these programme areas are given in detail in this report. Without duplicating the information given in later pages, it may be worthwhile highlighting a few of the activities undertaken.

PA 100 : Coastal Systems Research

The Mangrove Wetlands Conservation project covering most of the east coast of India has reached a stage when Joint Mangrove Forest Management Committees involving both the Forest Departments and representatives of the communities deriving their livelihoods from Mangrove Wetlands are getting established. This Project, supported by the India-Canada Environment Facility, pays concurrent attention to people and mangrove forests. For example, in the village of MGR Nagar in the Pichavaram area, the inhabitants had not been classified during the past 50 years with reference to their community status. Thanks to the efforts of MSSRF scientists, they were classi-

fied during 1998 as *Irulars*, a tribal community. This helps them to obtain the benefits extended to scheduled tribes. Also, the village had no school and both the adults and children remained without opportunities for education. They will thus enter the 21st century illiterate. *Saving mangrove forests without saving the children for whose wellbeing the mangrove forests are being saved makes no sense.* Hence, a school was established in this hamlet through support from the project and private donations to give the children an opportunity for primary education. Steps are also being taken to promote adult literacy.

The restoration of degraded mangrove forests is making progress. In the Sunderbans area of West Bengal, mangroves are being planted in wastelands. A Mangrove Atlas has been prepared. The International Tropical Timber Organization (ITTO) has designated MSSRF as the Indian Ocean Regional Centre under the Global Mangrove Information Service (GLOMIS).

PA 200 : Biodiversity and Biotechnology

This programme area has three principal goals:

- Developing an implementation framework for achieving the triple aims of CBD, namely, conservation, sustainable use and equitable sharing of benefits
- Saving endangered habitats and species
- Use of genetic enhancement, biomonitoring and micro-propagation techniques for promoting the cause of conservation and sustainable use

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Good progress was made during the year in achieving these goals. A large number of tribal and rural women and men were trained in the art and science of biodiversity conservation and in chronicling local biodiversity resources. Such trained youth constitute a Community Agro-Biodiversity Conservation corps, who will be able to assist their respective communities in taking decisions on questions like "prior informed consent", "access and benefit-sharing", after the national Biodiversity Act comes into force.

In the area of sustainable use, further progress was made in linking conservation and commercialisation in a mutually supportive manner and in promoting participatory plant breeding. The work on the revitalisation of the *in situ* on-farm conservation traditions of tribal and rural families and on sustainable and equitable use received generous support from the Swiss Agency for Development and Cooperation (SDC). This project is in progress in the States of Tamil Nadu (Kolli Hills), Kerala (Wayanad) and Orissa (Jeypore). A Voluntary Code of Conduct based on the principles of CBD guides the work of all researchers working in this project.

The participatory plant breeding work initiated this year in collaboration with the farming families of Kolli Hills, Wayanad and Jeypore has made a good beginning. The methodological underpinning of the project was discussed at a workshop jointly organised by MSSRF and the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) at Hyderabad. An important component of this work relates to the improvement of *Njavara*, a rice strain widely used in Ayurvedic medicine in Kerala.

The community *in situ* and *ex situ* conservation activities were streamlined through a linked network of *in situ* Field Gene Banks (on-farm) and *ex situ* Cryogenic Gene Bank. This represents the first scientifically structured *Community Gene Management System* in India (the term "gene management" refers to conservation and sustainable and equitable use of genetic resources).

Several training programmes for rural youth were organised by the B R Barwale Chair in Biodiversity. Steps were also taken to assist local communities in the preparation of People's biodiversity registers. Pending the setting up of official-level Panchayat Biodiversity Councils, the formation of broad based village level Biodiversity Management Committees including the Panchayat President, Village Officer and Local School Headmaster, is being promoted. This voluntary code of conduct calls for adherence to the principle of prior informed consent.

In the field of molecular mapping and genetic enhancement, a binary vector carrying the BADH gene cloned from mangrove species was constructed. Methods of integrating the BADH gene, which confers tolerance to sea water salinity, into the tobacco genome were standardised. The work on biomonitoring of ecosystem health using *Pseudomonas* and lichen species made further progress. Micropropagation protocols were standardised for 14 species (10 endangered and medicinal and 4 mangrove species). These protocols have been made available to the Department of Biotechnology for commercialisation.

PA 300 : Ecotechnology and Sustainable Agriculture

The Ecotechnology programme aims to promote sustainable livelihoods in rural areas by undertaking the technological and skill empowerment of the poor. The seed village programme at Kannivadi led to the distribution of nearly a million rupees as wages to women labour. The ornamental fish production and Low External Input Sustainable Aquaculture (LEISA) programmes at Keelamanakudi and Chidambaram helped to improve household income substantially. The work on creating markets for traditional grains like *Panicum*, *Paspalum* and *Setaria* species made good progress. Wheat bread prepared with 10% of flour of *sadan samai* (*Panicum sumatrense*) was substantially high in micronutrients like calcium, iron and vitamins. Negotiations are in progress for introducing a new brand of bread prepared with the flour of wheat and minor millets.

In order to help small scale aquaculturists, a fresh water prawn hatchery, capable of yielding annually 300,000 fingerlings of *Macrobrachium rosenbergi*, was established with financial support from the Department of Biotechnology, Government of India. Seed and feed are the major limiting factors in the spread of inland and coastal aquaculture. Both these constraints are being addressed so as to provide fishermen and landless labour families with opportunities for deriving economic and nutritional benefits from environmentally sustainable aquaculture.

PA 400 : Reaching the Unreached

An important component of the activities of Project Access related to building the capacity of elected Panchayat leaders and teacher

trainers at the level of early childhood. Other programmes included working with NGOs on the control of female infanticide and foeticide, and research and advocacy on the status of child care workers. The Tamil video spots under the series "Messages that move" have been dubbed in Hindi.

The Uttara Devi Resource Centre for Gender and Development conducted a study of the role perceptions and effectiveness of women members of Panchayats and organised a workshop to examine the gender dimensions of hunger. The Centre also held a discussion on the progress made in implementing the Beijing Platform for Action adopted at the World Conference on Women held at Beijing in 1995. Steps were taken to internalise the gender dimension in all the research and training programmes of MSSRF. Indicators were developed for conducting gender and social audit of the projects carried out by the JRD Tata Ecotechnology Centre.

The programme "Voicing Silence" undertook networking of organisations involved in tackling gender issues through cultural activism. Performances which reach out to different communities were organised. Work was continued on giving voice to different constituencies of women such as traditional women artists and girl students.

PA 500 : Education and Communication

A large number of training programmes, technical consultations, dialogues and seminars were organised. The training programmes ranged from village level "learning by doing" programmes to an International Training Course on Timber Trade Sta-

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tistics for professional foresters. The International course which was attended by 45 participants from 16 countries was sponsored by the International Tropical Timber Organization, Japan. A highlight of the course was training in the use of internet as a source of data. Assistance was also extended to the British Council in training non-governmental organisations in designing web sites and in the effective use of the INDEV database which provides information on the work of nearly 1000 NGOs in the country in different fields of development.

Dr Klaus Töpfer, Executive Director of the United Nations Environment Programme (UNEP) released in January '99 the results of a study conducted on behalf of UNEP for developing a conceptual framework for implementing the benefit sharing provision of CBD. Several seminars and consultations were organised on a wide range of topics such as nutrition, hunger, International Year of the Ocean, sustainable fisheries and biotechnology. The Annual Inter-disciplinary Dialogue held in February '99 was on the topic "Climate, Biotechnology, Food and Water Security". It was inaugurated by Dr Ismail Serageldin, Chairman of the Consultative Group on International Agricultural Research (CGIAR) and of the World Water Commission. An indepth discussion on biotechnology and water security was held which resulted in the formulation of a proposal for organising a Global Biotechnology Partnership for Water Security in the 21st century. This proposal was warmly welcomed by the World Water Commission at their meeting held in Cairo, in March '99.

In the first printed Annual Report of MSSRF it was mentioned that a major purpose for

which the Foundation was established was to foster a working culture and environment where creative young minds can give their best to both science and society. Looking back over the past 10 years, it may be seen that this goal has been fulfilled to a large extent. Over 150 young scientists and scholars of MSSRF working in different parts of Tamil Nadu, Kerala, Andhra Pradesh and Orissa, several of them living in remote villages, have given their best to mobilise appropriate technologies for serving the twin causes of conservation of nature and natural resources, and improvement of the livelihood security of women and men living in poverty. The administrative, accounts and supporting staff are also doing their best to enable the scientists to perform well. Efforts were continued during this year to provide opportunities for the professional growth of young scientists and scholars. The fact that a few of the young scientists who have been with MSSRF during the last 7 to 8 years have now achieved the status of world leaders in their respective fields is a good index of the value of a management culture which encourages creativity, innovation and dedication.

The future of MSSRF will depend largely on its ability to attract and retain outstanding young scientists and scholars who combine a commitment to professional excellence with dedication to the cause of environment protection and poverty elimination. The Trustees of MSSRF have therefore taken several steps during this year to place the Foundation on a sustainable management and financial foundation. A corpus is being raised so as to insulate core programmes from the fluctuations of project support. Similarly, the management is being strengthened with the appointment of an Executive Director.

Chairman's Introduction

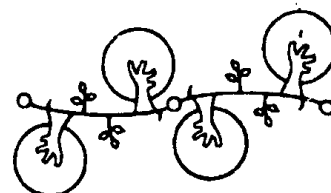
The various activities summarised above and the results achieved would not have been possible but for the generous support of different Ministries/departments of the Government of India as well as of the Governments of Tamil Nadu, Pondicherry, Kerala, Andhra Pradesh, Orissa and West Bengal. Similarly, UNDP, FAO, UNESCO, UNEP, GEF, UNICEF, WHO and IAEA have extended both financial and technical support. We are also indebted to the bilateral, institutional and individual donors listed at the end of this Report for their support and encouragement.

We are particularly grateful to *The Hindu* Group of Publications and NABARD and Arava R&D Centre for help in establishing respectively, *The Hindu* Media Resource Centre for Ecotechnology and Sustainable

Development, and the NABARD Resource Centre for Precision Farming for Poverty Elimination. Particular thanks go to Dr R Chidambaram, Chairman, Atomic Energy Commission and the Department of Atomic Energy for establishing the Homi Bhabha Chair for Nuclear Science and Rural Society. We can only assure the donors and well wishers, both institutional and individual, that we shall strive to the best of our ability to prove worthy of their trust.

Finally, our thanks go to Dr V Balaji for coordinating the compilation of the Annual Report, Dr Nandhini Iyengar for editing the report, Mr N Ram and *The Frontline* for designing the cover and Mr P I Peter and the Reliance Printers for printing the Report.

Programme Area 100



Coastal Systems Research

The Coastal Mangrove Wetlands Conservation and Rehabilitation programme entered the phase of promoting Joint Mangrove Forest Management by Forest Departments and the rural communities living in areas adjoining the Mangrove Forests. Work was initiated on the application of nuclear and biotechnological tools in strengthening the ecological security of coastal areas and the livelihood security of coastal communities.

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Sub Programme Area 101

Coastal Wetlands: Mangrove Conservation and Management

The "Coastal Wetlands: Mangrove Conservation and Management" project is being implemented in the states of Tamil Nadu, Andhra Pradesh, Orissa and West Bengal with the collaboration of the Forest Departments of the concerned states and participation of the local mangrove user communities. The purpose of the project is to build capacity in local communities, voluntary organisations, grassroot level democratic institutions, Forest Departments, MSSRF and other government agencies to restore, manage and conserve mangrove wetlands through participatory research, training and extension.

The project has three major components: i) preparation and data collection; ii) mobilising and organising communities for joint mangrove forest management; and iii) training and human resource develop-

ment. In the first phase of the project, the existing situation was analysed at each project site. This revealed the status of the mangrove wetlands in terms of available resources, degree of degradation, causes for degradation, number of dependent villages, population and resource utilisation practices of the mangrove users.

During the current year, efforts were focused on 3 aspects: i) mobilising and organising the local community; ii) developing partnership between the Forest Department and mangrove user communities for Joint Mangrove Forest Management (JMM); and iii) training to community and Forest Department staff on various needs related to JMM and livelihood security. In order to develop successful and replicable JMM models, the number of demonstration villages was restricted in each of the project sites (Table 1.1).

In mobilising the community and developing a partnership between the community and the Forest Department the following process was adopted:

Table 1.1 : *Number of demonstration villages in the project sites*

State	Tamil Nadu		Andhra Pradesh		Orissa	
Site	Pichavaram	Muthupet	Krishna	Godavari	Mahanadi A	Mahanadi B
Demonstration Villages	3	2	2	3	2	2

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Step 1 : Participatory Rural Appraisal (PRA)

In each demonstration village, PRA was conducted to identify the major concerns of mangrove wetland conservation and management and socio-economic development. The various exercises, in which the staff of MSSRF and the Forest Department participated, led to an understanding of the situation and people's interaction with the mangrove wetland. The PRA was also used as a tool to develop rapport among the stakeholders. Gender specific PRA exercises were also conducted.

Step 2 : Organising community based institutions

In each demonstration village, PRA was followed by the organisation of a village level institution. The purpose of this institution is to provide a platform for stakeholders to discuss major concerns unreservedly and take collective decisions to solve them. It provides an opportunity for marginalised groups including women and poor people to take part in decision making.

Step 3 : Identification of mangrove management unit

The mangrove management unit of a village is defined as a part of the mangrove wetland, which is traditionally utilised by the people of that village for livelihood and subsistence. The villagers and Forest Department personnel along with the staff of MSSRF demarcate this area for joint restoration and protection.

Step 4 : Preparation of micro plan

For each demonstration village, the community and Forest Department prepare the micro plan and MSSRF facilitates the process. This plan gives the details of the activities to be undertaken by various stakeholders to solve the major concerns relating to mangrove conservation and management and socio-economic development. This plan helps in mobilising funds and manpower from the participating villages and fixing the responsibilities in achieving the results.

Step 5 : Implementation of micro plan

As per the micro plan, the stakeholders implement the activities. Apart from providing technical support, MSSRF helps in mobilising funds from the project, government agencies and other resources to implement it.

Step 6 : Monitoring and Evaluation

Monitoring the project activities is an important tool to assess the progress and performance of various components and for effecting needed course correction. Quarterly progress reports are received and reviewed both by the Project Directorate as well as by an internal Management Committee. Indicators are also being developed to monitor the project effectively.

101.1 Tamil Nadu

In Tamil Nadu 5 hamlets, 3 in Pichavaram and 2 in Muthupet, were selected for the development and demonstration of JMM. The socio-economic and demographic details of

the hamlets and dependency of the people of these hamlets on the mangrove wetland have been given in the earlier report. Work is currently progressing only in 2 hamlets in Pichavaram, namely, MGR Nagar and Vadakku Pichavaram. In the Muthupet area, work is advancing only in Veerankoil. In these 3 demonstration hamlets, activities are taken up step by step as per the process explained earlier. Table 1.2 shows the progress made in these demonstration hamlets.

Formation of village development and mangrove councils

In all the 3 hamlets Village Development and Mangrove Councils (VDMC) have been formed. The structure of the VDMC is similar to that of the Village Forest Council formed in the JFM of the Tamil Nadu Forest Department. The structure is shown in Figure 1.1.

Table 1.2 : Major steps achieved in the demonstration hamlets of Pichavaram and Muthupet areas

Project Step	Pichavaram		Muthupet
	MGR Nagar	Vadakku Pichavaram	Veerankoil
Participatory Rural Appraisal	*	*	✓
Formation of Village Development and Mangrove Council	✓	✓	✓
Identification of Mangrove Management Unit	✓	✓	✓
Preparation of micro plan for socio-economic development and JMM	✓	✓	☆
Implementation of the micro plan	✓	✓	☆

* Completed during the previous year; ✓ Completed during the current year; ☆ in progress

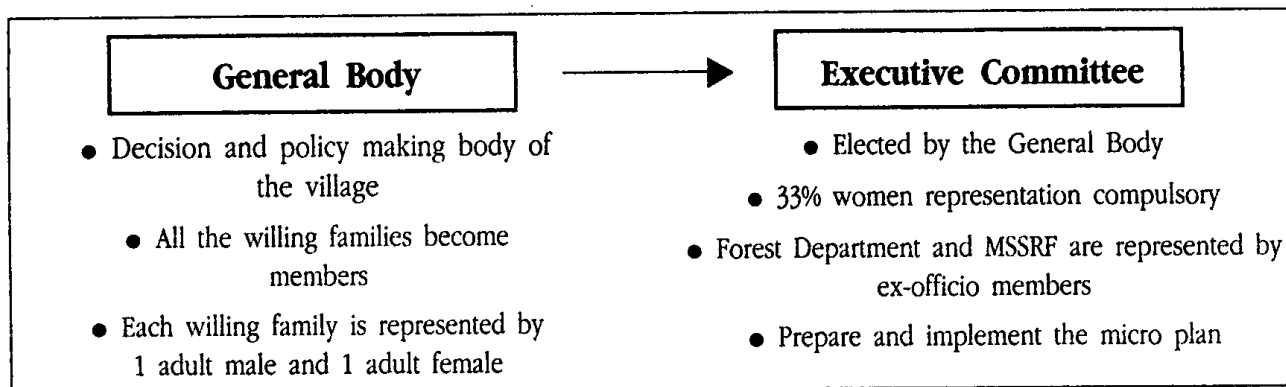


Figure 1.1 : Structure of Village Development and Mangrove Councils

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In MGR Nagar and Vadakku Pichavaram about 78% and 63% of the families have become members of the General Body respectively, and in Veerankoil of Muthupet 55% of the families have become members. Efforts are being made to persuade other families to become members of the General Body of the VDMC.

Identification of Mangrove Management Unit

In order to prepare and implement the plan for the JMM activities, management units for each demonstration village were identified (Table 1.3).

called "canal fishing" in restoring the degraded mangrove wetland. The major concerns of the people are socio-economic developmental needs and issues related to mangrove conservation, which formed the basis for the preparation of the micro plans. The activities planned, implemented, and results achieved, as per the micro plan, in MGR Nagar and Vadakku Pichavaram are given below.

Mangrove restoration and protection activities

MGR Nagar : The people of MGR Nagar completed restoration in the 17 ha of degraded

Table 1.3 : *Total area of the mangrove management unit and the area of different land cover*

Hamlet	Total area of the unit	Land-cover pattern (ha)		
		Healthy mangroves	Degraded mangroves	Dry land
MGR Nagar	62	39	17	0
Vadakku Pichavaram	54	20	32	2
Veerankoil	600	75	525	0

Micro planning

In the demonstration hamlets as well as in the mangrove management units, all the activities are implemented on the basis of the micro plan. So far, micro plans have been prepared for MGR Nagar and Vadakku Pichavaram. The preparation of the micro plan for Veerankoil is yet to be done since the Forest Department is examining the proposal of applying an indigenous technique

mangroves within the mangrove management unit by applying the canal technique developed and demonstrated successfully by MSSRF. The construction of the canal was completed in December '98 and about 2,00,000 *Avicennia marina* propagules were planted in January '99. The entire operation was carried out under the supervision of the Forest Department. The survival and growth rate of *Avicennia marina* plantation and changes in the biophysical condition of the restored area

are being closely monitored jointly by the community, the Forest Department and MSSRF. Agreement has been made between the community and the Forest Department that the former will undertake maintenance work of the canals dug in the restoration area for free flow of tidal water, whereas the community and the Forest Department will jointly protect the plantation.

Vadakku Pichavaram: The people of Vadakku Pichavaram are currently involved in constructing canals for restoration in about 32 ha located within the identified management unit. As in the case of MGR Nagar, the people of Vadakku Pichavaram have been trained in the restoration method. Technical guidance and funds are being provided by MSSRF and the Forest Department is supervising the work.

Veerankoil: In the management unit of Veerankoil, about 525 ha of mangrove are degraded due to stagnation of tidal water. It was found that the traditional fishing method is suitable for the restoration of this area. This traditional method, locally called *vaikkal meenpidippu* (canal fishing) avoids stagnation of tidal water and also provides fish and prawn worth about Rs. 20,000 to 25,000 per year. This income from fishing in the canals could be considered as an economic incentive for the people if they are involved in restoration activities. Based on this concept a proposal has been submitted to the Forest Department by the people of Veerankoil for permission. The process is being facilitated by MSSRF. The Forest Department has formed a committee, namely Veerankoil Mangrove Protection Committee under the chairman-

ship of the Ranger of Muthupet. The Committee is scrutinising the proposal.

Socio-economic development activities

MGR Nagar

- The people of MGR Nagar had not been issued community certificates due to lack of evidence to identify the community. The ethnographic studies conducted by MSSRF helped the Revenue authorities to identify the residents as a tribal community called *Irulars* and certificates have been issued accordingly.
- Illiteracy in the village is very high. A school has been opened in a concrete building in the hamlet to facilitate more children to get primary education. About 52 students are enrolled in this school.
- Self-Help Groups (SHG), six in number (2 for women and 4 for men), have been formed to create a resource base for easy access to credit that will be utilised for production and other purposes. The total savings of these 6 groups is about Rs.40,000.
- MSSRF facilitated one of the women's SHG to get a loan of Rs. 20,000 from the Central Bank of India under the NABARD-SHG scheme. The loan will be utilised for purchasing a boat and net as well as to start a small provision store.
- 40 male members have been trained in using nets to catch shrimp in the mangrove water. The Ecotechnology Centre of

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MSSRF organised the training under a CAPART scheme. Easy credit has also been provided to purchase 20 caste-nets under the same scheme.

Vadakku Pichavaram

- Three Co-operative Irrigation Societies have been formed for optimum utilisation of ground water in the places where no canal irrigation facilities are available. Each society has 12 to 15 members with a land holding of about 0.3 to 1.5 ha. For each society, one bore well was dug where ground water is available throughout the year. All the other members of the society share the water from this bore well. The villagers selected the site where bore wells were sunk. MSSRF provided financial assistance and technical support. 50% of the amount will be repaid to help other needy farmers.
- Forty farmers have been trained in seed treatment with fungicide and bio-fertilisers by the project staff and 15 farmers have been trained in Integrated Pest Management for groundnut, which is the major crop cultivated in the hamlet, by the Krishi Vigyan Kendra, Virudhachalam.
- An irrigation canal, which provides water to about 200 acres of groundnut fields, has been renovated with the help of funds provided by the Member of Parliament under the Local Development Fund. MSSRF helped in mobilising the resources and PWD provided technical support. The fund was released through the District Rural Development Agency.
- A visiting Veterinary Centre has been opened in the village with the help of the Animal Husbandry Department. The Centre is treating the livestock for various diseases and providing artificial insemination.
- SHG, twelve in number (7 for women and 5 for men), have been formed to create a resource base for easy access to credit. The total savings of these groups is Rs.1,40,000. The Indian Bank, which is the lead bank for this hamlet, is negotiating with these SHGs for providing loans for production purposes under NABARD-SHG scheme.
- Three off-farm activities namely, palm candy production, palm brush manufacture and dairy farming, have been identified as suitable micro-enterprises. 10 families (1 male and 1 female from each family) have been trained in the production and marketing of palm candy. A trial run was carried out which indicated the possibility of producing high-quality palm candy in the villages. Arrangements are being made to open a palm candy production unit with the help of the Tamil Nadu State Palmgur and Fibre Co-operative Federation Ltd.
- About 100 saplings of grafted tamarind and 40 saplings of Singapore Silk Cotton have been planted in the village common land. VDMC is looking after this plantation. It is expected that after 4 years the village will get about Rs. 1,25,000 every year from the produce of these trees.

101.2 Andhra Pradesh

In Godavari mangroves, work is progressing in three demonstration villages namely, Matlapalem, Corangi-Dindu and Bhairavalanka and in the Krishna area, work is advancing in Nakshatranagar and Dheendayalpuram villages. In all the five villages, the various steps leading to JMM have been completed and baseline survey conducted with the help of local NGOs namely SRAVANTI, Visaka Jilla Nava Nirmana Samiti (VJNNS), Gandhian Organisation for Rural Development (GORD) and College of Social Work, Hyderabad.

Participatory Rural Appraisal

In all the demonstration villages, PRA has been completed and major concerns and issues relating to mangrove conservation and management identified.

Formation of Mangrove Protection Committee

In organising the villagers into groups for mangrove conservation and management, two different approaches were followed in the Godavari and Krishna areas. In the Godavari area, Eco-Development Committees (EDC) were formed in Matlapalem and Coringa Dindu villages which are adjacent to the Coringa Wildlife Sanctuary. In Bhairavalanka village, a Forest Protection Committee (*Vana Samrakshna Samiti*) was formed since this village falls under non-sanctuary area, as per JFM rules laid down by the Forest Department. In the General Body of the EDC of the Matlapalem and Coringa Dindu villages all the families have become members. In the

Forest Protection Committee of the Bhairavalanka village 84% of the families have enrolled as members of the General Body. In the Krishna area, MSSRF formed an Environment and Village Development Committee (EVDC) in both the demonstration villages. All the families in Dheendayalpuram and Nakshatranagar have become members of the committee. In all these villages, the group has an Executive Committee, which is actively involved with MSSRF and the Forest Department in planning and implementing various activities related to mangrove conservation and socio-economic development of the village.

Mangrove Management Unit of the demonstration villages

Table 1.4 gives the details of the location of the mangrove management units of the different demonstration villages and total area to be conserved and restored through JMM efforts.

Assessment of biophysical conditions of the restoration area and preparation of the contour maps have been completed. Restoration activities such as canal digging have been completed for Dheendayalpuram in Sorlagondi Reserve Forest and are being undertaken in Matlapalem, Corangi-Dindu, Bhairavalanka and Nakshatranagar. The restoration activities are being carried out by the village groups with financial and technical support from MSSRF. Community mangrove nurseries have been established separately for Krishna and Godavari areas at Sorlagondi and Chollangi respectively.

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Table 1.4 : *Details of Mangrove Management Units of demonstration villages in Godavari and Krishna mangroves*

Name of the demonstration village	Location	Protection area (ha)	Restoration area (ha)
<i>Godavari mangroves</i>			
Matlapalem	Coringa Wildlife Sanctuary	250*	4
Dindu	Coringa Wildlife Sanctuary	250*	23 (rehabilitation)
Bhairavalanka	Rathikalava Reserve Forest	200*	4
<i>Krishna mangroves</i>			
Deenadayalpuram	Sorlagondi Reserve Forest	100	8
Nakshatranagar	Kothapalem Reserve Forest	200	5

* Allotted to the Eco-Development Committee by the Forest Department

Micro-planning

Micro plans for all the five demonstration villages have been prepared jointly by the community, Forest Department and MSSRF. In the Matlapalem, Coringa Dindu and Bhairavalanka villages of Godavari area, NGOs namely, VJNNS, SRAVANTI and ARTIC participated along with officials of the government agencies such as Fisheries, Rural Development, Revenue Department and Education Department. In the Krishna area, NGOs namely, GORD and Coastal Community Development Programme (CCDP) participated along with the representatives of the government agencies in the preparation of the micro plans. All the activities planned are being implemented jointly by the community and MSSRF. The following are the activities completed as per the micro plan:

- The people of Matlapalem village depend on the mangrove forest for small timber,

mainly for house construction. To reduce this pressure, seedlings of bamboo (90 numbers) and casuarina (60) were distributed and planted to about 30 households. The survival rate is about 60%. Bamboo and casuarina were also planted in 1.1 acre of common land, to grow timber for domestic use. The people of the village and members of the DWCRA fenced the entire area under "shramadan" (Voluntary labour). The Social Forestry Division, Forest Department, supplied the seedlings free of cost.

- In Coringa Dindu 140 bamboo seedlings were distributed to 28 houses and in Bhairavalanka 150 bamboo seedlings have been distributed to 52 houses.
- In Deendayalpuram and Nakshatranagar, SHG for women were formed. The total saving of these groups is around Rs. 1,15,000. MSSRF has helped in getting a

matching grant of Rs. 1,10,000 from the government under DWCRA scheme.

- ARTIC, an NGO, has commenced the housing project and 25 houses have been built.

101.3 Orissa

In Orissa, the Forest Department desired that the project activities be confined to the Mahanadi area since Bitarkanika has been declared as a Wildlife Sanctuary and the Forest Department has not finalised the introduction of any participatory management system for this sanctuary. Therefore, the project activities are confined to Mahanadi area which is divided into 2 sites namely, Mahanadi A and Mahanadi B. In each site, 2 hamlets namely, Kandarapatia and Kharinasi and Sanatubi and Kajalapatia have been selected as demonstration villages.

The Forest Department has given its concurrence and is supporting the project activities though a Memorandum of Understanding has not yet been signed. The local communities in the demonstration villages are mostly migrant Bengali population. Preliminary information regarding socio-economic conditions, livelihood strategies and mangrove dependency has been collected.

The PRA has been completed in three villages and in Kajalapatia this work will commence shortly. Mangrove Forest Protection Committee (locally called *Luna Jungala Samrakshyana Samiti*) has been formed in Kandarapatia. All the 38 families of the village have become members of the group

and the total membership of this group is 76 (one man and one woman from each family). The mangrove management unit of this village is yet to be identified. Micro plan has been prepared for Kandarapatia on the basis of the concerns identified and prioritised. Action has been taken as per the micro plan.

- A prawn farm had been constructed near the village on encroached land. Saline water intrusion from this farm caused heavy loss to paddy cultivation. The community, the Forest Department officials and MSSRF, after repeated attempts, succeeded in making the farmers close the farm.
- Since most of the paddy lands are affected by salinity, a saline resistant paddy variety called "Lunishree" developed by Central Rice Research Institute, Cuttack, is being tested.
- In order to reduce pressure on the mangrove forest for timber and firewood, 500 acacia and 500 eucalyptus trees are being grown in the community land.
- A SHG for women has also been formed in the village with the aim of generating resources for socio-economic developmental activities.

101.4 West Bengal

It has been decided that the project operation in Sundarbans of West Bengal will be only in the later stages of the project since West Bengal Forest Department has already

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introduced participatory management systems in the mangroves. Preliminary reconnaissance studies were conducted in the Sundarbans and after discussions, the Forest Department has given proposals for project interventions, which aim at strengthening the ongoing JFM process. These proposals were studied in consultation with the India-Canada Environment Facility (ICEF) and a framework for project interventions has been agreed upon. The project will be implemented in three areas of Sundarbans namely : i) Ganga Sagar under Namkhana Range, in seven villages; ii) Dhanchi station in Ramganga range, in three villages; and iii) Bhagawatpur Range in Bhagawatpur Reserve Forest, in six villages. In some of these villages Forest Protection Committees under JFM have already been registered as per provisions of an earlier forestry project. In other villages, the process will be initiated under this project.

The Forest Department of West Bengal has agreed to the proposal that mangrove afforestation along riverbanks would be taken up mostly on non-forest and wasteland. The Jilla Parishad of 24 Paraganas South District will be persuaded to allow the community to take up mangrove plantations and to have rights for the usufructs including timber. The village communities will participate actively in raising, protecting and managing the plantations and contribute 50% of the cost. All the activities will be carried out on the basis of the micro plans.

Project Activities in Sunderbans

The following are the proposed activities:

- Preparation and planning
- Awareness building and education
- Entry point activities - drinking water supply, irrigation channels etc.
- Afforestation/ regeneration
- Development of alternate sources to mangrove products and
- Training and exposure visits for staff and community.

The project activities will commence shortly.

101.5 Geomorphological, Hydrological and Sedimentological Studies

The biophysical studies conducted in the project sites indicate that the physical factors such as seasonal closure of the mouth of the estuaries and reduction in freshwater flow are responsible for the degradation of the mangrove wetlands rather than the social causes. This observation applies mainly to Pichavaram and Muthupet of Tamil Nadu and Krishna of Andhra Pradesh. Hence, in order to develop a long-term strategy for the conservation of the mangrove wetland, a Consultative Group has been established. The members of the group include experts in physical oceanography, coastal engineering, modeling and hydrology. On the basis of the suggestions of this group the following objectives have been chosen for the geomorphological, hydrological and sedimentological studies:

- To study the physical process relating to increasing the freshwater inflow and tidal water circulation in the Pichavaram, Muthupet and Krishna mangrove wetlands

- To prepare a specific intervention plan to achieve the above objective
- To evolve suitable scientific protocols to implement the intervention plan

The Consultative Group visited the Pichavaram mangrove wetland recently and on the basis of their observation, prepared a plan of action for collection of data on various physical factors that influence this mangrove wetland. The Indomer Coastal Hydraulic Limited, Goa, is entrusted with collecting most of the data. Data is being collected on the following aspects:

- Hydrodynamic study: Data is being collected on seasonal variation in tides, current and circulation pattern within the mangrove wetland along with water quality. In addition data will also be collected on littoral drift and beach profile.
- Hydrological study: River discharge into the mangrove wetlands and level of silt load are being estimated. This study might provide insight into the amount of freshwater required for maintaining the mangrove wetland.
- Sedimentological study: Rate of sedimentation in the mangrove wetland will be studied to understand the lifetime of the Pichavaram mangrove wetland with reference to the hydrological characters.

101.6 Remote Sensing Applications and Geographic Information System

In the last two and half years remote sensing data has been used to prepare different the-

matic and resource maps of the project sites as well as the project villages. During the current year attention was given more to integrate the biophysical and socio-economic data collected by the field staff to create a GIS database. The thematic maps prepared for the study areas of 6 sites of Pichavaram, Muthupet, Krishna, Godavari and Mahanadi A and B wetlands using remote sensing data and collateral data were compiled and a Draft Atlas was prepared. The Draft Atlas contains the following maps and description for each site.

Resource maps

- Base maps: Administrative, Reserve Forest boundaries, road and railway network, village locations, management network and other infrastructure facilities
- Geomorphology maps: Beach, sand dune, ridges, spit, lagoon, vegetation and mudflat associated with the coastal areas of the project sites
- Drainage maps: Rivers, streams and canals that drain freshwater into the mangrove wetlands
- Mangrove wetland maps: Area of the mangrove vegetation, degraded area, mudflat and associated vegetation and other coastal land use classes
- Mangrove vegetation change maps: Changes in the mangrove vegetation cover between the years 1970, 1986 and 1996

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Socio-economic data:

- Households and population
- Livestock population
- Status of the community in terms of their socio-economic status
- Dependency of the community on mangrove for fuel wood, cattle grazing

The draft atlas was presented to top level managers, District and field level officers of the Forest Department for comments and suggestions. The atlas will be finalised after receiving the suggestions from agencies.

Some interesting points were noted from the mangrove vegetation changes study:

- In Pichavaram mangrove, forest cover has increased in the Periaguda region where MSSRF and the Forest Department undertook restoration work.
- In the Muthupet area, the shoreline of the wetland has moved into Palk Strait due to sedimentation; regeneration of mangroves has been observed in these newly accreted lands.
- In Godavari delta, the vegetation and the shoreline along the northern part of Godavari River mouth was found to have disappeared in 12 years due to erosion. Approximately 130 ha of mangrove vegetation was lost by this natural calamity. The width of the mouth of the Nilarava River has been reduced by sediment deposition.
- In Krishna delta, the mangroves are regenerating in the eastern part of the delta and degrading in the north-west region.

101.7 Training and Human Resource Development

Capacity building through training and human resource development is one of the major components of the project. The main aim of this component is to enhance the capacity of the local community, Forest Department personnel and project staff in participatory approach, mangrove ecology, restoration and conservation, various livelihood activities including off and on-farm income generation activities and gender issues. In order to achieve the above aim, a training plan was prepared for all the stakeholders with the help of in-house experts. This training plan contains the details of: i) training process; ii) groups to be trained; iii) training needs; iv) identified resource agencies or resource persons; and v) time schedule for training programmes. The Training Plan was approved by the India-Canada Environmental Facility (ICEF). As per the Training Plan, the following training programmes were conducted successfully during this year. All these training programmes were need based and most of the training programmes were conducted separately for the project staff, Forest Department personnel and the community. Some of the training programmes were conducted jointly for the project staff and staff of the Forest Department.

Training programmes conducted for the project staff

Training: The following are the training programmes conducted for the project staff of the 3 states. The major aspects covered in these training programmes were: i) group

formation; ii) micro planning; and iii) micro credit. The details of the resource agency which conducted the training and the number of participants and duration, are given in Table 1.5.

Exposure visits: In order to have better clarity as well as to develop more practical skills, exposure visits were organised for the staff of the project. Since in all the project villages SHG are being formed for micro-credit

as a part of the socio-economic development activities, project staff particularly social workers and agronomists were taken to Panchapatty area of the Trichy District of Tamil Nadu, where successful models of the micro-credit programme exist. The exposure visit organised to the JFM areas in West Bengal and Andhra Pradesh provided insight into the intricacies of participatory management. Table 1.6 shows the details of the exposure visits organised for project staff.

Table 1.5. : *Training programmes conducted for the project staff*

Theme of the training	Resource Agency	Target group	Duration of the programme	Number of participants
Group formation	Association for Stimulating Know-how (ASK), New Delhi	All the field staff of Tamil Nadu and Andhra Pradesh	6 days-3 days in Chidambaram and Kendrapara	21
Micro credit	ASK, New Delhi	All the staff	6 Days-3 days in Chidambaram and Kendrapara	19
Micro plan	ASK, New Delhi	All the staff of Tamil Nadu	4 Days-Chidambaram	11
Documentation and reporting	ASK, New Delhi	All the staff	5 Days-Kakinada	17
Gender issues and documentation	MSSRF	Social workers and agronomists	3 Days-Chennai	13
Monitoring and evaluation	Asian Centre for Entrepreneurial Initiatives, Bangalore	Project managers	3 Days-Chennai	8
Experiential learning for animators	CYSD Bhubaneswar	Animators and project staff	6 Months	14

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Table 1.6 : *Exposure visits organised for project staff*

Theme of the exposure visit	Resource Agency	Target group	Duration of the programme/Venue	No. of participants
Micro-credit	Legal Education Association for Development LEAD, Trichy	All social scientists and agronomists	3 Days-Panchapatty village, Trichy	13
JFM	Forest Dept. of Andhra Pradesh	Project staff of Andhra Pradesh	3 Days-Narasapur and Applarajugudem	18
JFM, West Bengal	Forest Department of West Bengal	Project managers	7 days-Sunderbans	12

Training programmes conducted for the community

The community is a major stakeholder in the project and hence a series of training programmes and study trips were organised in 3 states, for improving skills in various aspects related to livelihood security and

mangrove management. Training was provided by the project staff with help from outside agencies.

Tamil Nadu: In Tamil Nadu the emphasis was on pest and water management for groundnut and micro-enterprises. In the case of micro-enterprises in Tamil Nadu and

Table 1.7 : *Training programmes for the community in Tamil Nadu*

Training need	Resource Agency	Duration day(s)	Number of participants
Palm candy making	Palmyra Workers Development Society, Marthandam, Tamil Nadu	7	10
Groundnut seed treatment	MSSRF Field Centre, Chidambaram	1	40
Integrated Pest Management	Krishi Vigyan Kendra, Virudhachalam	1	15
Coir-making	Coir Industry, Pattukkottai	1	17
Fishing net-making	Local fishermen, Financed by CAPART through JRD Tata Ecotechnology Centre, MSSRF	1	40

Andhra Pradesh, a consultant group, South India Producers Association, Chennai, (SIPA) was involved in identification of suitable micro-enterprises. Palm candy production was identified as one of the most suitable micro-enterprises for the people of Vadakku Pichavaram. Table 1.7 gives the details of the training conducted to the community of the project villages of Tamil Nadu.

Andhra Pradesh: In Andhra Pradesh training concentrated on enhancing leadership and membership skills and joint mangrove forest management. Table 1.8 shows the details of the training conducted in Andhra Pradesh.

Training programmes conducted for Forest Department personnel

As mentioned earlier, the field staff of the Forest Department were trained in micro planning and participated in many of the exposure visits conducted for the project staff. In addition, the Remote Sensing and GIS laboratory of MSSRF and some of the trained officials of the Forest Department of Andhra Pradesh conducted training on using remote sensing and GIS tools in mangrove conservation and management. A study trip was also organised for the officials to NRSA, Hyderabad. Apart from these, the District

Table 1.8 : *Training given to the community members of the project villages in Andhra Pradesh*

Training need	Resource Agency	Duration day(s)	Number of participants
Leadership & membership skills	Gandhian Organisation for Rural Development, Rapalle	4	50
Mangrove ecology & restoration	MSSRF, Kakinada	1	30
Exposure visit to JFM areas	MSSRF and Forest Department, A.P.	3	18
Training on coir rope making	Coir Board, Rajamundry	30	5

Orissa: In Orissa, about 8 progressive farmers were trained along with the project staff in alternative irrigation systems for rain fed agriculture with the help of International Development Enterprises. In addition, the Krishi Vigyan Kendra of Kendrapara trained 10 farmers in mushroom cultivation.

Forest Officers concerned with the project sites of Tamil Nadu, Andhra Pradesh, Orissa and West Bengal participated in a study visit on Community-based Mangrove Management in Thailand, Philippines and Malaysia. In Thailand, the Asian Institute of Technology organised the training whereas in the

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Philippines, the International Institute of Rural Reconstruction conducted the training course. The training included tours to different mangrove localities, interaction with the communities and exposure to JMM procedures followed in these countries.

101.8 Gender Issues in Mangrove Conservation

Tamil Nadu

In this project a gender sensitive approach has been adopted from the beginning. During the data collection for problem analysis both gender sensitive observations and gender segregative data were collected through RRA/PRA methods. The RRA helped to understand the utilisation pattern of the user communities and women – mangrove interaction. During the gender desegregated exercises conducted through PRA, the exercises like daily routine charts, matrix ranking and focus group interview-access and control profile were given importance. The PRA helped in understanding the daily routine and activities of men and women and also gender dimension in the livelihood opportunities, the gender role in the decision making at the community and domestic level and the control of and access to community and domestic resources.

The results show that:

- Women have to perform multiple roles and there is no time for them to relax and take rest
- The tight schedule acts as a barrier for women to participate in activities outside the household.

- Women have access over household resources but enjoy no control over them
- Technology empowerment only helps men to come out of drudgery.

In the baseline survey an exclusive gender section was planned to quantify the perception of women in the following aspects:

- Status of women
- Gendered division of labour
- Access and control over resources
- Intra household dealing and community level decision-making.

The results obtained clearly show that women toil in the domestic arena and contribute more or less equally in the economic domain. Women have access to household property but lack ownership rights and the power to sell and buy. Men play a vital role in intra household and women are virtually excluded from the community-level decision-making.

In the VDMC formation process, 50% women membership in the general body and 33% minimum representation for women in the executive committee are ensured. Women also actively participate in evolving the norms, roles and responsibilities for the general body, executive committee and office bearers. SHG are formed separately for men and women. Linkages were established with service banks like Indian Bank, Central Bank and Women Development Corporation. Micro crediting has taken roots and attempts are on to start

microenterprises for income generation. Gender sensitive microplanning was done where the prioritisation of concerns for men and women groups were done separately. Concerns exclusive to women were taken up for micro planning. It is encouraging to see the active involvement of women in different phases of micro plan implementation, monitoring and self evaluation.

Andhra Pradesh

The status of any social group is determined by its level of health, nutrition, literacy, education, employment and income.

Health status of women: High infant mortality rate, high nutritional status, high incident

of skin diseases and general ailments and high fertility rate are noticed.

Employment status: The majority are engaged in fishing. Fisherwomen are engaged simultaneously in three different occupations for their employment. i.e. fishing, mangrove, non-fishing activities. 80% of women are involved in marketing in addition to fishing. Everyday women spend nearly 2 hours collecting firewood from the mangrove forest. Less than 20% of the fishing women are involved in other activities like agriculture and labour other than fishing/vending/marketing.

Employment: In jobs like grain procurement, cooking, grain preservation, cleaning, fetching water and firewood collection, the role

Table 1.9 : *Details of decision making (Orissa)*

Activity	Predominantly Men	Predominantly Women	Both
Fishing			✓
Agriculture	✓		
Selling fish catch			✓
Cooking		✓	
Fuel wood collection	✓		
Education for children			✓
Household purchases			✓
Religious function related expenditure			✓
Agriculture implements	✓		
Livestock care		✓	
House construction			✓
Paddy threshing			✓
Household work		✓	

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of women is very significant. Male involvement is marginal except in cases like grain storage/teaching and to some extent firewood collection. In financial matters like savings or loan settlement men involve women also in decision making. In Matlapalem women in the executive committee constitute 33%, in Bhairavalanka it is 50% and in Corangi-Dindu it is 33%. DWACRA/SHG are showing interest in monitoring homestead plantations. It is interesting to note that when the canal digging for planting mangrove seedlings was allotted to men in Bhairavalanka village, women also claimed the same job and hence this work was allotted to both men and women.

Orissa

The following points summarise the observations on gender status in the village.

- Men are engaged more in productive activities, whereas women are engaged both in productive and non-productive activities like household maintenance, child care, fetching drinking water, kitchen gardening etc. While women have opined that men are the bread earners of the family, men have commended women for their role in these activities. Table 1.9 gives details of decision making.

Sub Programme Area 102

Nuclear and Biotechnological Tools for Coastal Systems Research

This research programme, primarily designed to integrate conservation and development

in the rural communities of the coastal areas in Southern India, was initiated in the year 1998 as a partnership between the Department of Atomic Energy and MSSRF. This joint endeavour of the Biosciences and Radio-isotope Groups of the Bhabha Atomic Research Centre (BARC) and MSSRF has been to

- evolve practical methodology for arresting natural resources degradation and alleviating rural poverty in the coastal regions
- develop crop varieties with greater tolerance to salinity
- enhance soil fertility and crop productivity
- reclaim saline soil in coastal areas
- use radiotracer technology for monitoring water quality parameters in the coastal aquifer
- lay emphasis on popularisation of improved pulse crop varieties through capacity building and extension activities.

This project became operational during July, '98. The initial phase included interactive meetings of the scientists of MSSRF and BARC with the farmers of the coastal areas to identify the scope for agriculture in these areas.

Isolation of stress induced genes

As a step towards understanding the mechanisms of salt tolerance in mangrove species, *Porteresia coarctata*, a species growing in the mangrove locations, has been selected for study. This plant grows in high saline

conditions and can tolerate high salinity levels. The long-term goal is to isolate salt tolerant genes from this species and provide pre-breeding material to grassroot level breeders for developing locality-specific crop species.

Porteresia coarctata plants were collected from Pichavaram mangrove forest and grown in a nutrient medium for seven days. The plants were then treated with 1M NaCl solution for 48 hours. Total RNA from the leaf tissues of salt treated plants were isolated following a protocol developed by us. The mRNA for making complementary DNA (cDNA) was purified from the total RNA using oligo-dT cellulose column. Using reverse transcriptase enzymes the double stranded cDNA was made and ligated with pSPORT 1 vector. The ligated cDNA was transformed into *E. coli* (DH5 α) to enrich the library. About 1,00,000 colonies obtained from the cDNA library have been prepared from this species.

Preliminary screening of this library has been initiated using both heterologous probes specific for salt tolerance as well as random sequencing of the ESTs (Expressed Sequence Tag's). Using heterologous *Arabidopsis thaliana* Pyrroline 5-Carboxilate Synthetase (P5CS) gene which is involved in proline (a known osmoprotectant) biosynthesis, two positive clones have been isolated from this library. End sequencing of these clones shows significant homology with P5CS of *Arabidopsis thaliana* and *Oryza sativa*. Work is underway to isolate and characterise the full length gene from this library and also to study its expression pattern.

By random sequencing of selected cDNA clones a full length clone for Histone H3 and a clone homologous to metallothionein-like protein has been isolated. Complete sequencing of the Histone H3 gene has been carried out and submitted to the NCBI Gene Bank (Accession No. 109910). The clone homologous to metallothionein-like protein has also been sequenced completely. Further analysis, including study of the expression pattern, is being carried out.

Soil biological criteria and bioremediation

Soil salinity, which is one of the stresses, poses a major hindrance to the realisation of the potential yield of most plants. The amount of soluble salts in saline soils significantly influences the physico-chemical properties of soils, their ability to support plant growth and microbial species, their numbers and activities in soil. A better understanding of the role of the microbial osmotic adaptation will help us in harnessing these microbial species in amelioration techniques.

Amelioration of such types of soils could be done to restore or regulate the processes which would help to increase the soil biodiversity and increase nutrient recycling mechanisms. This could be achieved either by looking for halotolerant microbial strains and breeding plants resistant to salinity stress or using a biological approach which could absorb and temporarily immobilise Na⁺ extracellularly which would result in decreased soil salinity in crop rhizosphere.

Osmoadaptation mechanisms in soil microbes

Isolation and screening of nitrogen fixers associated with *Porteresia coarctata* (from rhizosphere, endophyte and leaves) was done. Some of these isolates and those obtained from the agrisystems along the Tamil Nadu coastline, maintained as culture collections at MSSRF, were taken up for screening for their salt tolerance limits. Preliminary analysis of *Acetobacter diazotrophicus* (associated with *Porteresia coarctata*) has shown that they can grow comfortably in 4% NaCl in specific media. A few aerobic heterotrophs like *Pseudomonas* spp. have also shown that they can grow upto 1.5 - 2 M in mineral media. The total protein profiles of these isolates have shown that proteins are induced under stress. Further work on these lines, including labelling techniques to understand the expressed protein profile, is underway at BARC.

Amelioration studies using Anabaena torulosa

Cultures of *Anabaena torulosa*, isolated from the east coast of Tamil Nadu, were obtained from BARC. This was re-established successfully at MSSRF and a good quality culture has been established. A portion was scaled up to 20 l (in about 2 weeks) and then the biomass was harvested and released into the field (0.22 acres) at the demonstration plot at Kalpakkam. This particular strain not only has the capacity to fix nitrogen but also absorb and temporarily immobilise Na⁺ extracellularly. At the end of two weeks of its

release, the establishment of the biomass was observed to be very low when compared to the local population (consisting of green algae). This could be due to the consistent rains at the field site. Secondly, the physico-chemical properties showed an EC value of <1 and pH was towards the acidic side which is not favourable to *A.torulosa*. It was felt that in the next season (March) these factors should be considered before deciding to use *A. torulosa* or *Al. 31*, which would better suit the present soil conditions. Further work will be carried out to standardise the type of *Anabaena* to be released here and its ameliorating capacity.

The microbial analysis showed that phosphate solubilisers were very low. Macronutrients like N, P and K were also found to be very low in these soils. Pot experiments (with paddy) have been initiated with the soil samples from the demonstration site. Phosphate solubilisers from the culture collection of MSSRF are being tested in these experiments to study the efficiency and remediation capacity of these isolates.

Development of the demonstration plot at Kalpakkam

One of the major objectives of the ongoing project is to develop demonstration plots along the coastal areas. The first project demonstration site development activity has been initiated at Kalpakkam. The team of scientists from MSSRF and BARC visited various sites around Kalpakkam and held several discussions with the authorities of IGCAR for a possible site for the demonstration. With

the cooperation received from the IGCAR authorities, a 10 acre plot has been allotted to MSSRF for developing as an experimental plot. It is proposed to sign a MOU with the IGCAR for smooth functioning of the project. In the first week of October the identified land was handed over to MSSRF. The land was completely covered with luxuriant growth of *Prosopis juliflora* and other sporadic plant species. The development activity in the plot started by mid-October with the removal of the *Prosopis* and making plots for experimentation.

The basic model applied in the development of the demo plot is that of the Integrated Intensive Farming System model developed by MSSRF. A number of activities will take place in a single location. The design covers the cultivation of rice and millets, groundnut, blackgram, greengram, vegetables, floricultural species and a site for semi-intensive aquaculture in addition to various other ecotechnology options. The soil samples of the plots have been tested for their micro- and macro-nutrients and also for soil microbial populations (with special reference to beneficial organisms).

The basic design of the demo plot includes:

- about 1.6 ha for rice (rice crop with farm manure, green manure, *Azospirillum* and *Anabaena*)
- about 0.8 ha for fish pond
- about 0.4 ha for groundnut
- about 0.6 ha for pulses (greengram and blackgram)

- about 0.4 ha for vegetables and floricultural species
- about 0.4 ha as buffer zone

Along the fish pond banana plants (both *in vivo* and *in vitro*) are being grown. Castor seeds have been sown around the experimental field to serve as trap crops for insects and pests. Along each rice field blackgram seeds have also been sown as trap crops.

The first planting at the site started in the 1st week of November with the transplanting of rice (var. Ponni and CO43) along with various treatments for green manure, farm manure, *Azospirillum* and *Anabaena*. The fish stock development and sowing of other crop species will take place in the coming months. A base design of the demo plot is given in Figure 1.2.

Popularisation of pulse crop varieties of BARC

Field trials for improved pulse crop varieties developed by BARC were initiated at Kottam, Paraikulam and Pudukkudi in October and November '98. The trials were conducted primarily to test the response of blackgram (var. TU:94-2) and greengram (var. TAARM) developed by BARC under semi-dry conditions in Tamil Nadu and to ascertain the critical watering regime for the above mentioned variety. In addition, it is intended to assess the impact of different sowing methods and to select suitable conditions of irrigation, sowing and phosphorous application to enhance the pulse productivity.

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The 2 acre plot was divided into 36 treatment plots of about 5 cents each, based on the owners' plot layout. This 2 acre plot was leased from the farmers and was controlled by the local level organisations and MSSRF for conducting the experimental trials.

Data related to total plant height, plant density, root length, number of root nodules per plant, incident of insect/pest and disease were

collected at an interval of 15 days. Local farmers were trained to collect the data. Regular feed back was received from the farmers about this experiment in comparison with their conventional method of cultivation. Watering schedule was also monitored in terms of hours of watering and quantity of watering. Recommendations based on these observations will be made for improving pulse varieties.

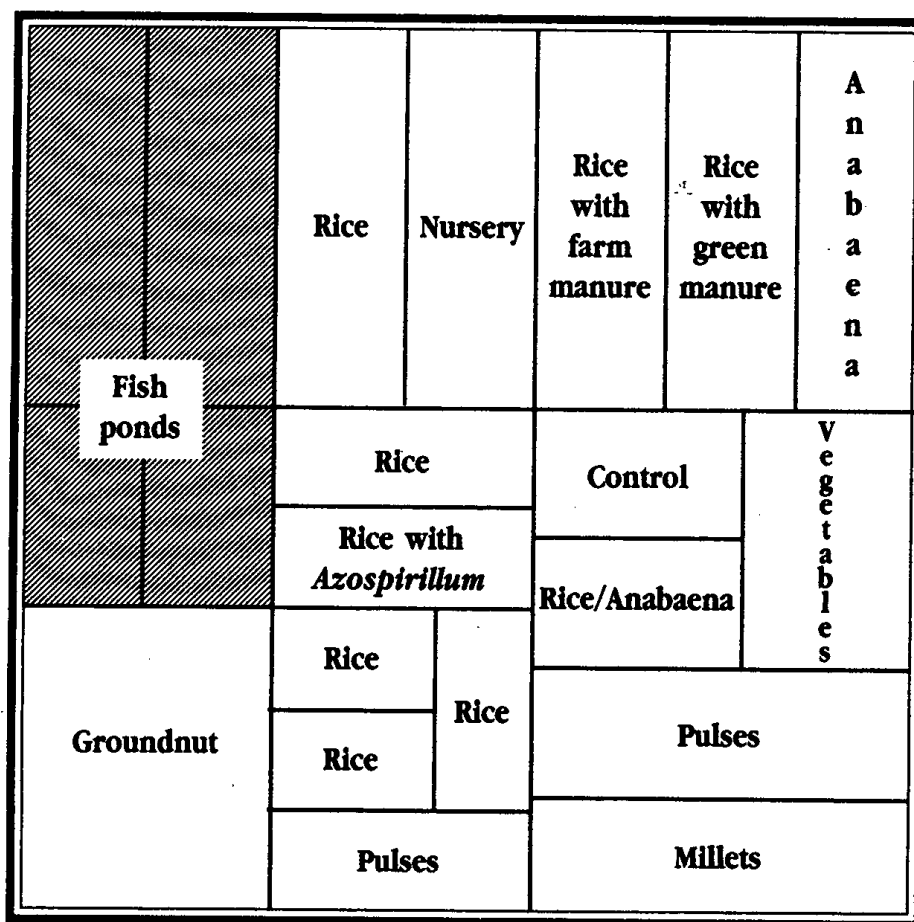
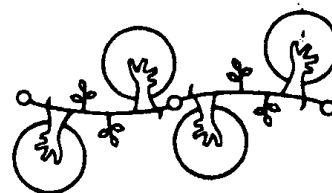


Figure 1.2 : DAE-MSSRF demo-plot layout at IGCAR, Kalpakkam

Programme Area 200



Biodiversity and Biotechnology

The revitalisation of the in situ on farm conservation traditions of tribal and rural families made good progress in Kolli Hills (Tamil Nadu), Wayanad (Kerala) and Jeypore (Orissa). A Community Gene Management System involving in situ field gene banks, area level seed banks and a community gene bank with cryopreservation facilities was developed for Orissa. Scope for transferring genes conferring tolerance to salinity from mangrove species to annual plants has been demonstrated. Further refinements were made in the development of biomonitoring tools.

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Sub Programme Area 201
Conservation Traditions:
Chronicling and Revitali-
sation

The programme for chronicling and revitalisation of genetic conservation traditions adopts a multi-pronged strategy to focus on biodiversity conservation. It includes the following components:

- chronicling the use of biodiversity by tribal communities
- documenting traditional conservation practices, especially sacred groves
- identifying market linkages to promote income generating opportunities for the tribal families.

The overall goal is to develop procedures for recognising and rewarding the contributions of tribal and rural families, particularly those of women, in the conservation and enhancement of genetic diversity, in accordance with the provisions of the Convention on Biological Diversity.

201.1 Kolli Hills, Tamil Nadu

The result of last year's study using anthropological tools revealed that the pristine ecosystem of Kolli Hills was changed due to migration and settlement by Malayali tribals about eight generations ago.

Kolli Hills is located at a distance of 40 kms from Namakkal and is a Panchayat Union i.e. a development block located in the north-eastern part of Namakkal district

of Tamil Nadu. Its 14 panchayats have 263 hamlets. It is surrounded by Rasipuram taluk in the north and Thuraiyur taluk in the east and Namakkal taluk in the west and south. The highest point in Kolli Hills is 4,663 feet (1554 m), above mean sea level. It stretches 29 km from north to south and 19 km from east to west.

It is spread over an area of around 476 km² having a population of 33,888 (6,840 households) as per 1991 census. The population density is 69 persons per km², 32,080 people belong to scheduled tribes (Malayalis) and the remaining 939 to scheduled castes. Historical evidence reveals that they came from Kancheepuram near Madras and settled here some 400 to 500 years ago. This block is divided into 14 panchayats and 16 revenue villages for administrative purposes.

Forests occupy 57% of the total area (12,454 ha) and agriculture is taken up over 52% of the total area (14,609 ha). Nearly 85% of the land in Kolli Hills constitutes dry upland. Well irrigation is not common here. Around 1,873 ha of land is irrigated by springs and jungle streams.

Though there was no mention of tapioca cultivation in Kolli Hills or in Namakkal taluk in the Manual of Salem district in the Presidency of Madras, it is the number one crop now in terms of area coverage (over 4,000 ha). This is followed by millets (1,727 ha), paddy (1,502 ha) and *ragi* (1,337 ha). Creation of estates for plantation crops is also a comparatively new agricultural activity here and is found over 660 ha. The estates grow coffee, silver oak and pepper.

Area selected: Gundur Nadu is one of the 14 panchayats in Kolli Hills. As the cultivation of minor millets (*samai*, *thinai* and *ragi*) is still practised here in the remote parts by the Malayali tribal community, it has been selected this year. Valappoor Nadu (where Arappaleswar temple and waterfall are located) has been selected for People's Biodiversity Register preparation (see SPA 204 for details).

Farmers' practices: Most of the farmers here clear the vegetation in their dry lands by burning as they believe ash is a good source of fertiliser for minor millets. The shortage of farmyard manure (FYM) results in almost no application of it. Thus, soil health has to be improved by providing biofertiliser or by arranging for FYM. The government provides Rs. 250 and critical inputs to those who grow minor millets. Despite this encouragement the acreage and productivity have not increased.

The following activities were taken up in Kolli Hills for revitalisation of genetic conservation practices:

- Selection of Panchayats and villages: Gundur Nadu and Valappur Nadu
- Construction of Community Grain Storage (*Thombai*)
- Installation of low cost greenhouse, for minor millet seed supply in non-season
- Chronicling and documentation of use of plants by the tribes for
 - (a) mother and child health
 - (b) medicine
 - (c) bee keeping
 - (d) festivals
 - (e) biofertilisers and biopesticide (*Penathalai*)
- Preparation of herbarium for medicinal plants
- Seed exchange programme among farmers in the area
- Herbarium collection competition to encourage interest in plants among the younger generation and other competitions for Kolli Hills children to develop interest in biodiversity conservation
- Identification and study of sacred groves.

Studies and chronicling

Plants used for green leaf manure: The foliage of the all pervading *unni* (*Lantana camara*) is used as green manure. It is a prickly straggler which is found growing wild. Once considered totally useless, its foliage is now used as the best green manure. Besides *Lantana*, the tribals also use the foliage of *Ageratum sp.*, *Glyricidia sp.*, *Dodonea viscosa* (*Virali*), and *Cipadessa baccifera* as green manure. A few years ago, one could not come across *Parthenium hysterophobus*, an obnoxious and poisonous weed. But now it has invaded Kolli Hills.

The plants found in Kolli Hills and their uses are described in Tables 2.1 to 2.3.

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Table 2.1 : *Important plants found in Kolli Hills*

Plants grown for flowers	Semparuthi	<i>Hibiscus rosa-sinensis</i>
	Tuluka samanthi	<i>Tagetes</i> sp.
	Kanakambaram	<i>Crossandra undulaefolia</i>
	Roja	<i>Rosa indica</i>
Plants grown for fruits	Maampazham	<i>Mangifera indica</i>
	Palapazham	<i>Artocarpus</i> sp.
	Koyyapazham	<i>Psidium guajava</i>
	Vazhaipazham	<i>Musa paradisiaca</i>
	Madhulampazham	<i>Punica granatum</i>
	Pappali	<i>Carica papaya</i>
	Orange	<i>Citrus</i> sp.
Plants grown for edible oil	Kaduku	<i>Brassica juncea</i>
	Aamanakku	<i>Ricinus communis</i>
Plants grown for vegetables	Parankikai	<i>Cucurbita maxima</i>
	Kaththarikai	<i>Solanum melongena</i>
	Vendaikai	<i>Hibiscus esculuntum</i>
Spices	Koththamalli	<i>Coriandrum sativum</i>
	Elakkai	<i>Elletaria cardamomum</i>
	Milaku	<i>Piper nigrum</i>
	Biriyani elai	<i>Cinnamomum zeylanicum</i>
	Kirambu	<i>Eugenia caryophyllata</i>
Fence plants	Kattukottai	<i>Gossypium</i> sp.
Minor wild fruits in the forest	Navappazham	<i>Syzigium jambolanum</i>
	Kilukkai	<i>Carissa carandus</i>
	Elanthappazham	<i>Zizyphus jujuba</i>
	Perunellikai	<i>Emblica officinalis</i>

Table 2.2 : *Ethnobotanical information (Malayali tribes, Kolli Hills)*

<i>Plumbago auriculata</i> Lam. Plumbaginaceae	It serves as a medicine for cattle. It is injurious to human skin.
<i>Cynoglossum</i> sp.	Local people call it <i>ottatai</i> . Leaves are chewed for relief from toothache.
Boraginaceae <i>Rubus cordifolia</i>	Bleeding gums are rubbed against the leaves of this plant Rubiaceae to get relief from pyorrhoea disease.
<i>Achyranthes aspera</i> Amaranthaceae	Leaves and seeds are crushed and taken in a piece of cloth and tied around the face to get rid of worms in the intestine.

Table 2.3 : *Plants used as greens*

Pulichcha keera (<i>Hibiscus</i> sp.)	Eenga keera
Nalla pulichchan	Seng keera (<i>Amaranthus</i> sp.)
Seppai (<i>Colocasia antiquorum</i>)	Kuppai keera (<i>Amaranthus viridis</i>)
Milaku thakkali or Manathakkali (<i>Solanum nigrum</i>)	Mullu keera (<i>Amaranthus spinosus</i>)
Kunni Keera	Koththamalli keera (<i>Coriandrum sativum</i>)
Poosani thaali - tender leaves (<i>Cucurbita maxima</i>)	Kuppai meni (<i>Acalypha indica</i>)
Panna keera (<i>Celocasia argentea</i>)	Selvanthai keera
Vallarai keera (<i>Centella asiatica</i>)	Thagaarai

Bees and Plants: Kolli Hills are famous for honey with a special flavour, taste and medicinal properties. *Thirumurugatrupadai*, an ancient Tamil hymn (c.200 AD) mentions the honey and *thinai* (Italian millet) from Kolli Hills, which were offered to the god Murugan in Palani. As the bee population is found to be decreasing and the wild bee varieties are on the verge of extinction, the Government of Tamil Nadu is encouraging the formation of Bee-keepers Cooperative Society, and giving bee boxes at subsidised rates. There is a need for finding alternative methods to produce honey and save the wild bees.

Our documentation of the traditional knowledge of the tribals reveals that the following plants and flowers are preferred by the bees in Kolli Hills: *Mula maratbu poovu*, *Koththamalli poovu*, *Kayalai poovu*, *Indu mullu poovu*, *Valichcha mara poovu* and *Paddy poovu*.

Festivals and Plants: The celebration of fes-

tivals is also part of the culture inherited from their ancestors. *Pongal* and *Adi 18 vizha* are important festivals for the Malayali tribals in Kolli Hills. During *Kappu kattu* the tribals use the following: *Poolappoo*, *Koppa malli poo*, *Vazhampul*, and *Maa elai*. During *Mattu Pongal* they use unripe plantain, *poosani*, and *motchai* (field bean) which they boil, add salt, coconut and banana and offer to the men who perform the dance (*Aandi kulaththan*). *Sarai konnai* plant is used for decoration during the celebrations.

Medicinal Plants: Plants which are used as medicine are listed in Table 2.4.

Sacred Groves

Sacred groves are a traditional way of in-situ conservation. The survey indicates that there are 15 sacred groves in Kolli Hills (only groves with more than 2 acres are considered) and they are roughly 300 - 400 years old.

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Table 2.4 : *Medicinal Plants of Kolli Hills**

Botanical name	Family	Local name	Plant part used	Uses
<i>Solanum torvum</i>	Solanaceae	<i>Sundai</i>	Fruits	Deworming
<i>Centella asiatica</i>	Umbelliferae	<i>Vallarai</i>	Leaves	Memory
<i>Cardiospermum halicacabum</i>	Sapindaceae	<i>Motakkathan</i>	Leaves	Greens; rheumatism
<i>Phyllanthus niruri</i>	Euphorbiaceae	<i>Keela nelli</i>	Whole plant	Jaundice
<i>Citrus medica</i>	Rutaceae	<i>Elumiccbai</i>	Fruits	Pickles; Vit. C
<i>Punica granatum</i>	Punicaceae	<i>Muthulai</i>	Fruits unripe	Dysentery
<i>Coccinea indica</i>	Cucurbitaceae	<i>Kovai</i>	Fruits	Edible
<i>Dodonaea viscosa</i>	Sapindaceae	<i>Vilari</i>	Leaf	Cures inflammation; Green manure
<i>Calotropis</i>	Aesclpidaceae	<i>Erukku</i>	Milky latex	Insect poison
<i>Cipadessa baccifera</i>	Meliaceae	<i>Pena Thalai</i>	Leaf Young leaf	Green manure Stomach pain
<i>Vitex negundo</i>	Verbenaceae	<i>Notcbchi</i>	Leaves	Boiled vapour cures headache, fever
<i>Bidens pilosa</i>	Asteraceae	<i>Otrancedi</i>	Leaf	Wounds
<i>Leucas aspera</i>	Labiatae	<i>Thumbai</i>	Leaf	Extract, headache
<i>Tridax procumbens</i>	Asteraceae	<i>Velluvai Thalai</i>	Leaf	Wounds
<i>Euphorbia hirta</i>	Euphorbiaceae	<i>Amman Pachcharici</i>	Creeper leaf	Cooling effect
<i>Achyranthes aspera</i>	Amaranthaceae	<i>Nayuruvi</i>	Leaf Root	Dog bite Whitens teeth
<i>Solanum anguivi</i>	Solanaceae	<i>Kandangkathibari</i>	Fruit	Tooth ache
<i>Ocimum sanctum</i>	Labiatae	<i>Thulasi</i>	Leaf	Cold
<i>Catharanthus roseus</i>	Apocynaceae	<i>Nithiyakalyani</i>	Flower	Appetite
<i>Hibiscus rosa-sinensis</i>	Malvaceae	<i>Semparuthi</i>	Flower	Heart
<i>Justicia betonica</i>	Acanthaceae	<i>Kurungu chedi</i>	Leaf	Ear pain
<i>Ficus hispida</i>	Moraceae	<i>Peiperukkan</i>	Leaf	Cattle umbilical cord
<i>Ricinus communis</i>	Euphorbiaceae	<i>Aamanakku</i>	Seed oil	Laxative
<i>Dolichos trilobus</i>	Fabaceae	<i>Kondarai</i>	Seed	Blood pressure
<i>Oxalis corniculata</i>	Oxalidaceae	<i>Siru pulichai</i>	Leaf	Body pain

* Specimens of all the listed species are available in the herbarium at the site office.

The study tried to understand whether there is any linkage between the groves and the agricultural system.

Sacred groves are surrounded by fields of intensive agriculture. They have been protected by the religious belief of the people. God, Goddess and forefather worship are found in these groves. In the grove, Ayyan pattan solai, animal structures (cattle and pig) are found. In Peruman Koil the deity is found under *Valanpillu* (a wild grass) roof.

The common plants found in the sacred groves are mostly used for fuel-wood, making agricultural implements etc. In Attaiattu solai (the word *attai* means leech and *aru* means river), *chambaka* trees are abundant.

Devakkanni is another tree commonly found in sacred groves and beehives are found in this tree. Sacred groves are abodes of insects and birds. In general, sacred groves are also treasure houses of micro-organisms. As sacred groves conservation enhances biodiversity, 3 informal groups have been constituted in Ayyan pattan solai in Padasolai, Pidari amman in Thenoor palli and Peruman koil in Oor puram colony. Some local taboos restrict the participation of women in these informal groups, though they are allowed inside the grove during festival times to cook and offer *Pongal* to the deity or forefather.

The groups are now interested in planting and rejuvenating the native species in the groves which is a refreshing change from their earlier intention of introducing cardamom, coffee and pepper.

Other activities related to revitalisation

- *Azospirillum* and Phospobacteria packets were distributed to the growers of minor millets to help them acquire familiarity with the use of biofertilisers.
- Traditional community seed storage systems (like *Kudhir* or *Thombai*) are being popularised.
- *Anai* and *Penai thalai* (the leaves of *Cipadessa baccifera*) which are now used as green leaf manure are also used to control pest attacks in the seed storage system. The farmers have been persuaded to plant more of them.
- Even though the focus is on minor millets, support was extended for the conservation of the black banana variety found in the sacred groves and in temple areas, which is found to be under threat of extinction.
- The minor millets growers are prepared to exchange seeds in the traditional way (barter system) by taking 1 kg this season and returning 2 kg of seeds after harvest. 57 farmers have joined this effort.
- An essay writing competition, drawing competition and herbarium collection competition were held at the Higher Secondary School in Semmedu in which 1,050 students participated. These students hail from the 14 Nadus of Kolli Hills.

Networking

Efforts are on to form a local network of stakeholders for conservation of biodiversity. Efforts have been made to contact and get

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Table 2.5 : *Biodiversity networking members*

Sangams	Government officials	Co-operative societies and bank
Tribal Welfare Association, Kolli Hills	District Forest Officer, Salem	Lamp (Tribal Welfare Co-operative Society) - M.D., Secretary
Farmers' Sangams	District Forest Officer, Attur	
Anthyodhaya New Life Trust	Forest Ranger, Kolli Hills 14 VAOs	Manager of the lead bank in the area, Bee-Keepers' Co-op Society, Milk Producers' Co-op Society.
Presidents and <i>oor gounders</i> of all the 14 panchayats in Kolli Hills	BDO	AGM of NABARD
Local School Headmasters	ADO, Kolli Hills	
Honorary Wild Life Warden, Namakkal and Salem districts	Horticulture Officer, Kolli Hills	
Trekkers' Club	AD (Agri.)	
Local Youth Club		
Apex Club		
Rotary Club	Veterinary Doctors	
Poultry Farmers' Association	Dean, Veterinary College, Namakkal	

the consent of the members of various *sangams*, NGOs, government officials, headmasters, panchayat presidents and *oor gounders*. The Biodiversity Networking members are from the groups listed in Table 2.5.

Trainers' Training Programme in Biodiversity Conservation

The 8th Trainers' Training Programme on Biodiversity Conservation was held at Sri Parama Kalyani Centre for Environmental Sciences, Alwarkurichi from 10-15 August '98. Thirty participants from 26 NGOs, selected mainly from three southern districts viz., Tuticorin, Thirunelveli, and Kanyakumari, participated in the programme. The main objective of the programme was to create an

awareness about the conservation and sustainable utilisation of biological resources among the local users, particularly local health traditions and medicinal plants. The following subjects were covered in the programmes:

- Biodiversity: needs for conservation, methods of conservation
- Siddha medicine systems
- Conservation and commercialisation
- People's Biodiversity Register
- Plant propagation techniques
- Kitchen gardening
- Traditional biodiversity conservation system
- Medicinal plants and communication techniques

- Farmers' rights and sharing benefits with the community
- Eco-development approaches and people's participation in forest management
- Agrobiodiversity conservation and organic farming
- Intensified ecological farming systems
- Traditional communication systems

Eminent professors and experts in the various fields handled the subjects. Group discussions were an integral part of the course, enabling the participants to describe their activities and discuss the methodologies of conducting grassroot level training programmes to promote biodiversity conservation.

Exposure trips were organised, including one to the Western Ghats (Sengaltheri, Papanasam and Sivasailam Forest areas). They interacted with the local people of Sivasailam village

where the ecorestoration project on Kalakkad Mundanthurai Reserve Forest is operated by the Forest Department with the participation of the local people as partners in managing and enhancing forest biodiversity.

As a sequel to this programme, 12 selected NGOs were identified to conduct Grass Root Level Training Programmes (GRLTP) on their own in their respective villages, dealing with local issues, to encourage the grassroot level NGOs to include and implement conservation activities in their own programmes. Table 2.6 provides the details of the training programmes.

As an outcome of the grassroot level training programmes a network has been formed at the district level to sustain the activities of the biodiversity conservation training programme at the field level. This Community Biodiversity Conservation Network

Table 2.6 : *Details of the grass root level training programmes*

Name of the organisation	Activity	No. of trainees
Arumbugal Trust, Thirunelveli	Cultural and Folk media	20 artists
LEADS, Sethaparpanallur	Organic farming	35 farmers
CARDS, Thirunelveli	- do -	20 CARDS members & 40 farmers
Rural Education for Development, Idayankudi	Cultural media	25 artists
ROAD, Marthandam	Medicinal plants conservation	30 farmers
Nature Care India, Varrickavillai	- do -	32 farmers
Academy of Sustainable Agriculture and Environment, Ariyapuram	Integrated Intensive Farming systems	35 farmers
SEDCO, Sattankulam	Medicinal plants conservation	35 farmers and Self-help groups
Nehru Yuva Kendra, Thirunelveli	Sacred groves restoration & conservation	20 NYK members
Annai Kasthuribai Mahalir Mandram, Kadayam	Kitchen garden	28 <i>mahalir mandram</i> members
CHORDS, Nazareth	Organic farming	35 farmers
RUSET, Nenmeni	Agroforestry	30 farmers

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(CBCN) is a cluster of (12) NGOs linked by their common interest in the various aspects of biodiversity.

The overall objective of the network is the conservation and management of biodiversity with the participation of local people and

Table 2.7 : *Tasks identified by the CBCN*

Name of the organisation	Activity	Target
Arumbugal Trust, Thirunelveli	Folk media group formation and chronicling	Using folk media - creating awareness on biodiversity conservation and preparation of PBR for 20 villages
Academy of Sustainable Agriculture & Environment, Ariyapuram	Documenting and analysing five models of Integrated Intensive Farming Systems	Demonstration of IIFS and training 25 farmers on organic intensive farming
Nehru Yuva Kendra, Thirunelveli	Sacred Groves restoration	Documentation of Sacred Groves in Thirunelveli and Tuticorin districts and restoration of four Sacred Groves
Annai Kasturibai Mahalir Mandram, Kadayam	Kitchen gardening	Training 20 Mahalir Mandrams and creating 10 sustainable kitchen gardens
ROAD, Marthandam	Sacred Groves and medicinal plants conservation	Documenting Sacred Groves in Kanya Kumari district and restoration of two groves with conservation of medicinal plants by forming medicinal plant conservation council
RED, Idayankudi	Palm tree related issues	Management and creating market linkages and preparation of Coastal Biodiversity Register for 20 villages
Nature Care India, Varrickavillai	Reforestation	Creating 1 sq.km green belt through afforestation programmes in 5 villages
SEDCO, Sattankulam	Palm tree and medicinal plants conservation	Market linkage and medicinal plants garden
CARDS, Thirunelveli	Organic agriculture	Demonstration and training on organic farming in 5 villages
RUSET, Nenmeni	Under-utilised crops reviving and management	Minor millets and pulses (6 crop species), reviving and creating market in 5 villages and agroforestry in 10 ha.
CHORDS, Nazareth	Documentation	Preparation of PBR for 20 villages
LEADS, Gandhinagar	Organic farming	Training in organic farming methods in 5 villages

NGOs for effective implementation at the field level. CBCN follows the wheel model – the co-ordination unit forms the hub of the wheel which is connected by the spokes of NGO partners, which are in turn linked to each other through a rim.

The participating organisations held four meetings to discuss the modalities for the successful operation of the network. They have identified activities and tasks for one year as seen in Table 2.7. They have also planned to have a monthly newsletter for the exchange of ideas.

201.2 Wayanad, Kerala

In June '99, the Community Agrobiodiversity Centre (CAbC) completed two years of service to the management of natural resources in Wayanad, a biodiversity “hot spot” region in the Western Ghats. The strategies include the four basic elements of biodiversity conservation: studying, chronicling, sustainable and equitable use and saving biodiversity. The three village panchayats of Kottathara, Meppady and Thariyode have been identified for implementing this strategy from a priority list of six such panchayats in the district. The special focus

this year has been on the study and chronicling of medicinal plant traditions of the local tribal and rural people.

The activities of the Centre are streamlined through two main channels : Biodiversity Conservation Campaign (BCC) and Research on Biodiversity Conservation (RBC). The BCC activities consist of organising communities, community empowerment and capacity building, while the RBC focuses on serious inquiry into the high value botanical resources and highly threatened botanical diversity of the district.

Research on biodiversity conservation

Green Health Campaign: A specially designed programme called Green Health Campaign (Table 2.8) was launched in the district to revitalise the primary health care traditions of the local people. Under this programme 10 important medicinal plants in the primary health care system have been identified and raised in a nursery. These plants have been given to a number of people, especially women and students, with information on their various uses. CAbC participated in a popular flower show of North Malabar, ex-

Table 2.8 : *Green Health Campaign: Activities*

Place	Date	No. of Participants/viewers	No. of plants Given to each participant	Species exhibited
Thariyode	24 October '98	102	-	30
Thariyode	10 December '98	40	10 Spp.	-
Meppady	6 January '99	30	6 Spp.	-
Thariyode	7-8 February '99	>4000	-	60
Kalpetta	22-26 January '99	>25000	-	250
Kottathara	26 February '99	65	-	25

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hibited more than 250 species of medicinal plants and won the first prize for the best stall.

Studies on medicinal plant diversity

Wayanad is a haven for both medicinal plants and traditional medicine men. A literature survey shows that nearly 300 species of medicinal plants are distributed in this part of the Western Ghats. The Centre has collected more than 100 such plants from various parts of the district and procured another 100 from different *ex-situ* collection centres in Kerala. These are being grown in

the farm of CABc designed for the preservation of important botanical diversity of this region. Special attention was given to the study of threatened medicinal plants and their exact distribution in the district. During the year 40 such species were collected (Table 2.9) and preserved in live or dry forms. The status of each species has been analysed by using IUCN guidelines for threat assessment. Five medicinal plant species – *Lobelia nicotianaefolia*, *Bridelia scandens*, *Salacia reticulata*, *Embelia ribes*, and *Chonemorpha fragrans* – have been identified for detailed biochemical screening.

Table 2.9 : *Threatened medicinal plants collected during the year*

Name	Place of collection	Status	Remarks (plants available in/as)
<i>Adenia bondala</i>	Madakki forest, Kottathara	Vu/R	H
<i>Adhatoda beddomei</i>	AVS, Kottakkal	CR/G	LP
<i>Aphanamixis polystachya</i>	Chembara foothills	Vu/R	H
<i>Arenga wightii</i>	Wayanad Ghat	Vu/R	LS
<i>Aristolochia tagala</i>	Various evergreen forests	EN/R	LP, H
<i>Artocarpus hirsutus</i>	Madakki forest	Vu/G	LS
<i>Baliospermum solanifolium</i>	AVS Kottakkal	EN/R	LP, H
<i>Caesalpinia crista</i>	Chembara foothills	EN/R	LP, H
<i>Calophyllum apetalum</i>	Brahmagiri hills	Vu/G	
<i>Canarium strictum</i>	Madakki forest	Vu/R	LP
<i>Celastrus paniculatus</i>	Sugandhagiri hills	Vu/R	H
<i>Chonemorpha fragrans</i>	CABc Farm	EN/R	LP, H
<i>Cosciniium fenestratum</i>	Chooral mala, Meppady	CR/G	
<i>Drosera indica</i>	Manikunnu mala, Puthoorvayal	LR-NT/R	H
<i>Drosera peltata</i>	Manikunnu mala, Puthoorvayal	EN/R	H

Table 2.9 Contd....

<i>Embelia ribes</i>	Wayanad Ghat	Vu/R	H
<i>Geophila repens</i>	Sugandhagiri hills	EN/R	LP
<i>Gloriosa superba</i>	Meppady, Puthoorvayal	LR-NT/R	H
<i>Glycosmis macrocarpa</i>	Chooral mala, Meppady	LR-NT/G	H
<i>Knema attenuata</i>	Madakki forest, Kottathara	EN/R	H
<i>Memecylon malabaricum</i>	Pallikunnu, Kottathara	Vu/R	LP, H
<i>Michelia champaca</i>	Madakki forest, Kottathara	Vu/R	LP, H
<i>Myristica dactyloides</i>	Madakki forest, Kottathara	EN/R	H
<i>Myristica malabarica</i>	Madakki forest, Kottathara	EN/G	LS
<i>Nervilia aragoana</i>	Manikunnu mala, Puthoorvayal	EN/R	LS
<i>Niligirianthus ciliatus</i>	Sugandhagiri hills	EN/G	LP, H
<i>Nothopodytes nimmonia</i>	Various forests	Vu/R	LP, H
<i>Persea micrantha</i>	Various places	EN/R	LP, H
<i>Phryinium capitatum</i>	Wayanad Ghat	CR/G	LS
<i>Piper hymenophyllum</i>	Sugandhagiri hills	Vu/R	H
<i>Pseudarthria viscida</i>	Manikunnu mala, Puthoorvayal	Vu/R	LP, H
<i>Rhabdophora pertusa</i>	Madakki forest, Kottathara	LR-NT/R	LP, H
<i>Salacia reticulata</i>	Palukappu swamp, Kottathara	CR/G	H
<i>Selaginella lycopodioides</i>	Sugandhagiri hills	EN/R	LP, H
<i>Sida beddomei</i>	Pallikunnu, Kottathara	CR/G	H
<i>Smilax zeylanica</i>	Madakki forest, Kottathara	LR-NT/R	LP, H
<i>Syzygium travancoricum</i>	Palukappu swamp, Kottathara	EN/G	LP, H
<i>Tragia muelleriana</i>	Madakki forest, Kottathara	EN/G	H
<i>Trichosanthes nervifolia</i>	Madakki forest, Kottathara	EN/G	LP, H
<i>Tylophora tenuiflora</i>	Palukappu swamp, Kottathara	EN/R	H

CR/G= Critically endangered globally; EN/G= Endangered globally; EN/R= Endangered regionally; Vu/G= Vulnerable globally; Vu/R= Vulnerable regionally; LR-NT/G= Low Risk - Near threatened globally; LR-NT/R = Near threatened regionally; LP= Live Plant; H=Herbarium; LS= Live Seed

Studies on medicinal and wild edible macro fungi

Certain macro-fungi, especially mushrooms, are excellent sources of many important vitamins and rich in proteins and amino acids that are required for human beings. The soil

of Wayanad, particularly of the forest areas, is very suitable for the growth of a very diverse range of fungi. However, studies are inadequate in the various aspects of this plant group. CABIC is conducting surveys in different parts of the district to collect fungi for the study. During the year specimens of

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various macro-fungi were collected (Table 2.10) of which 19 have been identified at family level, 7 at genus level and 6 at species level. The Centre has domesticated three species of *Pleurotus* collected from the wilderness of Wayanad. Apart from this the Centre has procured culture collections of 4 species of *Pleurotus* and one species of *Calocybe* from Agricultural University, Vellayani and TBGRI, Thiruvananthapuram. A small museum has been established with about 50 wet collections. An interesting hypogean fungus usually associated with old termite nests under the soil which is locally

called *Nila Manga* as it resembles a mango fruit, was collected. The identity of this taxon is still not confirmed even at genus level though it has been referred to the experts on fungi in India. This taxon has many uses in the traditional medicine system such as the treatment of jaundice, dehydration due to diarrhoea, severe stomachache, and ear pain. The pharmacological uses warrant a detailed investigation into its utilisation. Attempts at bioprospecting of this medicinal plant have been initiated in order to evaluate the traditional knowledge associated with it and its widespread usage.

Table 2.10 : *Fungi collected during the year*

Name	Collection site	Nature of preservation	Usage/remarks
<i>Agaricus campestris</i>	Kottathara	Wet	Wild/edible
<i>Termitomyces</i> sp.	Kottathara	Wet	Wild/edible
<i>Pleurotus flabellatus</i>	Kainatty	Wet	Wild/edible
<i>Pleurotus eous</i>	Way to Kuruva Isls.	Culture	Wild/edible. Domesticated
<i>Pleurotus</i> sp.1	"	Culture	Wild/edible
<i>Pleurotus</i> sp.2	"	Culture	Wild/edible
<i>Pleurotus djamar</i>	Agri.College	Culture	Edible
<i>Pleurotus ostreatus</i>	"	Culture	Edible
<i>Pleurotus</i> sp.3	"	Culture	Edible
<i>Citrinopileatus</i>	TBGRI	Culture	Edible
<i>Calocybe</i> sp.	Agri. College	Culture	Edible
<i>Amanita</i> sp.	Puthoorvayal	Wet and dry	Poisonous
<i>Ganoderma</i> sp.	Kottathara	Dry	Medicinal
<i>Nilamanga</i>	Kottathara, Meenangadi Vythiri, Kasaragode	Dry	Medicinal. Efforts are being taken to culture it.
<i>Polyporus discolor</i>	Manandavady	Dry	Inedible
<i>Polyporus</i> sp. 2 to <i>P.</i> sp.13	Various parts of Wayanad	Dry and Wet	Inedible
<i>Lycoperdon</i> sp.	Kuruva Isls.	Wet	Edible
<i>Cyathis</i> sp.	Kunjuvum Forest	Wet	Inedible

Survey on little known ("lost") crops of Wayanad

Till the introduction of cash crops like coffee, tea, rubber, areca and now banana the crop diversity of Wayanad was rich and unique. The studies at Kottathara village show that people know about 124 tree species, >100 medicinal plants, 43 varieties of paddy, 6 varieties of millets, 22 types of leafy vegetables, 15 types of legumes, 6 types of cucurbits, 13 types of *Dioscorea*, 12 tarrows, 4 yams, 12 different ants, 2 types of termites, 25 mammals, 7 butterflies, 8 mushrooms, 47

fish varieties and several other unknown plants and animals. Unfortunately, many of these varieties are completely lost or existing in very restricted fields as seen from Table 2.11. While coffee and tea are responsible for the disappearance of millets and a unique type of hill paddy called *karuthan*, areca and banana are to blame for the dwindling of paddy fields and the vanishing of many landraces. Table 2.12 lists the varieties of rice known in Wayanad. The heavy application of chemical fertilisers and pesticides has virtually killed the fertile and productive soil of Wayanad.

Table 2.11 : *Plant varieties lost in Kottathara village*

Name of Crops	Number of Cvr/s/Sp. known 20-30 yrs ago	Number of Cvr.s. known at present	% of loss
Paddy	43	6	86
Millets	4	0	100
Leafy vegetables	22	10	54
Legumes	15	5	67
Dioscorea	13	4	69
Yams	4	2	50
Taros	12	4	67
Banana	10	6	40
Fruit trees	15	8	47
Bamboos & reeds	8	4	50
Medicinal plants	>100	70+	30
Liana/climbers	10	6	40

Biodiversity Conservation Campaign: Conservation of biological diversity, particularly agrobiodiversity, consists of five activities, namely:

1. Organising village communities in conservation
2. Community empowerment & capacity building
3. Mushroom cultivation for the economic benefit of ST/SC families
4. Saving paddy cultivation
5. Conservation corps for saving agrobiodiversity

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Table 2.12 : *Traditional varieties of rice in Wayanad*

1. Anakomban	38. Manjuvari
2. Aryan	39. Mannadan
3. Aryankali	40. Mannu veliyan*
4. Athiyan	41. Marathondi
5. Bhoothakali	42. Mullan munda
6. Chembavu	43. Mullan puncha
7. Chempathy*	44. Mundakan*
8. Chendadi	45. Njavara*
9. Chennellu*	46. Onavattan*
10. Cheriya aryan	47. Ongan puncha
11. Cheriya kaima	48. Padu kuliyan
12. Cheru vellari	49. Pal veliyan
13. Chettu veliyan*	50. Pala chemban
14. Chitteni	51. Palliyattu
15. Chomala*	52. Palthondi
16. Chunna modan	53. Parambu vattan
17. Gandhaka sala*	54. Peru vazha
18. Jeeraka sala*	55. Ponnari mala
19. Kaima*	56. Ponnariyan
20. Kakka thondi	57. Poothadi kaima
21. Kalladiyaran*	58. Poothala
22. Kalluruthi	59. Puncha
23. Kanni Chennellu	60. Thaichoonal
24. Kara vala	61. Thavala kannan
25. Kariyam kari	62. Thekken cheera*
26. Karum kaima	63. Thondi*
27. Karuthan	64. Thonnuran thondi*
28. Katta modan	65. Uruni kaima
29. Kochu ooty	66. Valia kaima
30. Kochu vithu	67. Valichoori
31. Kodagu veliyan	68. Vattan
32. Koiyan	69. Veliyan*
33. Kothandan	70. Vellari
34. Kozhi vala	71. Velumbala
35. Kumbalan	72. Villi
36. Kuttadan	73. Wayanadan thondi
37. Kutti veliyan	

* varieties collected during the year

Organising village communities in conservation: The first task was to create a favourable political atmosphere to implement the programme. CABc appealed to the local Gram Panchayat leaders to assemble, protect and manage their natural resources. As a result of this and the constant encouragement from the Centre they have set up a body called the Community Biodiversity Conservation Committee (CBCC) in their panchayats. In each site the Gram Panchayat president is the chairman of the committee. A number of awareness programmes in the form of discussions and seminars on the importance and value of natural resources have been held. The people are realising the need for studying their biological resources and chronicling the knowledge and insights of elders. The CBCC is now coordinating the efforts of villagers in the preparation of a Biodiversity Register of their villages.

Community empowerment and capacity building: Local biodiversity conservation will succeed only when the communities start deriv-

ing tangible benefits from utilising the biotic resources. Towards this direction CABc has taken efforts to empower the communities by adopting new strategies and skills in resource management. For example, steps are being taken to set up medicinal plant cultivation by involving tribal men and women. Arrangements are being made to link the cultivators with Desiya Ayurveda Pharmacy, a leading pharmaceutical company in Kerala. CABc trained women in Thariyode panchayat in medicine preparation for minor ailments. The rice farmers of the area are encouraged to cultivate a highly profitable and medicinally important rice variety called *Njavara* under the Participatory Plant Breeding Programme (more details in SPA 202), and women are encouraged to take up cultivation of native vegetables.

Mushroom cultivation for the economic benefit of ST/SC families

This is a project started during the year for large scale cultivation of mushrooms by involving the poorest people from tribal

Table 2.13 : Training & awareness programmes of the mushroom project

Target group	Duration	Number of participants
Tribal & rural women & men	6 days	15
Tribal women & men	4 days	12
Rural women	4 days	10
Tribal women & men	7 days	12
Tribal women & men	7 days	12
Tribal women & men	4 days	12
NGOs	2 hrs	30
Tribal women	2 hrs	50
Rural women	2 hrs	65
Students	3 hrs	120

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and rural families. They have formed a society called Mushroom Growers of Wayanad with 36 members in three units and produce 5 kg of mushrooms every day. A well-equipped spawn production unit has been established at the Centre under this project. Several training programmes and awareness classes (Table 2.13) were arranged for various groups of men and women in mushroom cultivation techniques and on fungal diversity.

Saving paddy cultivation : Wayanad, once the *nadu* (land) of *Vayal* (paddy field) endowed with many landraces of rice, is experiencing a depletion of paddy fields. A high rate of genetic erosion in the existing varieties is taking place owing to many reasons. Attempts are being made to organise the rice farmers of the villages for conserving both the traditional farming methods and varieties of paddy cultivars. It has been reported that there were 73 varieties of paddy grown in Wayanad. Our investigation shows that only 18 varieties are left in the field but even they are under severe stress for their existence. Efforts are on for a joint venture of farmers and scientists to conserve the varieties left.

Conservation corps for saving agrobiodiversity

People will appreciate diversity more when they are able to distinguish each taxon and understand the pattern of its distribution in their areas. CABc has trained a few youths from Kottathara and Thariyode panchayats to serve as conservation corps in identifying

major biodiversity, largely the agrobiodiversity, in particular the plant groups of their area and in spreading the message of conservation and sustainable and equitable development. Several field trips were conducted to various corners of the selected villages. The corps of Kottathara village has formed a group under the name *Vayal* (which is the local name for a paddy field) to protect the environment and resources of their village. They have established a small library with the help of CABc to disseminate information on biodiversity. They have collected several important plant species to enrich the small community herbarium established at the Centre. Now the herbarium holds a collection of 500 specimens belonging to 250 taxa.

Saving endangered plant species

This ongoing programme is focused on saving the endangered plant species of the Western Ghats from the fate of early extinction. Wayanad, gifted with diverse flora, is facing a serious threat to its diversity owing to multifarious man-made activities. CABc has initiated the preparation of a checklist of threatened plants of the district as well as of Kerala flora. The list shows that 160 higher plants are threatened in the State and about 90 such species in Wayanad. During the year, five of these species: *Capparis rheedii*, *Ceropegia elegans*, *Humboldtia brunonis*, *Salacia beddomei* and *Sonerila waynadensis* were collected. Apart from this, several threatened medicinal plants have also been collected under the Medicinal Plant Programme.

201.3 Orissa

Three tribal districts of Orissa namely Kalahandi, Bolangir and Baragarh were selected for documentation of traditional knowledge of useful plants, including medicinal plants and crop diversity, from the tribal areas of these districts. Market linking was also studied for agricultural and forest produce.

Kalahandi district

Four blocks, namely Thuamul-Rampur, Madanpur-Rampur, Lanjigarh and Bhawanipatna, out of 13 blocks were covered for this study. The tribal communities inhabiting these blocks are the *Kandha*, *Ganda*, *Kutia Kandha*, *Desia Kandha*, *Bhunja*, *Paroja*, *Munda*, *Mirdha* and *Shabar*. During this study, 51 villages were covered, 23 Traditional Healthcare Practitioners (THP) were contacted, and a total of 300 data sheets

were filled. Herbarium specimens (106) were prepared. In addition, information on 16 traditional cultivars of rice, 5 cultivars of millets and 5 cultivars of pulses was also collected.

The team visited two medicinal gardens, one at Jakam and the other at Thuamul, and collected information on 204 medicinal plants maintained by the forest department. The team also surveyed a sacred grove i.e. Rapang Devi sacred grove and recorded 27 species of trees, 3 species of shrubs, 12 species of herbs, 11 of creepers, 3 of grasses and 9 species of different animals. The plants found in the district and their uses are listed in Tables 2.14 - 2.19.

It is obvious that oilseeds like niger and mustard are their cash crops and kendu leaf, mahua flower, *mahua* seed, *sal* seed are forest produce collected and sold for ready cash.

Table 2.14 : *Major produce sold by the households*

Niger	Mustard	Kendu leaf	Black gram
Rice bean	Cowpea	Maize	Mahua flower
Sal seed	Ragi	Sesamum	Brinjal
Tomato	Bajra	Foxtail millet	Horsegram Cotton
Siali	Arhar	Rice	Radish
Mahua seed			

Table 2.15 : *Plants used for animal diseases*

Local name	Botanical name	Family	Parts used	Diseases
Dumakanda	<i>Cissus repens</i>	Vitaceae	Tuber	Ulcer on leg
Gohiria	<i>Acacia ferruginea</i>	Mimosaceae	Bark	Lice
Pokasunga	<i>Ageratum conyzoides</i>	Asteraceae	Leaf	Lice
Tangena	<i>Xylia xylocarpa</i>	Mimosaceae	Bark	Foot and mouth diseases
Salaparni	<i>Desmodium gangeticum</i>	Fabaceae	Root	Tick and lice
Bheru	<i>Chloroxylon swietiana</i>	Rutaceae	Bark	Lice

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Table 2.16 : *Plants used as pesticides and insect repellent*

Local name	Botanical name	Family	Parts used
Karla	<i>Cleistanthus collinus</i>	Euphorbiaceae	Twig
Bheru	<i>Chloroxylon swietiana</i>	Rutaceae	Twig
Salapa	<i>Caryota urens</i>	Arecaceae	Leaf
Badel	<i>Annona squamosa</i>	Annonaceae	Leaf
Nirgundi	<i>Vitex negundo</i>	Verbenaceae	Leaf

Table 2.17 : *Plants used as fish poison*

Local name	Botanical name	Family	Parts used
Ganda	<i>Glochidion lanceolarium</i>	Euphorbiaceae	Bark
Hinjala	<i>Barringtonia acutangula</i>	Barringtoniaceae	Root
Patua	<i>Catunaregam spinosa</i>	Rubiaceae	Fruit
Kumbhi	<i>Careya arborea</i>	Barringtoniaceae	Root

Table 2.18 : *Fibre-yielding wild plants*

Local name	Botanical name	Family
Athia	<i>Sida rhombifolia</i>	Malvaceae
Bareng	<i>Kydia calycina</i>	Malvaceae
Dhaman	<i>Grewia tiliifolia</i>	Tiliaceae
Bansula	<i>Grewia sapida</i>	Tiliaceae
Gindul	<i>Sterculia urens</i>	Sterculiaceae
Luhamala	<i>Ventilago madraspatana</i>	Loranthaceae
Atandi	<i>Combretum roxburghii</i>	Combretaceae

Table 2.19 : *Minor forest produce that are sold in the weekly market by the tribals in Kalabandi District*

Local name/ English name	Botanical name	Parts sold	Used as	Market price/ unit (Feb. 99)
Honey	-	-	Edible	Rs. 75.00/kg
Anla	<i>Phyllanthus emblica</i>	Fruit	Medicine/Pickle	Rs. 5.00/kg
Baunsa	<i>Bambusa vulgaris</i>	Tender tip	Edible	Rs. 12.50/kg
Chatu	<i>Fungi spp.</i>	Whole plant	Edible	Per piece 50 p
Kendu	<i>Diospyros melanoxylon</i>	Ripe fruit	Edible	Per fruit 40 p
Char	<i>Buchanania lanzan</i>	Ripe fruit	Edible	Rs. 50.00/kg
Chitaparu	<i>Plumbago indica</i>	Root	Medicine	Rs. 50.00/kg

Table 2.19 Contd...

Patal garuda	<i>Rauwolfia serpentina</i>	Root	Medicine	Rs. 1,000.00/kg
Sala	<i>Shorea robusta</i>	Latex	Resin	Rs. 22.00/kg
Siali	<i>Baubinia vahlii</i>	Bark	Rope	Rs. 1.00 (15 feet)
Gandhiri	<i>Ageratum conyzoides</i>	Seed	Medicine	Rs. 9.00/kg
Badum	<i>Aristida setacea</i>	Whole plant (except root)	Broom	Rs. 2.00 (1 bundle)
Phulbadun	<i>Thysanolaena maxima</i>	Inflorescence	Broom	Rs. 3.50 (1 bundle)
Tentuli	<i>Tamarindus indica</i>	Mesocarp	Pickle	Rs. 5.00/kg

Gandhamardan Hills

Located in the western part of Orissa, Gandhamardan mountain ranges are a rich source of diversity for medicinal plants. Botanical Survey of India reported the existence of 220 plant species of medicinal value here. But local people (*vaidyas*) claim that there are more than 500 species of plants having medicinal value in this area.

The Gandhamardan ecosystem is now on the brink of disaster. The flora of the buffer zone is most vulnerable. Many medicinal plant species such as *Clerodendron indicum*, *Rauwolfia serpentina* and *Plumbago zeylanica*, which were once available in plenty, are becoming scarce. Till now no systematic research or action plan has been drawn up to conserve this precious ecosystem. The erosion of this natural resource base can be attributed to the following reasons:

- Unauthorised felling of timber species
- Over-exploitation of forest plants and of bamboo by forest-based industries
- Indiscriminate exploitation of forest for fuel-wood, young bamboo shoots, etc.

- Faulty method of harvesting of medicinal plants (such as harvesting before seed setting, uprooting entire plants) by local healthcare practitioners.

More than one hundred traditional healthcare practitioners are residing near Gandhamardan Hills. These tribal healthcare practitioners provide medical facilities to about 50,000 tribal people residing around Gandhamardan Hills. They have preserved a very rich heritage of information on medicinal plants and their usage. Valuable information for pharmaceutical research can be gathered if documentation of such information is done scientifically.

Unfortunately, this information has not been documented systematically and comprehensively. It is feared that after a period of thirty years or so, this knowledge and information will be lost to mankind. Besides, many valuable medicinal species, which exist in the Gandhamardan Hills and have high market demand at the national and international level, can fetch a substantial income to the tribals residing here if propagated on a mass scale in the wasteland available near Gandhamardan.

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An attempt was, therefore, made to document the traditional knowledge on medicinal plants acquired by healthcare practitioners and to chalk out an action plan for mass scale propagation of these important medicinal species.

During this survey, documentation work was done by interacting personally with individual traditional healthcare practitioners and by

visiting the hill sites for collection of plant specimens and their identification. A total of 600 information sheets of about 150 different medicinal plants were filled-in. Besides, the team interacted with the local Forest Department, Agriculture Department, Ayurvedic College and some tribal women of the area. Table 2.20 gives a list of medicinal species with high market demand.

Table 2.20 : *Medicinal species with high market value*

Scientific name	Local name	Family
<i>Aerva sanguinolenta</i>	Chauladhua	Amaranthaceae
<i>Ailanthus excelsa</i>	Mahaneem	Simaroubaceae
<i>Andrographis paniculata</i>	Chiraita	Acanthaceae
<i>Argyreia nervosa</i>	Brudhadarak	Convolvulaceae
<i>Asparagus racemosus</i>	Satabari	Liliaceae
<i>Chlorophytom arundinaceum</i>	Sufed musli	Liliaceae
<i>Curculigo orchioides</i>	Talamuli	Hypoxidaceae
<i>Diplocyclos palmatus</i>	Sibalingi	Cucurbitaceae
<i>Eclipta prostrata</i>	Bhringraj	Asteraceae
<i>Emblica officinalis</i>	Anla	Euphorbiaceae
<i>Euphorbia fusiformis</i>	Khirkanchan	Euphorbiaceae
<i>Gymnema sylvestre</i>	Gudmari	Asclepiadaceae
<i>Holarrhena pubescens</i>	Indrajaba	Apocynaceae
<i>Mucuna pruriens</i>	Kaincha	Fabaceae
<i>Plumbago indica</i>	Rakta chintamul	Plumbaginaceae
<i>Pterospermum canescens</i>	Muchukunda	Sterculiaceae
<i>Rauvolfia serpentina</i>	Patalagaruda	Apocynaceae
<i>Terminalia bellirica</i>	Bahada	Combretaceae
<i>Terminalia chebula</i>	Harida	Combretaceae
<i>Tinospora cordifolia</i>	Gulci	Menispermaceae

Sub Programme Area 202

**Participatory Plant Breeding :
Path to Utilisation of
Biodiversity**

Initiated in June '98, this programme has the following major objectives:

- Evaluation of the options at chosen sites in consultation with local communities for enhancing the potential of major crops
- Designing PPB programmes to optimise available options
- Participatory piloting of programmes to convert dormant genetic wealth into dynamic products of profitable livelihood.

The Project, currently at the mobilisation phase, has availed of the avenue of Participatory Rural Appraisal (PRA). To increase the efficiency of the project, an inter-disciplinary participation was envisaged. The ongoing work of MSSRF (SPA 201 in this report) on areas bordering the broad objectives of the SDC project led to a choice of three target sites with tribal farmers needing the benefits of participatory livelihood improvement. They are: Jeypore tract of Orissa, a primary centre of origin of rice; Wayanad district of Kerala, rich in spices and medicinal plants; and Kolli Hills of Tamil Nadu, known for a variety of small millets of high nutritive value. On the basis of PRA, rice was chosen for Jeypore, medicinal rice (locally called *njavara*) for Wayanad and little millet, *samai* (*Panicum sumatrense*) for Kolli Hills.

202.1 Jeypore

The project was started in June '98. 18 farmers willing to work with scientists on a participatory plane were selected. They belong to 13 villages with a range of agroclimatic diversity (districts) and land types (upland, medium land and low land), situated in a range of 6 to 115 km from Jeypore town (Table 2.21). Land areas situated about 900 m above sea level were classified as upland, those about 600 m as medium land and those in the flat plains as lowland.

Four farmers did not continue participation, leaving 14 farmers. A comprehensive profile of the farmers, including their cultivation practices, selection skill and economics of cultivation, was felt to be essential. The data was gathered on a pre-designed proforma, examined critically and the benefit-cost ratio (BCR) of cultivation calculated. Considering locations (districts) and land types (upland, medium land and lowland) as factors, the variation in three variables, BCR, yield/ha and TLG, the time lag (days) in sowing (direct seeding or transplanting as appropriate) from 14 June '98, the observed optimal sowing date for the area, was analysed on a two-factor design. The results have brought to light factors that strongly favour PPB.

- The 14 farm households had a range of 0 to 3 female and 1 to 4 male members approximating an overall female:male ratio=1:2. All the farmers, except four, were full time rice cultivators
- While rice is the primary crop, 50% of the farmers grew finger millet (also known as

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Table 2.21 : *Details of villages from which rice farmers were chosen for PPB in Jeypore tract*

District	Block	Upland	Medium land	Low land
Koraput	Jeypore Code	Balia (6) 1: K/UL/01	Okilaguda (8) 3: K/ML/01	Bhaluguda (43) 5: K/LL/01
	Boipariguda Code	Kolar (39) 2: K/UL/02	Bhaluguda (43) 4: K/ML/02	Pujariput (21) 6: K/LL/02
Malkangiri	Khairput Code	Khemaguru (60) * M/UL/01	—	—
	Mathili Code	—	Uduliguda (63) * M/ML/01	Sindhabela (67) 7: M/LL/01
	Malkangiri Code	Batapalli (115) * M/UL/02	Teakguda (116) * M/ML/02	Batapalli (115) 8: M/LL/02
Nabarangpur	Nabarangpur Code	Badakumuli (62) 9: N/UL/01	Mentry (65) 11: N/ML/01	Mentry (65) 13: N/LL/01
	Nandahandi Code	Mentry (65) 10: N/UL/02	Badakumuli (62) 12: N/ML/02	Hatibeda (60) 14: N/LL/02

Figures in parenthesis are the distances of villages in km from Jeypore;

* Dropped out of PPB mid-way; Code: Sl. No. and identity of farmer

ragi, *Eleusine coracana*), in addition; the other crops grown included horsegram, sugarcane, vegetables and pigeon pea

- There was a good variation of about a month in land preparation and transplanting or direct seeding of rice among the farmers. Four of them grew the crop in upland, 4 in medium land and 6 in low land conditions (Table 2.21). The variation in planting time was due to variation in the onset of monsoon, as rice is grown as a purely rainfed crop in these areas. However, the benefit of early sowing was reflected in high yield (22 q/ha) obtained even without fertiliser application by an upland farmer (Code No. 9, Table 2.21) in Nabarangpur. In contrast, another from Koraput (Code No. 1, Table 2.21), who planted the crop in late August could realise a yield of only 13 q/ha despite application of fertilisers. Such differences were common in the target areas
- Labour employed for rice cultivation varied across farms, the brunt of the field operations being borne by women than by men (the ratio being approximately 2:1). In particular, the contribution of women was substantial in field operations such as land preparation, sowing, thinning, irrigation, weeding and fertiliser application (Table 2.22)

Table 2.22 : *Distribution of farm labour for rice cultivation at Jeypore*

	A1		A2		A3		Total		Total
	F	M	F	M	F	M	F	M	
Range	7 - 53	11 - 35	8 - 40	0 - 9	8 - 17	4 - 28	30 - 99	15 - 60	45 - 140
Mean	34	19	19	3	12	11	65	34	99

A1: Land preparation, Sowing , Thinning etc. ; A2 : Irrigation , Weeding, Fert/Pesticides appln;
A3 : Harvesting, Threshing etc.; F : Female; M : Male

- Farmers were found to possess special selection skills particularly for tiller density and panicle length with seed density, followed by tillering vigour and disease resistance. When asked for the traits they would prefer in rice, they identified productivity, cooking quality, plant stand and plant height in that order.
- Wide variation was observed among farmers in the pattern of retention and sale of produce. Overall, 39% of the yield was retained for self-consumption, 9% as seed and 38% sold as grain in the open market.
- Likewise, the economics of rice cultivation varied across farmers. For instance, yield varied from 3.49 to 30.89 q/ha and benefit-cost ratio (BCR) from 0.26 to 4.44 (Table 2.23). The farmers invested in inputs and labour in proportion to the area. But the correlation between area and BCR showed a bimodal pattern. Farmers (Code Nos. 1,2,3,5,12) who had an area of 7 ha and above recorded a BCR positively associated with area (r , the correlation coefficient between area and BCR = 0.87, significant at 5% level). The r -value for farmers who had an area less than 6 ha (Code Nos. 4,6,7,8,9,10,11,13,14) was significantly negative ($r = -0.69$). In other words, small farmers (i.e. those having an area up to 6 ha) realised a better return than those with relatively large area in this sample of 14 farmers. The results implied that small farmers have spent the available resources optimally and tended their crop with care and concern to obtain substantial benefits. Large farmers have invested in inputs and management proportionate to the area to reap proportionate benefits.
- The observations, restricted by the small sample, were independent of upland, medium land or low land on which the crop was grown. Farmers, in general, grew only that variety of rice which was adapted to their area and locally popular. Such varieties were productive and responded to the traditional cultivation practices adopted in their area. Therefore variety variation was assumed to be too minimal to vitiate conclusions drawn.
- The analysis of variance in BCR, yield/ha and TLG indicated that location differences were predominant followed by land type

Table 2.23 : *Benefit-cost ratio of rice cultivation by Jeypore farmers*

Sr. No.	Area (ha)	Y/ha (kg)	LABR	FERT	OVHD	COST	RETN	B:C
1	10.12	13.34	67.88	26.80	6.15	100.83	67.50	0.67
2	6.88	3.49	45.14	0.01	0.30	45.45	12.00	0.26
3	20.23	21.00	95.40	28.57	3.29	127.25	212.50	1.67
4	5.26	3.59	30.23	0.19	0.54	30.96	9.45	0.31
5	8.09	14.18	52.08	3.10	0.98	56.16	57.40	1.02
6	4.05	28.02	24.56	1.86	1.48	27.90	56.70	2.03
7	2.43	20.59	15.05	4.92	1.97	21.94	25.00	1.14
8	4.05	30.89	28.85	8.60	3.90	41.35	62.50	1.51
9	2.02	22.24	4.65	0.22	0.20	5.07	22.50	4.44
10	2.83	25.42	12.48	0.00	1.85	14.33	36.00	2.51
11	5.26	11.88	32.18	0.10	0.30	32.58	31.25	0.96
12	8.09	16.06	52.90	19.78	8.78	81.46	65.00	0.80
13	3.64	5.15	21.20	0.00	0.00	21.20	9.38	0.44
14	3.24	23.72	14.64	0.25	0.72	15.61	38.40	2.46
Mean	6.16	16.37	35.52	6.74	2.18	44.44	50.40	1.13

Y/ha: Yield per hectare; LABR: Labour; FERT: Fertiliser; OVHD: Overhead; COST: Total cost; RETN: Total Return; B:C Benefit-Cost Ratio

differences and location X land type interaction, in general (Table 2.24). But, the variation in TLG was accounted for by significant differences in land types, as would be expected (particularly since the initial date of monsoon onset varied).

- However, the overall coefficient of variation was lowest for yield/ha and highest for TLG, benefit-cost ratio falling in between (Table 2.24). An overview of the results confirms that the sample (of 14 farmers) was representative of the land types and locations surveyed in Jeypore tract.

A visit to the farmers' one month-old rice crop reflected a wide variation in crop man-

agement. In most fields, direct broadcasting of seeds resulted in uneven clusters of germinated seedlings, poor land preparation led to germination of plants in clods disconnected with soil and overcrowding of plants led to early yellowing. In contrast, two progressive farmers (Code Nos. 7 and 8 Table 2.21) could raise excellent transplanted crop.

- A priority participatory intervention would then be to train farmers in adopting optimal cultural practices to establish a healthy crop growth.
- PPB programmes should enable participatory dialogues and idea generation among farmers. Mutual visits would help farmers

Table 2.24 : ANOVA of some parameters of rice cultivation in Jeypore

Source	Degrees of freedom	Benefit-Cost Ratio	Yield/ha (q)	@Time lag in sowing (days)
(————— Mean sum of squares —————)				
Location (LOC)	2	1.35	104.96	77.10
Land type (LAN)	2	1.07	66.56	642.01*
LOC X LAN	4	1.60	39.92	140.16
Residual	5	1.00	106.86	103.90
Total	13	1.29	79.83	193.72
Range		0.31 - 4.44	3.49 - 30.89	0 - 43
Exptl. C.V.		78.62	52.21	82.90

@ See text for explanation; * significant at 5% level

to understand practical problems and identify appropriate solutions.

However, a participatory dialogue with the farmers brought to focus crucial site-specific problems. Some, highlighted below, need urgent remedy for any PPB programme to succeed.

- The area being exclusively rainfed, farmers had to plant the crop only after the onset of monsoon. The variable pattern of onset of monsoon was the cause for variation in planting date and pattern (nursery raising and transplantation or direct seeding even in lowland areas). While monsoon variation is inevitable, varieties adapted to target areas can be developed. PPB would be the right option.
- Often demand for quality seeds of a single variety exceeds supply, denying good seeds to economically poor farmers. Gov-

ernment credit poses too many hurdles to be crossed. The same was true for additional labour deployment at times of need. Often field operations become due concurrently and the demand for labour increases. Supply being short, the wages of labour go up beyond the capacity of poor farmers. Non-availability of funds is also a cause for non-application of fertilisers, pesticides and other inputs. Therefore the need is strong to implement the concept of "seed villages" which encourage farmers to produce sufficient quantity of seeds for their own use and for the open market.

- Optimal techniques of site-specific cultivation are hardly extended by institutional mechanisms to tribal farmers who remain therefore uninformed and unreached. Thus they rarely get an opportunity to learn about high-yielding varieties and their adaptation potential to their areas. PPB can

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evaluate the productivity and adaptability potential of HYVs in such areas and take up genetic amelioration of HYVs, particularly incorporation of farmer-desired traits.

202.2 Wayanad

Wayanad, the land of *vayals*, was known for its paddy cultivation. Rice production has been gradually coming down and most of the paddy fields are now being converted to banana and ginger cultivation and for brick making industries.

More than 70 local varieties of paddy were cultivated once, some of which are now completely lost. Varieties like *Veliyan*, *Thondi*, *Pal thondi*, *Thonnuran thondi*, *Chennellu*, *Chomala*, *Jeerakasala* and *Gandhakasala* are being cultivated in tribal areas to meet their nutritive, social and ritual needs.

The community agrobiodiversity programme of MSSRF focused its activities in the Kottathara village panchayat. Kottathara is located about 10 km north-west of Kalpetta, the headquarters of Wayanad district. There are two small rivers in this village *Cheriya puzha* and *Valiya puzha* which are tributaries of the Kabani river. This is an economi-

cally and socially backward village with a concentration of tribal families.

Wayanad is also the second largest producer of pepper in the State. But this crop is severely affected by a virus causing quick wilt (*Phytophthora*) disease.

An evaluation of the cultivation practices and capacity of tribal farmers at Kottathara district revealed that a number of varieties of rice with medicinal properties, called *Njavara* in the local Malayalam language, used to be cultivated. However, the yield of such varieties remained stagnant and low. Rising cultivation costs have forced farmers to taper out *Njavara* cultivation and as a result, adequate quantity of quality seeds of the past varieties of *Njavara* rice is not available.

The PPB Programme therefore decided to take up breeding for high productivity, retaining medicinal qualities of *Njavara*. Therefore different varieties/agronomic variants of *Njavara* were collected from different parts of Kerala. In particular, seeds of three different rice varieties, *Njavara*, *Kalladiyaram* and *Athira* were given to eight selected traditional farmers belonging to seven different villages (Table 2.25).

Table 2.25 : *Characteristics of rice varieties given to Wayanad farmers* *

Variety	Nature	Duration	Water requirement	Yield (q/acre)
<i>Njavara</i>	Endangered variety	90-110 days	Moderately low	5-6
<i>Kalladiyaram</i>	Highly endangered variety	90-110 days	Very low	7-8
<i>Athira</i>	High yielding variety	100-120 days	Very high	28-30

* The farmers were from the villages of Kalpetta (2), Kottathara (1), Periya (1), Pulpalli (1), Ambalavayal (1), Pozhuthana (1), Nellarasala (1).

They will be further advised on the planting of the experimental material during the ensuing *kharif* season. In addition, it was felt desirable to assess the current status of tribal agriculture and the cost-benefit ratio of cultivation. Relevant data was gathered on a designed proforma. Data from 25 farmers spanning districts and castes. Currently efforts are on to expand the sample size of farmers for a fair assessment of pre-PPB status.

202.3 Kolli Hills

Kolli Hills is inhabited by Malayali tribes who form 94% of the total population. This region is of utmost interest as most of the traditional varieties of paddy, minor millets and pulses and the associated agricultural practices are under threat of being replaced by tapioca or cassava cash crops, and high yielding paddy varieties. Previous work has emphasised the need for intensive efforts to arrest genetic erosion and rescue traditional crop varieties.

The following species of millets once covered a wide area in Kolli Hills, but currently they remain endangered: Pearl millet, *cumbu* (*Pennisetum americanum*); Finger millet, *ragi* (*Eleusine coracana*); *thinai* (*Setaria italica*); Little millet, *samai* (*Panicum sumatrense*); *varagu* (*Paspalum scrobiculatum*); *panivaragu* (*Panicum miliaceum*).

A participatory appraisal with the tribal farmers has led to the choice of *samai* for participatory improvement. There are seven land races : *Kattavetti samai*, *Thirukula samai*, *Mallia samai*, *Sadan samai*,

Vellaperum samai, *Perum samai*, and *Kottapatti samai*.

Quality seeds of these landraces are currently not available as only small quantities were being cultivated. As a first step, MSSRF has collected available seeds of these races and planted them in an off-season nursery. Seeds would become available for PPB for the ensuing *kharif* season.

Twenty-five farmers have shown interest in the PPB Programme. The areas assigned to PPB would be surveyed, the number of participatory farmers firmed up and a design of PPB would be finalised before the *kharif* season.

Proposed PPB programme

An assay of the social, economic and agricultural status of the tribal farmers at the three target sites has indicated that several organisations draw upon the genetic wealth in tribal areas disproportionate to the benefit they offer in return. Therefore the first scientific intervention in farmer participatory research must assure certain benefits to the farmer in terms of productivity, grain quality, consumer preference and the like. Otherwise, it could dampen further participation by farmers. Such factors and the results of the participatory diagnostics of the pre-PPB assays at target sites have prompted the following feasible PPB programmes:

Disruptive ecological selection

Local varieties/landraces collected in the sites would be evaluated on an RBD field design

in the participatory farmer fields. This would enable the assessment of the productivity potential of varieties adapted to one site, at other sites of experimentation. Since the varieties are adapted to the region, there is a high likelihood of identifying varieties specifically suited to a site. The evaluation will be on a participatory anvil with farmers exercising selection of their preferred traits. Matching varieties would be scientifically multiplied on optimal agronomic practices not only to enhance production but also to select quality seeds.

A wide variation in crop management by farmers was observed for a variety of reasons, as mentioned earlier. However, possibilities exist for minor but crucial interventions like optimal sowing management in tune to the constraints, optimal spacing in place of haphazard broadcasting and crucial cultural operations. It is planned to adopt a split-plot design while planting the landraces to include farmers' management and scientific management within the available infrastructure. It is expected that this experiment would achieve the twin objectives of identifying a site-specific, relatively high-yielding landrace and optimal agronomic management practices.

Participatory conservation

MSSRF is maintaining a community gene bank which is essentially a back-up store of under and un-utilised crop varieties. While formal conservation is institution-funded, farmer conservation is still at personal cost for public good. An intersection of these two

broad segments is participatory conservation. Community gene banks are essentially large *ex situ* conserving mechanisms. Varieties conserved being site-specific, even normal regeneration needs to be done in sites. In this context, the concept of field gene banks is suggested which will be small and can be developed at a low cost. They will store seeds of landraces and accessions specific to the site. Several sites are located in hilly regions with sub-tropical to temperate climate, ideal for storing seeds in natural conditions in field gene banks. They will thus meet the pre-requisite of conservation for utilisation of genetic diversity. Such field gene banks would therefore be developed in all the three sites.

Participatory genetic enhancement

Tribal farmers prefer to have varieties endowed with locally preferred traits, particularly grain colour, texture and cooking quality, in addition to high yield. The twin requirements of consumer preference and high yield suggest the two following initiating cross types to develop desired derivatives: i) Local X Local; ii) Local X HYV.

In rice, efforts are on to produce F1s by training farmers in emasculation-pollination techniques. A large quantity of F1 seeds is sought to be generated through community participation. This would enable farmer-scientist participatory selection and evaluation of F2 in large plots. The process can also be extended to further generations until a desired variety is developed.

Participatory seed production

Assuming that a site-specific landrace is identified or a variety is derived, the next need is to make a large quantity of quality seeds available to farmers. It is therefore intended to learn from farmers their methods of seed selection and teach them the desired criteria for quality seeds. On a participatory mode, quality seeds are expected to be multiplied (consonant to the concept of seed villages) in the target villages.

**Sub-Programme Area 203
Technical Resource Centre for
the Implementation of the Equity
Provisions of the Convention
on Biological Diversity**

The Foundation has been regularly collecting invaluable plant genetic resource materials to build up the Gene Bank. Biodiversity rich areas of Orissa, Kerala, Andhra Pradesh and Tamil Nadu have been identified and selected for conservation of germplasm. (The realisation of the importance of genetic variability in crop improvement and an awareness of the consequences of genetic erosion have led to conservation of germplasm in the form of seeds. Tribal farmers still grow mixtures of different crops which are adapted to the local environment to reduce the risk of economic loss due to various climatic changes. The Community Gene Bank can provide germplasm material directly to farmers. The surveys conducted at Wayanad re-

veal that there were about 73 traditional rice varieties known but at present most of them are not available.) An attempt to trace the lost varieties of Wayanad has been made and initiatives have been taken to find out whether these materials are available in any of the national and international gene banks. Once located, this germplasm can be given to farmers to be reintroduced in their fields. This year currently available rice varieties such as *veliyar*, *chennellu*, *njavara*, *thondi*, *gandhakasala*, *chempathi*, *basumathi* and *jeerakasala* have already been collected and preserved at MSSRF Community Gene Bank (SPA 201 above).

(Linking *ex situ* with *in situ* on-farm conservation)

(The link between Community Gene Bank (*ex situ*) and Community Seed Bank (CSB) and Field Gene Bank (FGB) at the field level (*in situ* on-farm) is intended to facilitate easy availability of landraces. At the same time one set of site specific germplasm is being maintained at the field. This symbiotic relationship helps to maintain and cultivate landraces in the field, without fear of losing the indigenous germplasm.) (see SPA 202 in this Report) Periodic seed multiplication and seed regeneration are also possible and simultaneously the burden of germplasm regeneration at the Community Gene Bank is also reduced (Figure 2.1).

(Community Seed Bank (CSB))

A CSB was established at Jeypore, Orissa, after discussions with farmers who expressed

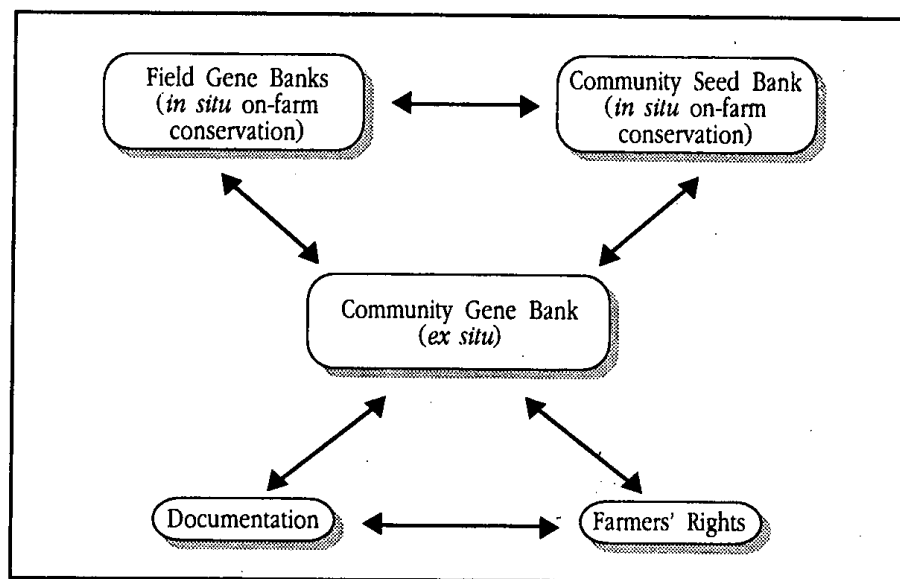


Figure 2.1 : *Community Gene Management System*

a desire to store landraces available with them. Farmers can draw seeds from the CSB, and return the stock to the bank with some extra quantity after harvest. It ensures active involvement of farmers in both conservation and enhancement. It also enables farmers to have an easy access to the germplasm from the Community Gene Bank, when it is not readily available in the field.

CSB has been functional in villages such as Tolla, Mohuli and Barangput where farmers have started depositing their traditional varieties. In Patraput, preservation is yet to start. Only at the time of sowing, the number of traditional varieties available will be known and input to CSB can be organised. In Barangput, traditional varieties are not cultivated. High yielding rice varieties are cultivated largely since adequate water for irrigation is available. Hence they preserve seeds of such varieties only in this village. The details of the varieties of seed material in the

CSB is given in Table 2.26. Interestingly, in all the villages except Patraput, women are in charge of the CSB. Three more CSB are being planned in other villages at Jeypore and also in Wayanad (Kerala). In Kolli Hills (Tamil Nadu) Community Grain Storage structure called *Thombai* has been initiated (Details in SPA 201.1).

Field Gene Bank

MSSRF is also planning field gene banks at the sites in Jeypore, Wayanad and Kolli Hills along the line of participatory conservation in the field (Details in SPA 202).

Germplasm field trial

For seed regeneration of accessions of little millet (*samai/Panicum sumatrense*) in the Community Gene Bank, an off-season nursery was planted during the month of February '99 at Kattupakkam (trial plot at Chennai). Randomised block design with 2 replications

Table 2.26 : *Information on Community Seed Banks*

Village details	Crop varieties*	Person in-charge
Village: Tolla Gram Panchayat: Mohuli Block: Boipariguda District: Koraput	Paddy 12 Minor millets 2 Sorghum 1 Pulses 12 Vegetables 8 Spices 4 Greens and others 4	Mrs. Manima Dalei Age 52 Tribe - Rana Village chief
Village: Mohuli Gram Panchayat: Mohuli Block: Boipariguda District: Koraput	Paddy 18 Ragi 2 Pulses 1	Mrs. Moti Pujari Age 46 Tribe - Bhumia
Village: Barangput Gram Panchayat: Danger Chinchi Block: Jeypore District: Koraput	Paddy 3 (HYV) Millet 1	Mrs. Jema Gadaba Age 33 Tribe - Gadaba President of CSB
Village: Patraput Gram Panchayat: Danger Chinchi Block: Jeypore District: Koraput	Yet to start preservation	Mr. Sunadhar Katia Age 49 Tribe - Katia Convenor of CSB

* Data on traditional varieties is being documented

has been organised at the field for 31 gene bank accessions. Data has been collected on morphological and physiological characters like node colour and plant spread. The crop growth was good and post harvest data such as plant height, panicle length, number of nodes, node colour, number of branches, total fresh and dry weight of both the plants and seeds are being collected for further analysis. It was also noted that there was no pest attack during the trial and though planted in off-season, the yield was also good.

Field multiplication of gene bank accession in the original habitat is being successfully

carried out this year with the help of the site offices at Jeypore, Wayanad and Kolli Hills. Seed multiplication has been organised at Jeypore with the 17 accessions (paddy) that were collected in 1996, as well as the 47 accessions (paddy) collected this year. Multiplication of 27 accessions (little millet) is being carried out at the greenhouse established in Neduvalampatti, Kolli Hills. Traditional varieties of 16 accessions of paddy collected this year have also been taken for multiplication at Wayanad.

Prof. S. Dana, who worked on mung bean and allied species of Asiatic *Vigna*, during his

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tenure at Nadia, West Bengal has a large collection of *Vigna* species. He has deposited his collection of 42 species of a wild taxa (*Vigna*) with the community gene bank. He expressed his desire to test them at Chennai and MSSRF is organising field tests at the trial plot at Kattupakkam. MSSRF has also received 22 lines of hybrid maize (*Zea mays*) germplasms from the Tropical programme of CIMMYT (through NBPGR, New Delhi). These lines were given to the Ecotechnology group to test their performance in the field at Namakkal. Data are being analysed.

Collection of valuable germplasm

This year collections of paddy (*Njavara*, a medicinal rice, has been collected from six different places), *bhendi*, little millet, peas, greens and medicinal plant seeds from Wayanad and Jeypore have been preserved. Ginger, turmeric (Wayanad) and yam (Orissa) collected this year have been placed at the greenhouse. As of now the community gene bank holds 752 accessions belonging to 41 species and 14 families. Details are given in the Box below.

Germplasm Collection

1. Traditional Millet and Paddy - Rishi Valley, Andhra Pradesh
Thinai, *Varagu*, Paddy, and *Samai* (4)
2. Traditional Millet and Pulse - Kolli Hills, Tamil Nadu
Kottapatti, Kattavetti (*Samai*), and Semmotchai (3)
3. Traditional varieties - Wayanad, Kerala

Paddy: *Njavara* (from 6 places); Kalladiyaran (from 3 places); Chennellu (from 2 places); Basumathi, Veliyan, Kaima, Gandhakasala, and Chempathy (16)

Vegetable and spices:

Pea, Amaranthus, Bhendi, Pepper*, Coffee*, Ginger* and Turmeric* (7)

Medicinal Plants:

Vayal chuli, Ashali, Kazhanehi kuru, Mashikkay, Cherupunnayari, Lanthakuru, Valmulaku, Vizhalari, Kudakappalayari, Ayamodakam, Chathuppa, Kadukka, Chittelam, Thethambal, Karkolari, Njerinjil*, Karimjeerakam (17)

4. Traditional Variety - Jeypore, Orissa (Koraput, Jeypore, Nabarangpur, Malkangiri and Kalahandi District)

Dioscorea alata - Yam (Greenhouse) (1)

Paddy:

Tulasi, Barapanka, Sitalchini, Sapuri, Sunasari, Kalamalli, Kandulkanthi, Rajamuan, Umuriachudi, Meher, Machhakanta, Kalajira, Mora, Baiganamanji, Bayagunda, Danger Dhan, Limbachudi, Gatia, Osagathiali, Bhatagunda, Dhobkuji, Bhattakubudi, Sindhkoli, Tikichudi, and Gadakuta (25)

5. Samai (Little Millet) – Birsa gundali (1)

From Ranchi – For use in PPB

6. Maize (Makka Cholam)

Zea Maize germplasm collection from CIMMYT (22)

7. Wild Species

Vigna species from Prof. S. Dana (42)

(* Not stored)

Documentation

Passport data related to the accessions stored in the community gene bank has been periodically updated with the IPGRI developed software called GMS (Gene Bank Management Software). Apart from this, a manual register and hard copy are being maintained. Data such as germination percentage, seed moisture content, viability, available quantity of germplasm, discarded germplasm, multiplication, regeneration and field trial are also being maintained.)

Community Herbarium

The Community Herbarium provides material along with the relevant information at one place for research on the vegetation of a region. The collection of voucher specimens at this herbarium is largely through the contributions of tribal communities who have a very good knowledge of taxonomy.

As the result of the exploration trips conducted at Wayanad, Kolli Hills and Jeypore Tract in the last few years, the Community Herbarium has a collection of 837 voucher specimens. 131 specimens belonging to 52 families have been classified systematically. The remaining specimens are in the process of identification and classification. This year, duplicate sets of 36 voucher specimens belonging to 19 families from Wayanad and 101 voucher specimens belonging to 51 families from Jeypore Tract (medicinal plants) have been deposited. The field offices at Wayanad (200 voucher specimens), Jeypore Tract (392 voucher specimens) and Kolli Hills (100 voucher specimens) are maintaining Community Herbariums and the details are available at the field offices.

Farmers' Rights Information Service

The rural and tribal people responsible for developing and protecting economically valuable biological resources have largely re-

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mained unrecognised and unrewarded. In order to reward the farmer's traditional wisdom, implement the Equity Provisions of the Convention on Biological Diversity and secure benefits from National and Global Community Gene Funds, an Information Service has been operational at MSSRF since 1996.

The Farmers' Rights Information Service (FRIS) multimedia database provides a method of documenting the contributions of the tribal and rural families in the conservation and improvement of agrobiodiversity. Towards this purpose the database links the details about their knowledge, community and area, so that a viewer can get a holistic view of people and their contributions.)

The FRIS database has been updated as on September '98, and is hosted on the Pan Asia Network <<http://www.mssrf.org.sg/webfris>>, with our server providing a backup. The database also forms part of the Data Services in the MSSRF Home Page on the Web.

The FRIS database has been distributed in a CD-ROM format to our field offices at Cuttack, Jeypore, Wayanad and Namakkal. The Department of Biotechnology (DBT), Govt. of India has approved FRIS for inclusion under its programme of distributed bioinformatics centres for the year 1999-2000.

The new features incorporated into the FRIS database are Gender Issues and Plant Information from Orissa and Kolli Hills.

Salient features of the FRIS

- The unique feature of the data base is that the issues and data are maintained as separate components.

- The introductory section gives a detailed account of the policy and technical issues involved in the recognition and reward of informal innovations that have contributed to the conservation of agrobiodiversity.
- For a better understanding of the farmer's entitlements, videos of/and statements from various institutions and agencies, such as FAO, the CGIAR and the Association of Indian Seed Industry are classified under issues, along with a brief note on the heritage of agrobiodiversity in India.
- The section on *Ethnography* gives a detailed account of the cultural practices of the major tribal groups of Tamil Nadu, Andhra Pradesh and Orissa.
- A specific section on *Gender Dimensions* has been included to highlight the contribution of women in the field of agrobiodiversity. The case studies are from Arunachal Pradesh, Kerala, Mizoram, Orissa, Tamil Nadu and Lakshadweep Islands and Srilanka.
- The section on *Conservation Practices in Kolli Hills*, which chronicles the agricultural practices of Kolli Hills, also lists the diversity of millets.
- The southern regions of Orissa have been considered a secondary centre of origin of cultivated rice. A section called *Orissa: a centre of origin of rice* is devoted to the details of the morphological/agronomic characters of the rice variety, the donor farmers' names and community, and location and date of collection, which have

been documented as a multimedia database for the districts.

- *Sacred Groves* are a cultural heritage, a system that has helped to preserve the representative genetic resources. The sacred groves are usually dedicated to the local deities, and the do's and don'ts attached to the sacred forests largely depend on the beliefs of the local people, which vary from place to place. The section carries details of the sacred groves of Tamil Nadu.
- Other information such as *Location Data* and *Plant Information* are also included here.

Sub Programme Area 204

B R Barwale Chair in Biodiversity

Research on linkages between biodiversity, sustainable agriculture, food security and strengthening the livelihood security of communities, especially those living near Protected Areas, is the mandate of the B R Barwale Chair in Biodiversity.

204.1 Correlates of Biodiversity, Gender, Sustainable Agriculture and Food Security

Tagging sea turtles in Orissa

The three-year project sponsored by NORAD and implemented with the collaboration of the Wildlife Institute of India, Dehra Dun

was concluded during the year. The most significant achievements of the study are the tagging of 5,305 nesting female Olive Ridley Turtles at the five tagging sites along the coast of Orissa and an off-shore tagging operation of 192 hours over a period of 51 days, in which 818 mating pairs of turtles were captured and tagged.

Results from the tagging study suggest a great degree of nest-site fidelity among the Olive Ridley Turtles using the Rushikulya rookery. Forty-four of the 519 turtles tagged during the February '97 arribada at Rushikulya were recaptured in March '98 at the same rookery.

Ridleys tagged at nesting beaches in Orissa also exhibited movement between the different sites. Two turtles tagged in February '97 in Rushikulya were recaptured in Robert Island in March '97. The range of inter-rookery movements of the nesting turtles within Orissa was from 35 to 220 km.

The study has also shed some light on post-laying movements of the turtles. One of the turtles tagged on 13 March '97 in Robert Island was subsequently recovered on 27 April '97 by a fisherman off the Kalmunai coast of eastern Sri Lanka. It is remarkable that the turtle had covered a distance of 1,900 km in less than 45 days.

Sustainable management of faunal resources

Work initiated in the coral reefs of Lakshadweep islands has yielded some data on the various species of bait fishes used in tuna fishing. Information has also been ob-

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tained on the methods of harvest and maintenance of live fish through indigenous technology. The different forms of damage caused to live coral in the process of fishing have been documented. Efforts are being made to sensitise the administration and the people on the long-term impact of such activities on coral reefs.

A detailed survey of mammals in Kolli Hills has been completed. Based on interviews of the local people, especially hunters, nearly 30 species of mammals have been listed. Efforts to validate the occurrence of these species were made through attempts to directly sight them or study indirect evidences including scats, footprints, etc., which revealed that except for 10 species of mammals (excluding bats and rats) they have either been completely eliminated or driven to very low numbers. The primary reason for the loss of mammals in Kolli Hills is hunting. The study has since been extended to the human-impacted landscape of Wayanad, Kerala.

Birds in Kolli Hills have suffered the impact of hunting and habitat transformation to a lesser extent than mammals. A detailed study of bird distribution at altitudes of 800 m and above has indicated the presence of not less than 100 species. Interestingly, of these at least 10 per cent are birds with small ranges including those considered endemic to the Western Ghats, those endemic and patchily distributed in the Indian peninsula and those endemic to South India and Srilanka. Habitat use and status of these 100 species are being studied systematically.

Research in Dharmapuri district has been linked to the felt needs of the Department of Forests. Two problems identified by the District Forest Officer, which are directly relevant to sustainable management of natural resources in the district, are pressure on forests due to cattle and goat grazing and over-fishing in the Hoggenekal river. Studies have been undertaken on these aspects by two students of the Salim Ali School of Ecology and Environment, University of Pondicherry, as part of their M.Sc dissertations.

Integrating gender in conservation

In all the studies, efforts have been made to integrate the knowledge and perceptions of women. They include the collection and documentation of gender segregated data on the faunal resources in all the landscapes under study.

204.2 Strengthening the Knowledge-base and Role of Local Communities

Based on the studies of the knowledge-base of the local communities, appropriate steps are being taken to integrate this with other activities of the MSSRF as well as government agencies. To this end, the Agrobiodiversity Conservation Corps (ACC) of Kolli Hills has been made the local partner in the IDRC/Foodlinks initiative on agroindustries. The ACC of Orissa is actively disseminating the message of mangrove conservation in Jagatjori (outside the Bhitarkanika WLS). They are also creating awareness among the local people on the need to protect the 50 ha

mangrove plantation restored by MSSRF during 1995-97. The ACC is seeking the cooperation of the local communities in controlling the damage caused to the plantation by free-grazing buffaloes.

After discussions with the Department of Forests in Dharmapuri, the ACC (Karikuttanur) underwent a training programme at the local Training and Research Centre of the Tamil Nadu Veterinary and Animal Sciences University on the advantages of rearing stall-fed goats. The ACC is engaged in disseminating the message locally. The ACC in Kalpetta (Wayanad) is working in coordination with the Community Agrobiodiversity Centre of MSSRF. Efforts are being made to link the ACC of Lakshadweep with the conservation activities of the Department of Science, Technology and Environment.

204.3 Creating a Forum for Sustainable Management of Biodiversity

Agrobiodiversity Conservation Corps

The ACC has been converted into local voluntary organisations in both Kolli Hills and Dharmapuri. The two groups have established a "Community Agrobiodiversity Fund" which they are operating for purposes of local conservation. Their activities include information dissemination through posters and banners in public places carrying messages of biodiversity conservation.

People's Biodiversity Register

People's Biodiversity Register (PBR) is a tool for local management of natural resources.

This local level database serves two purposes simultaneously, it creates a sense of ownership amongst the local communities and is a means by which public recognition of local knowledge and ownership is ensured.

The main aspects of the PBR are:

- Knowledge and information about the cultural and ecological history of the region
- Knowledge and information about conservation and sustainable use of biodiversity.

Preparation of PBR needs a step by step methodology for use at the village level. This methodology involves 3 phases each of which has its unique role in the logical sequence of PBR preparation.

Phase I is fundamental to PBR, because entering a village is difficult, especially with the purpose of collecting public domain knowledge. To facilitate this, public meetings were held and local resource persons and the public were approached individually. A general committee called the Biodiversity Management Committee (BMC) was also constituted. The members of this committee are the Panchayat President, Village Officer (VAO), Local School Headmaster (SH), Forest Range Officer (FRO), Kovil Poojari (KP), Ward member/*Oor Gounder* (OG) and local NGOs. The Panchayat President is the chairperson of this committee (Figure 2.2).

With the help of the BMC, 60 men and 50 women in Kolli Hills, Tamil Nadu, 20 men

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and 40 women in Wayanad, Kerala and 40 men and 30 women in Jeypore, Orissa were selected. Most of the selected people are local resource persons including elders, labourers, agriculturists, hunters, fishermen, traditional medicine practitioners and youngsters. These selected members are called Community Biodiversity Conservation Corps (CBCC). The CBCC is to play an active role in Community Biodiversity Conservation.

Meanwhile the CBCC-core group of 25 members will interact continuously with the community for PBR preparation under the guidance of BMC and MSSRF.

This level has been reached at 3 sites, Periakovilour (Arapaleeswarer Kovil) – Valarpurnadu Panchayat, Kolli Hills, Thariode Panchayat, Wayanad and Tolla and Parangput, Jeypore. This was achieved after 10 to 15

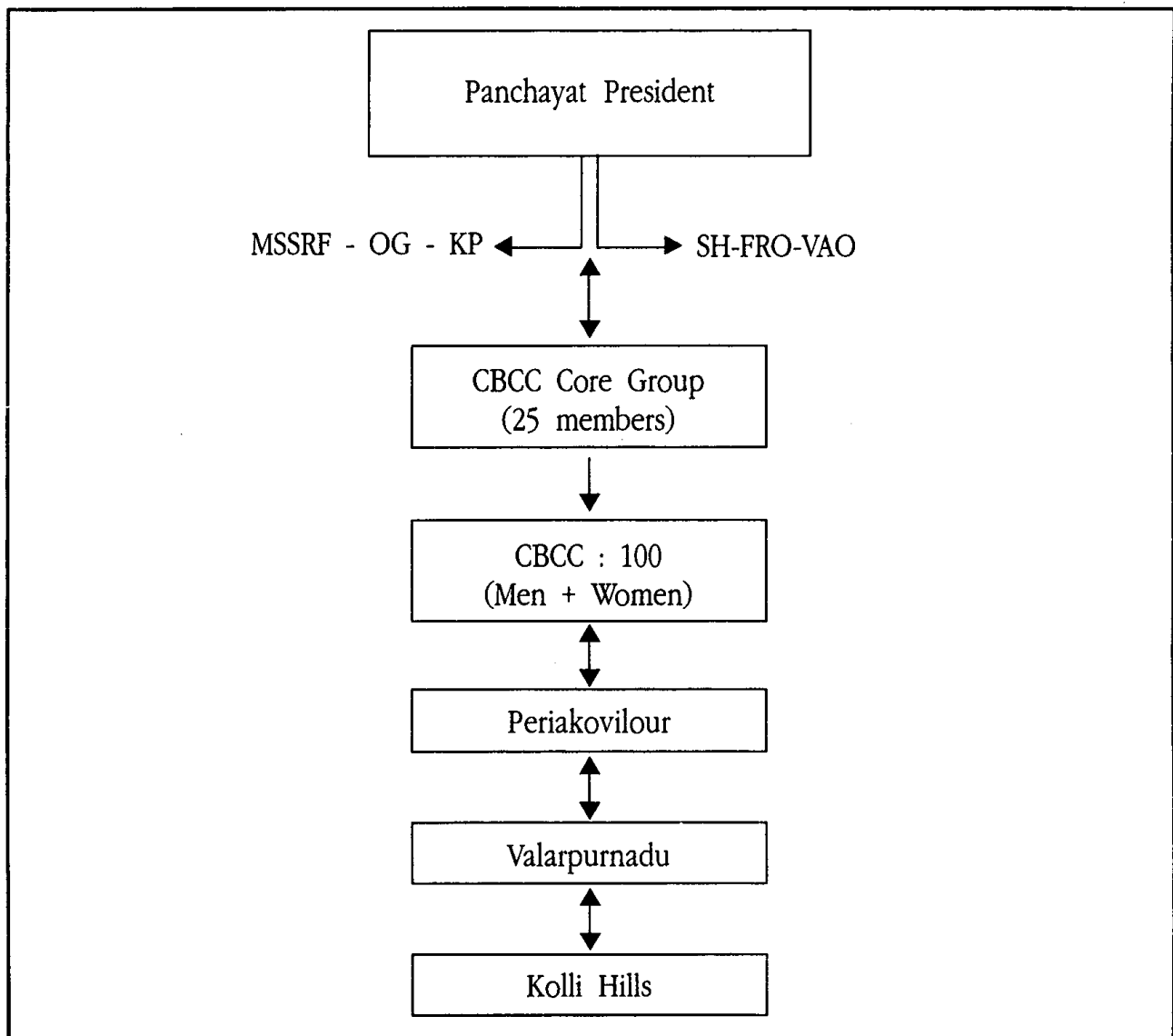


Figure 2.2 : *Biodiversity Management Committee*

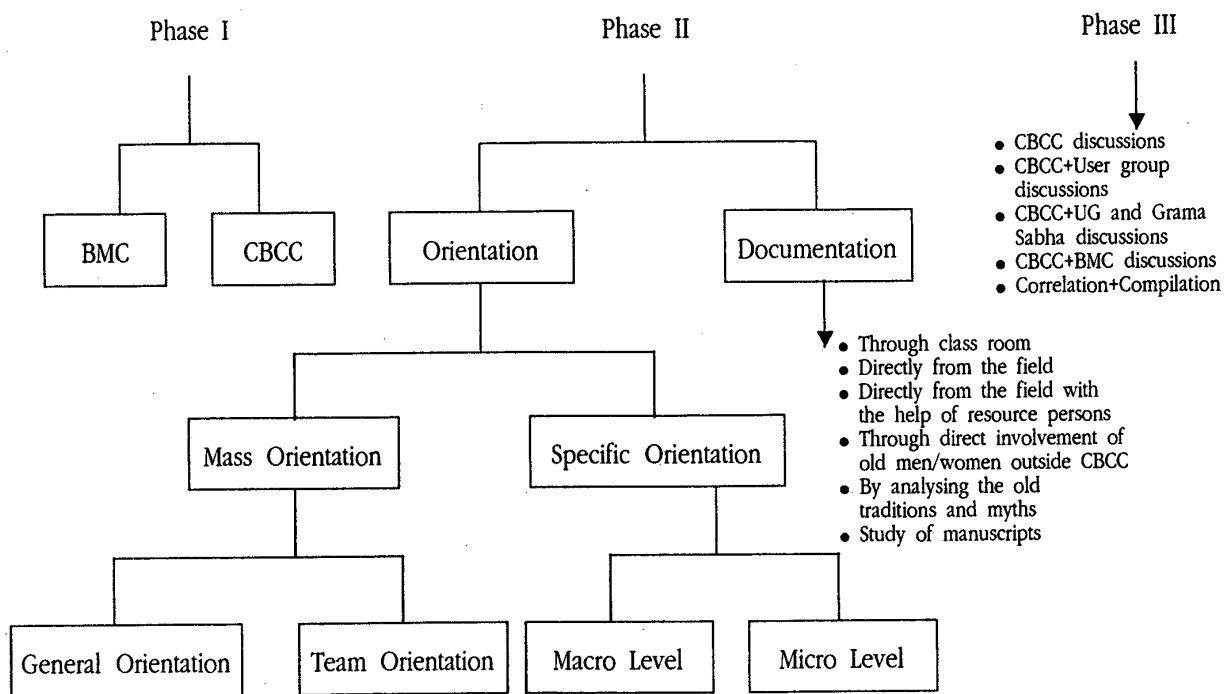


Figure 2.3 : *People's Biodiversity Register - Methodology*

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visits to these study areas, interacting with the local people and concerned Government officials and conducting seminars for the local NGO representatives and directors.

Phase II is intended to facilitate the documentation of public knowledge in the form of PBR. In this phase the CBCC is given the necessary basic information about the programme and proper training to carry it out. Training was given on the basis of the Voluntary Code of Conduct for Fostering Biopartnerships, developed by MSSRF (Figure 2.3).

Phase III involves interactive discussions of user groups. Based on this the PBR will be compiled. This will start after Phase I and Phase II are completed.

Chennai Biodiversity Forum

The Chennai Biodiversity Forum met 9 times during the year and discussed various issues relating to the sustainable management of urban environment. The members served as resource persons in a project undertaken by the Madras Christian College in July-August '98. The project concerned the training of graduate students of the college in assessing the local impact of environmental degradation. To broaden the scope of the Forum and its activities, a quarterly newsletter titled "Biodiversity News" has been launched.

204.4 Biodiversity Consultancies

Implementation of Article 6 of the Convention on Biological Diversity: National Report' was prepared on behalf of the Ministry of

Environment and Forests, Government of India. The Report was completed in December '98 and 5,000 copies were sent to the Ministry in New Delhi. The Report has been approved and formally released by the Union Minister of Environment and Forests on 31 December '98 at Kavratti, Lakshadweep. Copies have been submitted by the Ministry to the Secretariat of the Convention of Biological Diversity in Montreal.

The Chair is advising the Gujarat Ecological Commission (Government of Gujarat) and the Gujarat Ecological Society in the implementation of a biodiversity conservation action plan under the State Environment Action Programme. This initiative is for two years.

Sub Programme Area 205 Conservation and Utilisation of Biological Diversity : Marketing Study

205.1 Kolli Hills

Kolli Hills is undergoing a change in its agriculture sector, from a subsistence, semi-commercial agriculture to commercial agriculture. New crops such as tapioca and pineapple have emerged as important sources of livelihood during the last five decades. Organised marketing systems, commission agents, credits etc have influenced the agriculture substantially. On the other hand, traditional crops such as minor millets operate only within the subsistence economy.

Many studies have pointed out the declining agrobiodiversity in Kolli Hill. While there has been a change in the cropping pattern during the last three decades, Kolli Hill seems to have undergone a major change in crops during the last one hundred years. The Manual of Salem District in Presidency of Madras written by H. Le Fanu during 1883 has listed the various crops of Namakkal taluk. Tapioca has not been listed as a major crop in the Taluk whereas, during 1991, in Kollimalai alone nearly 4,000 ha are under tapioca cultivation. Similarly, the manual has estimated nearly 1,113 ha under *Samai*, *Thinai* and *Varagu* during 1883 in Namakkal taluk. But during 1991, the total area under millets (including, *Ragi* and *Cumbu*) in Kolli Hills was 1,727 ha. Since there are no clear break-up details available on minor millets, this study assumes that the area under minor millets has come down during the last one hundred years.

Many fruit crops seem to have been introduced during the last six to seven decades. According to the elders in the village of Aripalapatti, pineapple was introduced sixty years ago. The villagers also felt that the area under banana has been increasing. The introduction of tapioca and other cash crops and slow decline in the traditional crops such as minor millets and the disappearance of certain land races have bearings on the agrobiodiversity of Kolli Hills.

The study has identified the extent to which various crops are planted and market channels in which these crops are converted into value-added products. Unlike Orissa, the

market channels in Kolli Hills are well defined with a limited number of actors in between the producers and consumers. The price spread in tapioca is minimum, indicating an efficient market system.

The conservation of minor millets requires an economic stake and in recent times efforts are being made to introduce them in food fortification in the organised sectors due to their high micro-nutrient content. Efforts are also being made to develop traditional food products for the local village markets.

A household survey was conducted among the tribals to identify the marketable surplus in each of the sample households. The objective of this survey was to assess the consumption pattern and to estimate the marketable surplus of various agricultural commodities such as paddy, minor millets etc. The survey was conducted in 410 households in 14 Nadus of Kolli Hills. A proper sampling procedure was adopted and after a pilot survey the questionnaire was redefined. The interviewers were trained in canvassing the questionnaire.

Participatory Rural Appraisal was also conducted to substantiate the survey data in qualitative terms. A selected group of Malayali tribals visited the MSSRF site office for a focused group discussion on various marketing strategies. A discussion was held with Tribal Cooperative Marketing Development Federation of India Ltd (TRIFED), Ministry of Social Justice and Empowerment, Government of India. TRIFED has agreed to look into the potentials of Kolli Hills in developing the market mechanism within the frame-

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work of the project's objectives. A full-fledged report on the marketing structure of Kolli Hills will be completed by September '99.

205.2 Orissa

During 1998-99, a detailed study was conducted in the four southern districts of Orissa. Based on the observations, this study has recommended the process of marketing in linking the primary producer and conservers with the consumers. The study has raised the following salient points:

- The theoretical premise is that the market can play an effective role in biodiversity conservation, if it is evolved as a tribal-based, tribal-controlled value-oriented institution.
- The problems of underdevelopment in the southern districts of Orissa can be viewed in terms of lack of proper understanding of the relationships between forest, agriculture and marketing mechanisms.
- Underdevelopment is not due to lower productivity in agriculture but due to limited agricultural labour absorption and limited purchasing power of the tribal populations.
- The forest helps the barter economy and any problem in the forest condition or management has implications on food security.
- An inefficient market system can be seen in terms of price spread $\frac{3}{4}$ the limited share to the primary producers in the price paid by the consumers.

- The conventional, state-sponsored tribal cooperatives have not succeeded due to lack of value-oriented structures.
- NGO sponsored marketing structures are based on issues such as empowerment, market information, decision-making, implementation and benefit-sharing by the tribals. These marketing structures have proved successful.
- The role of women is crucial in the marketing structure since they play a major role in the market economy. The conventional cooperatives with their blueprint approach have not given any emphasis to the participation of women. On the other hand the green house approach of the NGOs has helped to organise the women around marketing structures.

Based on the above observations the study has recommended a process for linking the primary conservers with the market, as described below.

205.3 Green House Approach in Marketing

Certain NGOs have shown models of institutional structures in this direction. Dongria Kondh Development Agency (DKDA) is an organisation working with the Dongria Khond tribals in Rayagada district. This organisation observed that while cutting trees in shifting cultivation, Dongria tribals do not cut any tree which is fruit bearing, and these trees are considered as the symbol of mother earth. The organisation selected fruit-bearing trees such as jackfruit, mango, cashew nut etc,

which are also economically profitable. The tribals play a major role in managing the affairs of DKDA. Through a participatory approach, DKDA buys the products, sells them in the market and shares the profit with the tribals. DKDA does not see marketing as its only objective. It is involved in empowerment, health and sanitation, education, micro-credit and Panchayat Raj development. Thus the marketing structure is interwoven with the social fabric of the Dongrias. Therefore a marketing mechanism with a strong focus on development and conservation should adopt a green house approach in which the people for whom the market is developed evolve the structure and conduct. Similarly another NGO, AGRAGAMEE, is working with the tribals of Kasipur range in Rayagada district. They have organised a women's co-operative movement which focuses on value addition and marketing of many agricultural and forestry products. Women are empowered with management principles and market information. The decision-making process takes place in a tribal-cultural context.

Some of the interesting observations made during the preliminary study are:

- A stratified and loose market channel results in a very high price spread which indicates market inefficiency. The producer's share in the price paid by the consumers is very low.
- Barter system exists during off-season in agriculture. The agriculture sector offers limited employment potential. A low-key informal sector and limited secondary sector are not able to provide sustained employment. In such a situation the communities become hunters and gatherers (mostly gatherers). Forests and trees are the most important source of livelihood. Mangoes are exchanged for rice, neem seeds are exchanged for salt and mushrooms are exchanged for edible oil. Tubers from the forest are also an important source of nutrition. The barter subsistence system suffers when drought occurs. This situation leads to hunger and starvation
- Many of the traditional varieties are marketed within the subsistence economy and barter economy. Recently some initiatives are taking place to support a proper market system for these varieties.
- Land alienation has begun in many parts with outsiders' investment in commercial agriculture. However, this intervention is yet to create a major impact on employment and livelihood opportunities.
- The organised marketing structures such as cooperatives are ineffective since they have not been able to internalise the concept of development within their organisation.
- The traditional tribal markets were not only a mode of exchange of commodities. They also played a major role in the life-cycle decisions. Weekly markets play a major role in various types of tribal marriage systems such as negotiated marriage, marriage by capture, elopement etc. As the size and the character of these weekly markets are changing, with many outsid-

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ers dominating the market, the role of these markets in major life-cycle decisions may be changing.

- Though anthropologists debate the view that "women in tribal societies have higher status", it was observed that women from various tribal communities were dominant in the market systems, when the markets were limited in size and operating at a subsistence level. Studies have observed that tribal women are involved in every aspect of tribal economy such as production, distribution and consumption. In a barter economy, women defined the exchange system in terms of commodities for exchange and indirectly the price. None of the organised cooperatives have given significance to women's role in marketing. On the other hand in the successful tribal marketing structures of AGRAGAMME at Kasipur, women play a key role in taking decisions, implementing the decisions and sharing the benefits. Special attention has been given for empowering the women with market information and marketing strategies for micro and macro markets.

Sub Programme Area 206

Molecular Mapping and Genetic Enhancement

This programme addresses two major concerns, namely genetic erosion and decreasing agricultural productivity in the coastal agroecosystem that suffers from the

problems of low productivity and uncertain yield. The major focus of this programme is to:

- analyse genetic diversity and species relationship among the Indian mangrove species, using molecular marker technology as a prelude to conservation of genetic resources
- isolate and characterise stress tolerant genes to develop salt tolerant crop varieties for coastal agroecosystem.

206.1 Molecular Marker Assisted Genetic Diversity Studies

Genetic diversity, genomic relationships and evolutionary and phylogenetic trends were studied in major mangrove species using data obtained by chromosome analysis, Random amplified Polymorphic DNA (RAPD), Restriction Fragment Length Polymorphism (RFLP) and PCR-RFLP of chloroplast gene regions. Genotypes representing the species were collected from distinct populations along the Indian coast. The studies conducted so far have provided unambiguous molecular identification systems for Indian mangrove species. Intra- and inter-population genetic polymorphism have been documented in a number of species. The nature and extent of genetic diversity have been studied both at the intra- and inter-population levels. Significant results obtained through these analyses have been published/communicated for publication.

Comprehensive investigations were carried out to understand the extent and nature of genetic variation at the inter-generic and inter- and intra-specific levels in ten species be-

longing to the mangrove family Rhizophoraceae. Genetic diversity studies were undertaken using both protein (total leaf protein and isozymes) and DNA based markers (RAPD, RFLP and organellar DNA polymorphisms) so as to arrive at an understanding of the phylogenetic and evolutionary trends among these tree species.

All the ten species of Rhizophoraceae were characterised with 36 chromosomes in their somatic cells. The chromosome complements of Rhizophoraceae were median/submedian in nature, implying that they are stable and may have undergone limited divergence during the course of evolution. The wide range of chromosome numbers encountered in all the mangrove species studied suggest an independent origin of these species both in space and time. It appears that mangrove species may have had separate origins, although they share common habitat preferences.

The differences in the leaf protein profiles and isoenzyme pattern obtained between species of the family Rhizophoraceae could not be attributed to environmental factors. Clear species differentiation was observed for the two species *C.decandra* and *C.tagal* of genus *Ceriops* by these marker systems. *R.stylosa* was excluded as being the possible putative parent of *R.x lamarckii*, as the common alleles detected in the hybrid were from *R.apiculata* and *R.mucronata*.

RAPD based analysis revealed highest level of species differentiation in the genus *Bruguiera*, followed by *Rhizophora*. Genus *Ceriops* showed a very low level of species differentiation. Intra-specific diversity, which

enhances scope for species adaptation and survival was low in Rhizophoraceae as compared to other mangrove species. The lowest level of intra-specific genetic diversity was detected in *C.decandra* followed by *C.tagal*, *K.candel* and in three species of *Bruguiera*. This, in addition to their small population size, makes them priority candidates for conservation. *R.x lamarckii*, *R.apiculata* and *R.stylosa* showed almost similar profiles for all the random primers used, while *R.mucronata* remained distinct. While generic differences were very pronounced with all the primers, species-specific profiles were also observed. The microsatellite primer (GATA)₄, proved to be the only primer which differentiated all the ten species analysed.

RFLP analysis carried out in these species showed that the rDNA repeat units in Rhizophoraceae species were flanked by the enzyme *Hind* III. The rDNA regions were very conserved between the genus *Bruguiera* and *Ceriops*, while *Rhizophora* showed two different rDNA profiles, *R.apiculata*, *R.x lamarckii* and *R.stylosa* showed similar profiles and *R.mucronata* exhibited a profile similar to genus *Ceriops*. Genomic clones and rDNA probes could help to distinguish the four genera as some probes did produce species-specific pattern. The RFLP analysis, however, revealed low inter-specific differences. *R.x lamarckii* showed similarity in profiles to *R.apiculata* in most probe/enzyme combinations, while in others it showed an intermediate profile between *R.apiculata* and *R.mucronata*, while *R.stylosa* remained distinct.

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The nine mitochondrial probes in combination with three enzymes revealed that the four genera of mangrove Rhizophoraceae clustered into 3 mitotypes. Generic differences were very pronounced with all the probe/enzyme combinations. Specific differences were very low in the genera *Ceriops* and *Bruguiera*. The genus *Rhizophora* revealed a higher level of species differences for most probe/enzyme combinations. *R.x lamarckii* showed profiles similar to *R.apiculata*, while *R.mucronata* and *R.stylosa* remained distinct for most probe/enzyme combinations.

PCR-RFLP of the ten species with two chloroplast genes revealed that they cluster into 3 chlorotypes. A very high level of generic differentiation was observed for the two gene amplifications when digested with 19 restriction enzymes. Inter-specific differences were not observed for the two genera *Ceriops* and *Bruguiera*, revealing a very highly conserved nature of the chloroplast. Species-specific differences were observed in genus *Rhizophora* in the amplified gene region of *trnS-psbC* when digested with the restriction enzymes *Hae* III, revealing a high degree of speciation in this genus. Most plants of *R.x lamarckii* showed a restriction pattern similar to *R.mucronata*; while the rare propagule of *R.x lamarckii* showed a pattern similar to *R.stylosa*, which is intermediate between *R.apiculata* and *R.mucronata*. This finding suggests that further studies involving this propagule may be useful. The differences in the mitochondrial and chloroplast profiles of the hybrid *R.x lamarckii* indicate that the mitochondrial and chloroplast donors may be different in this hybrid.

All the marker systems revealed a high level of separation of the four genera. At the level of species, minimal differences were observed in the two species of *Ceriops* and in the three species of *Bruguiera* as compared to the four species of *Rhizophora* which showed a higher level of species differentiation. This indicates that the choice of marker system for species identification may vary and depends on the species under examination.

In all the marker systems it was observed that even though the distances separating the four genera were slightly different, the overall relatedness was the same. Genus *Ceriops* clustered with genus *Kandelia* in all the analyses to which the genus *Bruguiera* and then *Rhizophora* were subsequently clustered.

206.2 Genetic Enhancement

The major emphasis in this subcomponent is to develop characterised pre-breeding genetic material capable of offering resistance/ tolerance to coastal stress for grassroot level breeders for developing location specific crop varieties. The emphasis, therefore, has been on developing genetic material containing novel genes for resistance to abiotic stress, particularly salinity.

Isolation of Stress Induced Genes

The process involves exposing target mangrove species to varying degrees of abiotic stress and identifying and characterising stress induced proteins. The second approach involves developing gene libraries enriched with stress induced genes and screening for

potential genes conferring stress tolerance. It also involves characterisation, evaluation and controlled expression of the promising genes. The results obtained so far include identification of a 22kDa salt-stress induced protein from the mangrove species *Avicennia marina*. Three cDNA libraries have been constructed from the salt treated *A.marina*. Screening with heterologous probes from other organisms or through RT-PCR approach isolation of potential stress tolerant genes were isolated from the cDNA libraries developed from *A. marina*. The potential and promising genes include BADH, Enoyl-CoA hydratase, 40S ribosome protein S7, Sporamin and 18S rRNA genes. These clones have been fully sequenced and the extent of homology with these genes from other organisms have been established.

EST sequencing

Salt induced and enriched cDNA libraries have been constructed in three mangrove species. About 25 expressed sequence tags (ESTs) were sequenced (4,965 bp in total). Through sequence analysis of cDNA clones the following genes have been isolated so far:

- Betaine Aldehyde Dehydrogenase (1.717kb)
- V-Type ATPase (1.2kb)
- Enoyl-CoA hydratase (1.515kb)
- Ribosome binding protein subunit S7 (0.83kb)
- Aluminium induced gene (1.2kb)
- 18S rRNA gene (1.8kb)
- Histone H3 gene (0.8kb)
- Proline-5-Carboxylate Syntatase (2.5kb)

- Caffeic acid-O-methyltransferase (1.8kb)
- Beta-lactoglobulin gene (0.8kb)
- Sulphate aldehyde transferase (1.3kb)
- PEP carboxykinase (1.2kb)
- Acryflavin resistant protein (acrB) (1.2kb)
- DNA binding protein (1.5kb)

Development of a transformation system

In order to study the expression of genes isolated from the mangrove species in the genomic background of other plant species and to obtain information about the usefulness of these genes in conferring stress tolerance, an experimental transformation system was standardised in tobacco. For this purpose, a binary vector carrying the BADH gene cloned from the mangrove species was constructed. This vector carried BADH gene under 35S CaMV constitutive promoter. *Agrobacterium*-mediated transformation of tobacco leaf discs was done to get transgenic plants. These transformed plants were shown to have the BADH gene integrated into the tobacco genome. Assay for BADH revealed overexpression of the gene in the transgenic plants which indicated that the integration is stable and the gene is fully functional.

Sub Programme Area 207

Monitoring Ecosystem Health Using Microbial Diversity

This programme addresses the twin goals of indexing and documenting microbial diversity along the coastline of Tamil Nadu and

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Siruvani Hills in the Western Ghats and developing biomonitoring techniques using this baseline data. The major focus of the study in the coastal agroecosystem is to document the diversity of soil bacteria, especially with reference to heterotrophs and some beneficial organisms like biological nitrogen fixers, phosphate solubilisers (the two limiting factors in these soils) and the *Pseudomonads* and bioprospecting these organisms for their novel properties. These could then be harnessed to increase crop productivity and develop remediation techniques. The focus in Siruvani Hills is on using the lichen diversity associated in the region to assess the forest ecosystem continuity.

207.1 Microbial Diversity in Coastal Agroecosystems

After one year of continuous sampling of the chosen study sites along the coast was completed, the results have been consolidated and the trends analysed. The consolidated data reveals that the activity is more than double in the rhizosphere when compared to the non-rhizosphere zones. During peak summer (April to June) the microbial activity was found to be comparatively low in sites which were predominantly sandy but in clayey soils it was good. Activity was observed to be very good when farmyard manure was applied in the sites. The microbial count was found to be well correlated with the enzyme activity. Overall the recovery of phosphate solubilisers was found to be low in sandy soils and less when the salinity increased. Alternatively in clayey soil where paddy was cultivated the recovery was

found to be good. The recovery of biological nitrogen fixing population was observed to be more in sites where the organic content was more. Stresses like pesticides and salinity decreased the number of populations. With reference to the variability (both intra and inter-) which could be brought out by the farming practices and the physicochemical properties of the soil, the entire *Rhizobium* (90) populations, obtained from the groundnut varieties cultivated in this region, have been analysed for their genotypic diversity using universal primers. The RAPD analysis reveals a high degree of variability in both intra and inter-sites. The genotypic diversity associated with the other groups of biological nitrogen fixers namely *Azospirillum* sp., *Acetobacter* sp. and *Azotobacter* sp. is underway. *Acetobacter diazotrophicus* strains were isolated from *Elusine coracana* L., a new host plant cultivated along the coastline from one of the study sites. Using a species-specific oligonucleotide primer and PCR amplification the presence of this bacterium was directly demonstrated in plant tissues to prove their endophytic nature and was found to be absent in the non-rhizosphere soils. The isolates were also characterised on the basis of typical morphology, electron microscopy and biochemical tests inclusive of their nitrogen fixing efficiency to assess the diversity associated with these isolates. When RAPD analyses were performed on these isolates they fell into two distinct genetically related groups when compared with the type strain PA1 5 (ATCC 49037). Considering the importance of the crop to this region associated nitrogen-fixing *Acetobacters* maybe agronomically important because they could

supply part of the nitrogen that the crop requires. Preliminary screening of some of the *Acetobacter* isolates have shown them to tolerate 3% NaCl.

Nitrogen fixing efficiency of these isolates using GC (HP 4080) is underway as also the standardisation of using fatty acid profile in characterising the isolates. Once the programme has been fine-tuned the isolates from the coastal agriecosystem will be taken up for identification.

Initial screening of the *Pseudomonas* population isolated from the study sites using NEFERM plates (based on substrate utilisation pattern) confirmed that most of them belong to *Pseudomonas stutzeri*, *P. alcaligenes*, *P. pseudoalcaligenes*, *P. fluorescens*, *P. aeruginosa*, *P. maltophila* and *P. cepacia*. About 400 isolates of the total heterotrophic populations have so far been screened for their substrate utilisation pattern to understand the physiological diversity associated with these organisms. Very few isolates showed cellulolytic, amylolytic and lipolytic activity. Organic sites had comparatively larger populations showing cellulolytic activity.

The other populations of amonifiers, nitrifiers, denitrifiers and phosphate solubilisers will be taken up for their genetic diversity and efficiency studies. Identification of these isolates using the MIDI software based on their fatty acid profile will be done.

207.2 Lichen Research

In a climatically uniform forest region, variations in the distribution patterns of the li-

chens depending upon the microlevel changes in the mesohabitat conditions (viz. light intensity, substrate pH, texture, moisture etc.) can be used to identify ecological continuity/disturbance. This study has been concentrating on site-specific lichen biomonitoring methodologies for unexplored sites in Siruvani Hills. To establish and place the results obtained through these studies on a scientific base, the ecosystem health is also being quantified through other ecological methodologies. The combination of both these data is being used in identifying indicator lichen communities.

Twenty-nine transects have been laid down at mid elevations within Siruvani Hills and all the data listed in the data sheets quantified. The results have been consolidated and the trends in the lichen distribution pattern analysed. The results reveal that the lichen community with *Porina mastoidia* (agg.) as a dominant member indicated the sites with a long ecological continuity. This community also possesses *Phyllopsora parvifolia*, *Leptogium cyanescens*, *L. denticulatum* and species of *Pyrenula*, *Megallospora* as other members.

The other lichen community indicative of forest disturbance possesses species of *Parmelia* as a dominant member. The other members of this community are species of *Heterodermia*, *Brigantiaea*, *Graphis*, *Lecidea* etc. The lichen species belonging to both these associations form assemblages depending upon the varying levels of the ecosystem continuity/disturbance prevailing in the sites. These pattern changes also indicated the

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effectiveness of the methodology developed and used for this study.

A "Field Level Training Programme on Biomonitoring using Microbial Diversity" was conducted from 10-13 March '99 based on the trends of the study. The participants were from the Forest Department, Pollution Control Board, NGOs and Colleges. The course emphasised the need to study and conserve microbial diversity in the light of Agenda 21. Various components of microbial diversity, field demonstrations and interactive sessions with the foresters and local communities as well as lab studies were included in the course. A training manual was also prepared, based on the experiences in the area of research.

Subprogramme Area 208 Conservation and Bioprospecting of Endangered, Medicinal and Mangrove Plant Species

This programme envisages conservation of endangered/medicinal plants, mangroves and their associates through calculated intervention of conventional (e.g. seed and vegetative propagation) as well as biotechnology tools (e.g. tissue culture and bioprospecting) with due consideration to conserving maximum possible intra- and inter-specific genetic diversity. Since the inception of this programme, large scale tissue culture protocols have been developed in twenty endangered/medicinal plants and five mangroves and their associates. Vegetative propagation protocols were developed in five endangered/

medicinal plants and fifteen mangroves and their associates. Successful field transfer of over 15,000 micro-propagated plants was done and their performance is being monitored periodically. In continuation with the ongoing research activities the following progress was achieved in conservation and bioprospecting studies during the current year.

Studies on endangered/medicinal plants

Large scale micro-propagation of *Aegle marmelos*, *Curculigo orchioides* and *Syzygium travancoricum* has been a major achievement. Methods were developed to achieve maximum rooting efficiency and to reduce the mortality rates during hardening. Axillary shoot initiation and multiplication, using uninodal and binodal segments, was standardised in *Asparagus racemosus*, known for its anti-inflammatory properties. The best response was achieved in MS medium supplemented with BA and KN. Experiments are underway to induce rooting of regenerated shoots. Callusing was achieved from leaves of *Capparis zeylanica*, used for a broad range of ailments like pain, swelling, sores and *Jatropha gossipifolia* which has substantial molluscicidal activity. Studies are in progress to standardise organogenesis protocols in these species.

Genetic diversity studies were conducted using SPAR (Single primer amplification reaction) based on simple sequence repeats in *S.travancoricum*, to supplement the earlier RAPD based results. The results showed that the populations collected from various sites in the Western Ghats were highly heterog-

enous with narrow genetic distance. Thus all the accessions so far collected seem to constitute a single megapopulation distributed in the similar phytogeographical zone, which was fragmented in the evolutionary course, and/ or due to various natural and anthropogenic pressures.

Studies were conducted on *Syzygium travancoricum* to evolve short-term *in vitro* conservation strategies. The multiple shoot cultures developed through direct and indirect morphogenesis were cultured in MS (1962) medium supplemented with mannitol and sorbitol. The media supplemented with mannitol (0.5% to 3%) or sorbitol (0.5 to 1.0%) in the absence of sucrose resulted in browning and subsequent death of the cultures. Addition of sucrose (1.5%) in combination with mannitol or sorbitol was effective in maintaining the cultures upto 10 months without any subculturing. The multiplication rate and shoot elongation were good in mannitol-supplemented media compared to sorbitol-supplemented media. Also plants were green in colour in mannitol medium, while they turned pale green in the sorbitol-supplemented medium.

Seed germination trials in *S. travancoricum* showed that there was an increase in the germination rate when the seed was pre-treated with 0.01% HCl for 5 min, followed by cold treatment at 4°C for 10 hours.

The field evaluation trials of micropropagated *S. travancoricum* showed that the plants rehabilitated in Wayanad were performing better than in Gudalur gene pool area. Also the adaptability and growth performance of

tissue cultured plants were comparable with seed propagated plants in Wayanad.

Bioprospecting studies

Bioprospecting is a process through which value addition can be made to the biodiversity of the planet earth and it refers to discovering the potential use of every species for the benefit of society. Research in this area can provide alternatives to improvement in food, building material, fibre, medicines etc. to meet the demands of the growing population and, most importantly, the solid basis on which species can be conserved and sustainable management of biodiversity can be achieved. The emphasis has been on identification and characterisation of useful bioactive principles and issues related to intellectual property rights of ethnic communities to benefit the scientific as well as ethnic communities who work towards conservation of biodiversity.

The crude extracts from the leaves of *E. agallocha* exhibited antifungal activity against *Candida albicans* and *Aspergillus terreus*. Large-scale extraction from dried leaves was carried out by 2N HCl treatment and consequent extraction with chloroform. Fractionation of the crude extract using various solvents and combinations was standardised by column chromatography and the crude extract was repeatedly chromatographed and purified. Out of the three major fractions, two were bioactive and one was found to be β - sitosterol. Gas chromatography was done for the other fraction which indicated the compound to be in a highly pure state. Mass spectra, ¹H - NMR, ¹³C-NMR, 2D NMR

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analysis were carried out for the purified bioactive compound and is in the final stage of structural characterisation.

The efficacy of the crude extracts from leaves, stem, seeds, seed coat and fruits of *Jatropha gossipifolia*, was studied against human pathogens such as *Candida albicans* and *Aspergillus terreus* and plant pathogens like *Fusarium oxysporum* and *Pestalotiopsis sp.* and the fruits were found to be effective. The leaf extracts of *Capparis zeylanica* were studied against pathogens like *Candida albicans* and *Aspergillus terreus*. The crude leaf extract was found effective against pathogens like *Candida albicans* and *Aspergillus terreus*. The fractionation of the active principles is being carried out. Pest-repellent properties and pesticidal properties of *Lobelia sp.* are being studied against pests like *Heliothis*, *Spodoptera* and *Earias vitella*. The seed extracts of *Xylocarpus mekongensis* and the leaf extracts of *J. curcus* were ineffective against these fungi.

Various solvent extracts from four species of *Syzygium viz. S. gardneri*, *S. zylanica*, *S. leatum*, *S. travancoricum* were tested for their efficacy against *Candida albicans*, *Aspergillus terreus*, *Fusarium oxysporum* and *Pestelopsis spp.* *S. travancoricum* exhibited guaranteed activity against the test fungi. Phytochemical characterisation of the anti-fungal compound in this species is under way.

Studies on mangroves and their associates

Vegetative propagation protocols were standardised for some more mangrove spe-

cies viz. *Xylocarpus moluccensis*, *Sonneratia apetala* and *Intsia bijuga*. Three more plant species viz. *Salicornia bigilovii*, *S. brachiata* and *Intsia bijuga* were taken up for tissue culture studies. Callus initiation and establishment were standardised in *Intsia bijuga* using cotyledonary explants. Woody plant medium (Lloyd and McKown 1981) supplemented with 2,4-D, Casein hydrolysate and adenine sulfate gave the best response in initiation and further growth of callus. Experiments are underway to develop organogenesis/somatic embryogenesis protocols in this species. In the case of *Salicornia brachiata* direct shoot regeneration studies were initiated using mature embryo as well as seedling explants. Experiments are underway to achieve shoot elongation as well as multiplication. Micropropagated plants of salt and submergence tolerant wild rice relative, *P. coarctata* were field transferred to Pichavaram mangrove forest area.

Controlled pollination experiments between *R. apiculata* and *R. mucronata* were used to produce F1 hybrid. The hybrid embryo developed into mature propagule when *R. apiculata* was used as female parent with GA₃ (100 ppm) pretreatment 5 min. before pollination followed by 1 hr. after pollination. There were pollen tube growth abnormalities and embryo abortion when *R. mucronata* was also used as a parent when the flower buds were treated with BA, KN or a combination of both. The hybridity of the synthetic F1 was confirmed using RAPD analysis.

Molecular marker (AFLP and RAPD) based studies on the phylogenetic relationship of

P. coarctata T. with 20 species of genus *Oryza* showed that *O. australensis* is more closely related to *P. coarctata*. Also the results of cluster analysis based on AFLP and RAPD markers were mostly in accordance with that of previous classification of *Oryza* genus based on morphology, isosymes and Rubisco-LS proteins. Thus the present study also reestablishes the usefulness of AFLP marker system for studying genetic polymorphism and clarifying phylogenetic relationship between wild species.

Association of *Acremonium* endophyte and *Porteresia coarctata* is being investigated. *Acremonium* endophyte was isolated from the leaves and seeds of *Porteresia* and endophyte free plants were regenerated using micropropagation technique. Studies have been conducted on the genetic diversity in *Acremonium* isolated from *Porteresia coarctata* and other warm season grasses for the first time, using RAPD markers. The results showed very high genetic diversity levels of various culture isolates ranging from 60% to 100% among all the fifteen isolates studied. Cross inoculation of various culture variants is to be carried out to understand the significance of this endophyte association to *P. coarctata*.

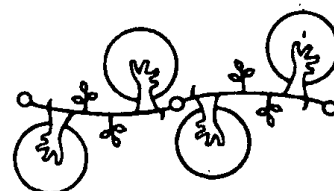
Sub Programme Area 209

Golden Jubilee Biotechnology Park for Women

The first Biotechnology Park for women will be coming up in Chennai under the joint

initiative of the Department of Biotechnology, Government of India, the State Government of Tamil Nadu and MSSRF. When fully functional it is expected to provide opportunities for remunerative self-employment for women entrepreneurs based on biotechnological enterprises with adequate support services in the form of technical and financial inputs. The Foundation Stone was unveiled by the Hon'ble President of India, Shri K. R. Narayanan, on 29 of July '98. The Golden Jubilee Biotechnology Park for Women has been registered as a Society under the Registrar of Societies Act on the 8 July '99. The bye-laws and Memorandum of Association were drawn up with the help of Tamil Nadu Industrial and Development Corporation (TIDCO). The office of the Society will be situated at the TIDCO premises. The members of the Governing Body were appointed. Prof. M.S. Swaminathan was requested to be the Chairman of the Governing Body. The other members were drawn from the Department of Biotechnology, Government of India, Industries Department, State Government, TIDCO, MSSRF, Women entrepreneurs, other R&D institutions and the financial sector. The appraisal of the project feasibility report, prepared by ITCOT, was carried out by Indian Overseas Bank and was presented during the first Governing Body meeting. The Architect is working on the design and preliminary work has been initiated at the site at Kelambakkam. It is expected that the first phase would be completed this year for the first batch of women entrepreneurs.

Programme Area 300



Ecotechnology and Sustainable Agriculture

A building to house the JRD Tata Ecotechnology Centre was inaugurated by H.E. the President of India on 29 July, 1998. Several capacity building and networking activities were undertaken by the CAPART Technology Resource Centre. A biocentre was established to serve as the hub of the biovillage movement. The B.V. Rao Centre for Sustainable Food Security initiated a Panchayat-led Hunger-free area programme in the Dindigal district of Tamil Nadu in association with the Gandhigram Rural Institute. A NABARD Resource Centre for Precision Farming for Poverty Elimination was established. Work on linking primary producers of horticultural products with the food processing industry, in collaboration with the Central Food Technological Research Institute, entered the operational phase.

301	JRD Tata Ecotechnology Centre	95
302	Biovillages	125
303	BV Rao Centre for Sustainable Food Security	139

Sub Programme Area 301

JRD Tata Ecotechnology Centre

The mission of JRD Tata Ecotechnology Centre is to link frontier science with traditional wisdom. The activities of the Centre, which began in 1996, underwent changes during 1998-99. Instead of a project approach based on specific technology, the Centre concentrated on an area approach. Three regions (Table 3.1) were focused on during this period: Chidambaram in Cuddalore district (coastal lowland ecosystem); Kolli Hills of Namakkal (hill ecosystem); and Kannivadi in Dindigul (semi-dry ecosystem). Facilities at Chennai are being used to support the field activities.

Important landmarks of the year are:

- H.E. the President of India inaugurated the new building, hostel and training centre on 29 July '98.
- Consolidation of the projects in terms of area approach
- Inauguration of the fresh water prawn hatchery
- Economic viability of Ecoaquaculture and Integrated Intensive Farming System(IIFS) models in Chidambaram
- Establishing the income-generation potentials of backyard ornamental fish breeding and sustainable fishery models at Keelamanakudi and MGR Nagar near Killai, in Chidambaram
- Establishment of two institutions and 25 Self-Help Groups (SHG) at Kannivadi
- 136 acres of land under seed production with 30,000 women labour days generated exclusively for seed production with Rs. 10 lakhs disbursed as wages for women labour in Kannivadi
- Integration of seed production, pulse production and biopesticide production in Kannivadi to facilitate a biovillage perspective
- 500 acres of land under *Trichogramma* cards in Kannivadi
- Bread and chapathis developed from minor millets, better understanding of the potentials of minor millets in Kolli Hills
- Inauguration of NABARD Resource Centre for Precision-Farming for Poverty Elimination
- Capacity building to the tune of 12,000 trainee days

Table 3.1 : JRD Tata Ecotechnology Centre-Project Areas-SAP 301

301.1	Chidambaram
301.2	Kolli Hills
301.3	Kannivadi
301.4	Chennai

Table 3.2 : *Ecotechnology models in Chidambaram*

No.	Model	Aim	Village
301.1.1	Ecoaquaculture	Sustainable production of prawn	Keelamanakudi
301.1.2	Management of village tanks	Improving the productive capacity of fish in village tanks and ponds	Parangipettai
301.1.3	Integrated Intensive Farming System	Biological intensification through greater inputs of renewable energy sources; resource-use efficiency; crop diversity; organic fertilisers; biological controls	Keelamanakudi
301.1.4	Sustainable income generation : backyard ornamental fish breeding	Enhancing the skills of rural poor landless women in backyard ornamental fish breeding for income generation	Keelamanakudi
301.1.5	Sustainable income generation-sustainable fishery using cast nets	Enhancing the skills of Irula tribals in fishery to enable them to earn more income without affecting the coastal wetland flora such as mangroves	MGR Nagar
301.1.6	Sacred groves	Studying the potentials of sacred groves as effective <i>in situ</i> conservation and storehouse of relict species	Suryampettai

301.1 Chidambaram

Models for sustainable development suitable for coastal regions are being studied in villages around Chidambaram. The models listed in Table 3.2 are being tested for their economic and social feasibility and environmental viability.

301.1.1 Ecoaquaculture

The project follows the principle of Low External Input Sustainable Aquaculture (LEISA). Ecologically sustainable aquaculture is adopted through maximum rainwater harvesting with zero water exchange method. In seven ponds (four of 500 m² and remain-

ing of 1,000 m²) rainwater was harvested using the northeast monsoon rains during September-December '98. The production details are given in Table 3.3.

The water level varied from 0.6 to 1.5 m in depth. There was no water exchange or replenishment and aerators were not used. Pond water quality was monitored fortnightly. Water temperature in these ponds ranged from 27.9 to 34°C. Dissolved oxygen (DO) ranged from 2 to 6.9 ppm and pH from 7 to 8.1. Every one rupee invested in the pond yielded Rs. 1.57. The bunds of the ponds have been used for cultivating rain-fed banana, chillies, radish, drumstick and various other vegetables.

Table 3.3 : *Production details of ecoaquaculture*

Total water spread area	0.5 ha
Date of stocking	28-10-98
Date of harvesting	14-5-99
Grow out period	195
Stocking density	5/m ²
Post-larvae (PL) stocked	25,000
Mean weight of PL	0.07
Survival at the time of harvesting	57.2%
Head on production	1024 kg/ha per crop
Average body weight (ABW)	36.83
Feed type	Commercial feed in pellet form
Food conversion ratio (FCR)	1:1.57

Interventions such as stabilising pH and managing DO were carefully made, keeping in view the lack of water exchange and level of organic loading. The FCR and productivity/ha were substantial. There is scope to improve the economics of the operation with measures such as isolating female animals after a certain period. Attempts will also be made to reduce the cost of feed without compromising on the nutrient composition.

This model is being attempted in a region which is heavily dependent on canal irrigation and monocropping of paddy. The focus is on developing a sustainable model of integrating aquaculture with agriculture and water harvesting. The farmers are being encouraged to observe and analyse the various dimensions of this model, before implementing it in their own lands. However, three farmers have already started implementing the model in their lands covering 2 ha.

301.1.2 Sustainable Management of Village Ponds

Village ponds have multi-purpose usage, mostly for non-irrigation purposes. The Panchayat manages most of these ponds, which are leased out to individuals who harvest the fish in the ponds. Very few efforts have been taken to improve the quality and productivity of these ponds. As common property resources, they can help in improving the village economy. There are not many studies regarding the status of village ponds. Hence the Centre took the initiative to study the status of these ponds and evolve policy measures to improve the quality and productivity of the ponds.

Parangipettai (near Chidambaram) has 41 Panchayats, which have leased out 141 ponds. These ponds have a water spread area of 55.73 ha, with an average size of 0.4 ha/pond. A study was carried out in all the 141 ponds.

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The results indicate a wide variation in productivity. Two types of ponds exist in this region, rain-fed and canal-fed. During the irrigation season, water flows through the canal-fed ponds and is drained through various channels. Thus, there is a regular water-exchange taking place in these ponds. In contrast, rain-fed ponds have more or less zero water-exchange systems. During the study it was observed that the villagers resist the practice of applying feed in rain-fed ponds as they feel that the feed may pollute the water. Table 3.4 shows that the productivity in canal-fed

ponds is much higher than in rain-fed ponds.

Management practices also significantly influence productivity (Table 3.5). However, there is a wide variation in the productivity/ha (as indicated by a high degree of standard deviation) reflecting lack of appropriate and uniform management.

The 141 ponds covering 55.73 ha have generated Rs. 7,49,563 per annum. The value of fish/ha is around Rs. 13,450. However, the majority of ponds have very low yield (Table 3.6).

Table 3.4 : *Productivity in various types of ponds*

	Total area (ha)	Productivity (kg/ha)
Rain-fed tanks	8.50	210.46
Canal-fed tanks	47.23	539.79 *

* significant at 1% level

Table 3.5 : *Productivity of ponds with different types of management*

Type of management	Total area (ha)	Productivity (kg/ ha)
Stocking & feeding	18.50	1,000.70
No management	37.23	273.39

Table 3.6 : *Value of fish sold from the ponds*

Value of fish/ ha (Rs.)	No. of ponds	% to the total no. of ponds
Less than 10,000	98	69.5
10,000 to 20,000	25	17.8
20,000 to 30,000	6	4.2
30,000 to 50,000	5	3.5
50,000 to 1 lakh	5	3.5
Above 1 lakh	2	1.4
Total	141	100.00

Table 3.7 : *Linear relationship between management inputs and productivity*

Category	No of ponds	Slope	Correlation coefficient	t (df n-2)	Coefficient of determination (r^2)
All Ponds	141	2.20	0.6049	7.18*	0.3659
Canal-fed ponds	114	2.23	0.5887	6.26*	0.3466
Rain-fed ponds	27	1.89	0.4081	2.88**	0.2286

* significant at 1% level ** significant at 5% level

The study examined the relationship between the value of management input/ha (denoted by A, which includes cost of stocking fingerlings, fertilisation, feed and other management costs) and value of output of fish per ha of pond (V/A). It was found (Table 3.7) that there was a linear relationship showing V/A against A for all the ponds and separately for canal-fed ponds and rain-fed ponds.

The analysis shows a positive significant relationship between V and A in all the ponds. Though there are other technical variables such as quality and quantity of water, variation in species-wise stocking etc. which determine the output, the regression analysis indicates that there is substantial scope to improve productivity through proper management.

The study has also analysed the social dimensions in the management of the ponds. It has initiated an intervention in which a group of women have taken over the management of the village pond. With technical and management information support from the project. In order to improve the potential of these ponds, the project is planning to initiate capacity-building programmes during

1999-2000 among panchayat leaders, lessees of the ponds and other people connected with the management of the ponds. It has also planned to encourage women (SHGs) to manage the ponds in a sustainable manner. Technical studies will be carried out in improving the viability of the ponds for fish production.

301.1.3 Integrated Intensive Farming System

The concept of IIFS is being demonstrated in a model farm at Keelamanakudi, near Chidambaram.

The model showed a productivity of 2.6 tonnes/ha, with a cost benefit ratio of 1:1.41. Fish production (through fish pond as well as paddy-cum fish culture) yielded 40.5 kg in 0.05 cents. The other important crop was banana in the bunds. The mushroom unit in the bunds yielded nearly 70 kg during the season.

With the help of the farmers, a comparative study was made between paddy (*Ponni* variety) produced under organic and conventional practices with large scale application of chemical fertilisers. The observa-

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tion was not made with a statistical framework. Two fields adjacent to each other were observed. Five plots of one m² in each of the plots were randomly selected and studied.

The paddy field with conventional practices had applied 11.5 kg of P and 4 kg of N for 8 cents of nursery area. In the main field, nutrients were applied @ 36:23:30 kg of NPK respectively/acre. In addition to this 8 cart loads of FYM were applied. In IIFS, seeds were treated with *Azospirillum* @ 200g/ha. Phosphobacteria was added in the nursery as well as in the FYM. Eight cart loads of FYM were used in the main field as a basal dose. Groundnut oil cake, poultry manure, 50 kg of neem oil cake and 50 litres of biogas slurry were also applied as top dressing from the 30th to the 45th day after transplanting. The results are shown in Table 3.8.

301.1.4 Income Generation Models: Backyard Ornamental Fish Breeding

A survey was conducted to review the impact of this intervention on the earning of the household. The analysis was based on data from all the households (numbering 102) of Keelamanakudi colony, including the 30 households who are involved in the project. All the households are landless agricultural labourers. The average household income of ornamental fish breeders was Rs. 9,620, whereas the other households earned an average income of Rs. 7,242 (this difference is significant at 1% level). The average annual income from the sale of fish (after excluding the feed costs) was Rs. 2,000. For 11 out of 30 families, the supplementary income earned from the fish sale contributed more than 30% to the total income. For one household, the contribution from the fish sales to the total income during the year of analysis is to the tune of 53%.

Table 3.8 : *Quality of paddy in different types of practices*

Parameters	Conventional farming practices with inorganic fertilisers	IIFS
No. of productive tillers/plant	19	14
No. of grains/ panicle	71.64	140.00
Weight of 1,000 grains (gm)	19.85	20.81
Grain yield/plant (gm)	27.79	38.96
Grain filling (%)	78.95	91.39
Harvest Index (%)	29.16	35.27

Table 3.9 : *Impact of ornamental fish breeding on household income*

	Ornamental fish breeders	Others	All the households
No. of Households	30	72	102
Average household size	4.7	6	3.9
Average annual income (Rs.)	9,620	7,242	7,941
Proportion of households with two or more dependents	43.3	30.5	34.3

The above table shows that the households involved in ornamental fish breeding have higher household size with two or more dependents compared to other households. This analysis raises an important managerial issue whether, larger household size with more non-working dependents is crucial for such income generation models. This issue would be further analysed during 1999-2000.

There are variations in the income flow among the participant households. Fifteen households had regular sales throughout the year and the rest had sales once in two months or intermittently and in these households 32% of the total income is derived from fish sales. For the rest of the participant households, fish sale contributed 16% of the household income. It has also been observed that significant income flow from the sale of fish is during March-May, i.e. during the lean season in agriculture. The flow is substantial during October-November, which is the peak agricultural season.

301.1.5 Income Generation Models: Skill Enhancement in Fishing among *Irulas* of Pichavaram

One section of the Irula tribe live adjacent to

the Pichavaram mangrove forest near Chidambaram. This tribe is a semi-nomadic, "small gaming and gathering" cultural group. They build bunds near the mangroves to restrict the movement of fish. The bunds disturb the natural tidal flow of water to the mangroves and affect the health of the mangrove system. In spite of this practice, almost all the families of Irula are living below the poverty line.

The Centre collaborated with the Coastal Wetland Programme of MSSRF at Pitchavaram to evolve methods which would help the Irula tribes to help themselves as well as protect the health of mangroves.

During the mobilisation process, the Participatory Rural Appraisal (PRA) identified that lack of skill in net-fishing and lack of finance to buy the net are the main reasons for the very low daily income. Irulas requested training in sustainable coastal fishery and forty-two members in the age group of 15 to 40 years from 90 households came forward to acquire the new skill. Resource persons were identified within the tribal groups and expert fishermen from the non-tribal fishing communities

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were requested to help them. The raining period was three months (July to September '98). The participants have formed an association and requested the Centre to provide nets on loan. The participants were also trained in making and repairing the nets. All the participants now use net for fishing. Bunding practices have been reduced to a substantial extent, facilitating the flow of water into the mangroves.

The Irula participants conducted a Participatory Monitoring and Evaluation programme (PAME) in which they used the survey method and studied the impact of the skill-enhancement in household income. The survey covered 66 of the 90 households in MGR Nagar near Pichavaram (Table 3.10).

The participants are training Iulus from other colonies. The Centre supported the Coastal Wetland Programme of MSSRF in building a

primary school. The tribal community shared the financial and managerial costs and the school was inaugurated on 1 May '99. During 1999-2000, the gender perspective in fishing would be further analysed.

301.1.6 Sacred Grove as Traditional *in situ* Conservation

Sacred groves as an *in situ* conservation measure offer insights into the traditional wisdom of the community. During 1998-99, the emphasis was on *Dimorphocalyx glabellus* var. *lawianus* (Figure 3.1). This species is abundant in the 15 acres of the Suriampettai Ayyanarkoil Sacred Grove. However, it has not been sighted anywhere else in the Cuddalore-Chidambaram region, and this is the first report from southern east-coast region, which matched with the specimen available in Madras Herbarium, Coimbatore.

Table 3.10 : *Impact of training on household income*

Type of households	No. of households	Household income from net-fishing * (Rs.)	Household income from fishing through groping ** (Rs.)	Household income through crab catching ** (Rs.)	Average household Income (Rs.)
Net users	23	4,311 (58.8%)	3,019 (41.2%)	Nil	7,330
Non Net Users	30	Nil	4,224 (100 %)	Nil	4,224
Crab Catchers	13	Nil	1,226 (15.8%)	6,514 (84.2%)	7,720

* income from December '98 to May '99 ** income from June '98 to May '99

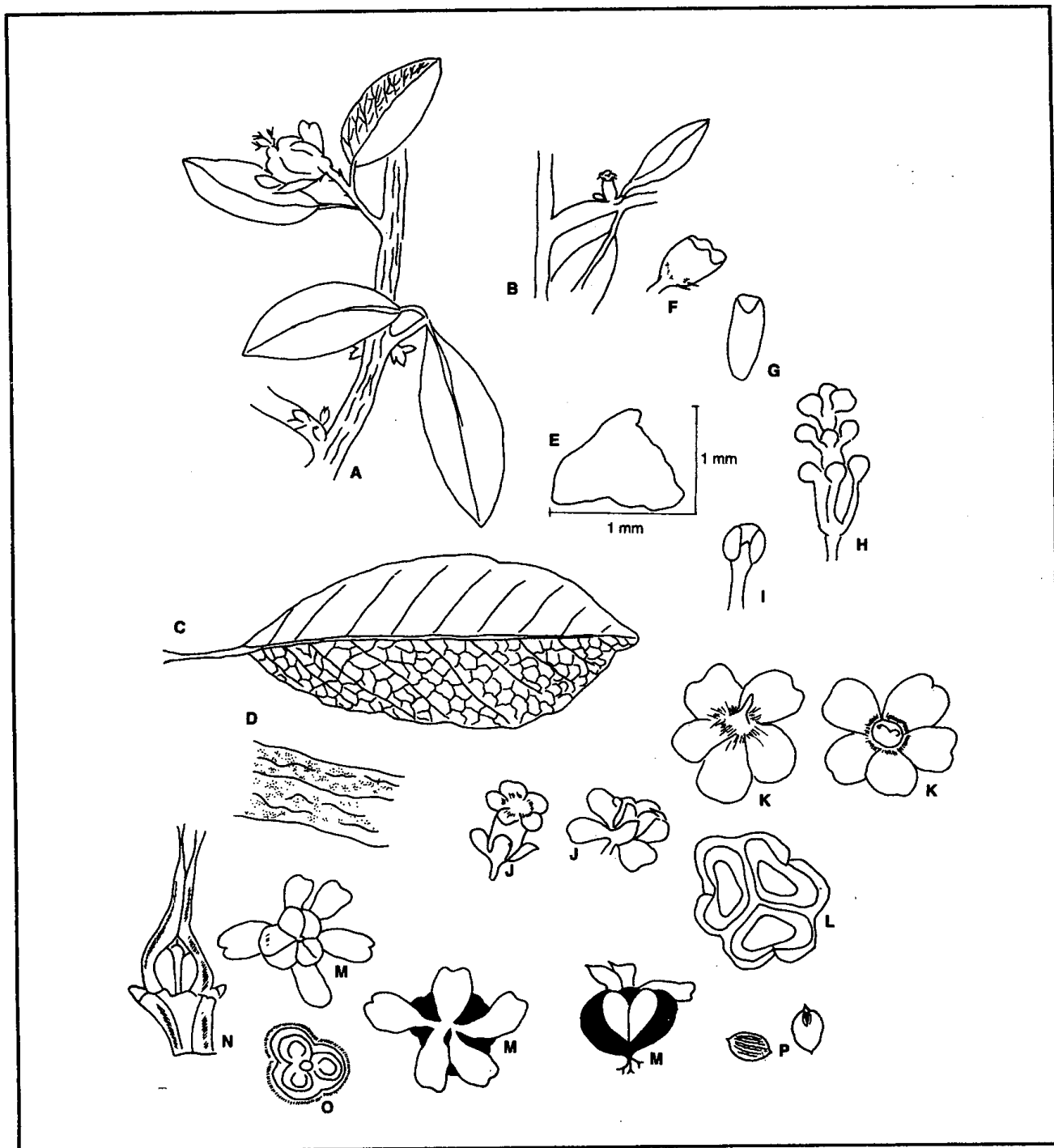


Figure 3.1 : *Dimorphocalyx glabellus* var. *lawianus*

A: Habitat with male flowers and fruits; B: Branch with sessile male flower; C: Leaf with reticulate venation; D: Bark with ribbed nature; E: Stipule structure; F-I: Male structure; F: Calyx; G: Petal; H: Androecium; I: Anther; J: Female flower; K: Calyx structure; L: CS of ovary; M: Fruit structure; N: LS of fruit; O: CS of fruit; P: Seed structure

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The specimen was studied thoroughly at the field site for its identity and taxonomical description and confirmed. The description is given in the box. This specimen has so far been collected in Karian shola, Coimbatore in 1937 and also in the Sivagiri Hills, Sethur Hills and Nagariar estate in the eastern slope of the Western Ghats in Tamil Nadu in 1979. This species has been noticed in the evergreen forests of Western Ghats of Karnataka, Kerala and Maharashtra, above 1,000m MSL

elevation. The presence of this species in the sacred grove of Cuddalore district which comprises tropical dry evergreen forest vegetation located at 100m MSL may offer insights into the past geography and the role of sacred groves in conserving relict species.

According to the villagers, this species has not been noticed anywhere else except in the sacred grove of their village. The bark of this species is used as a laxative. Local people

Description of *Dimorphocalyx glabellus* var. *lawianus*

Dimorphocalyx glabellus var. *lawianus* plants are mostly dioecious bisexual and rarely unisexual. Plants are shrubby probably due to the felling of branches for fencing and fuel. Plants occur as a single population in sandy red soil. This plant grows abundantly with others such as *Atalantia monophylla*, *Memecylon umbellatum*, *Glycosmis mauritiana*.

Leaf size 8-9 x 2.7-3.8 cm, thick, glabrous, elliptic to lanceolate, elliptic to obovate, acute to obtuse, entire, acute Petiole 1.3-2 cm, stipulate, opposite, diameter 1x1 mm length, opposite to the leaves, hairy brownish, white patch on the surface. Leaf alternate, pinnately nerved, lateral veins, 8-14. Branchlets brownish, white bark of branchlets ribbed, rough inflorescence: male sessile, absence of pedicel, attached at the node. Flowers axillary cymes 2-3 in clusters, whitish (1.1 x 5 cm), stalk 2-3 mm calyx 5, cup shaped, connate at the base, gland dotted, acute, salvar form, 5 mm across, white hairy corolla 5, 9.8 mm long, free, imbricate (all fives are out and in), whitish androecium, anther yellow upper, 3 middle, 6 lower, 5 filament length lower 2mm, middle 1mm upper. 8 mm, anther lower 5mm middle 0.3mm upper 0.8 mm, pollen yellow, globose. Male branch leaf alternate, thick, coreaceous, (9-12 x 4.2-5 cm), lateral veins 8-16. Petals 1.3 cm long. Inflorescence : Female solitary or axillary cymes (2-3) numbers. Flower white, pedicle 2.5 cm, peduncle 3mm, calyx shape, imbricate 5, 1.9 cm long, ovate, entire, emarginate. Corolla 5, white, free, imbricate, 0.8 cm long. Gynoecium 4mm long, ovary superior, trilocular, axile, syncarpus, ovule one in each locule, style short, stigma split in to 3, each bifid, connate at the base. Fruit Capsule, 3 seeded. 1.5 cm long, longitudinal dehiscence, persistant stigma, blackish when matured, accrescent calyx. Seed 10 mm long, white, flat compressed, ovule shiney, brownish, white spots, globose 0.4 mm long.

also use the branches for fuel and fencing. However, uprooting of any plant inside the sacred grove is prohibited. The plant occupies one third of the total area of the sacred grove. Larger trees provide microclimatic niche for the survival of the species. Certain studies have argued that based on the pollen and fossil evidences of the present Cuddalore region, that this coastal region was occupied by lush evergreen forests in the lower Cretaceous period.

The existence of a species in the lush evergreen forests occurring in a sacred grove of tropical dry evergreen forest raises the following questions:

- Could it be a relict species of the past vegetation, survived through the conservation mechanisms of the sacred grove?
- Is it scientifically not recorded disjunct distribution or endemic plant?
- Has a wide range distribution taken place through frugivore birds?
- Has it been intentionally or unintentionally planted by the early people for some reasons?

These are the issues which will be probed during 1999-2000.

301.2 Kolli Hills

Attempts were continued to include minor millets in the daily diet of the people. The activities relating to evaluation of minor millets are listed in Table 3.11.

301.2.1 Effect of Various Sources of Organic and Inorganic Manure on Productivity of Little Millet (*Panicum sumatrense*) Landraces

A field experiment was carried out at Namakkal, which is at the foothills of Kolli Hills, under irrigated condition during *kharif* 1998. Two sets of experiments using two different races, short duration race (*mallai samai*) and long duration race (*kattavetti samai*) were laid out in randomised block design with three replications and five treatments (Tables 3.12 - 3.13). Soil of the experimental site was clay loam with neutral pH. The treatments were:

T1 - control, T2 - *Azospirillum*, T3 - Farmyard manure, T4 - Chemical fertilisers and T5 - Poultry manure. The above nutrient sources were applied at the rates, which supplement 20:40:0 kg of N, P and K/ha. The recommended plant density of 4,00,000/ha was maintained and irrigation was given at fortnightly intervals when there was no rain.

Table 3.11 : *Activities relating to minor millets project*

301.2.1	Effect of various sources of organic and inorganic manure on little millet
301.2.2	Evaluation of landraces of little millet
301.2.3	Diversity and differentiation among traditional landraces of little Millets
301.2.4	Food fortification studies

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Table 3.12 : *Effect of different sources of nutrients on growth and productivity of little millet landrace – mallia samai*

Treatments	Characters						
	Plant height (cm)	No. of leaves/plant	No. of productive tillers/plant	Length of the panicle (cm)	No. of grains/panicle	Grain yield/plant (g)	Harvest index (%)
T1	65.67	171.33	43.33	25.33	372.33	15.40	18.73
T2	67.33	182.33	42.33	24.0	405.67	15.43	21.70
T3	67.67	187.67	38.33	23.67	326.33	14.03	19.23
T4	65.67	177.67	27.00	23.17	338.67	11.40	16.83
T5	68.67	184.67	29.67	26.00	448.00	13.73	18.73
SEd	NS	NS	S	NS	NS	S	S
CD	6.39	22.7	5.73	4.90	87.5	1.38	1.16

(p=0.05)

NS - Non Significant; S - significant

Table 3.13 : *Effect of different sources of nutrients on growth and productivity of little millet landrace – kattavetti samai*

Treatments	Characters						
	Plant height (cm)	No. of leaves/plant	No. of productive tillers/plant	Length of the panicle (cm)	No. of grains/panicle	Grain yield/plant (g)	Harvest index (%)
T1	79.67	172.33	24.00	23.33	332.67	26.33	16.13
T2	82.67	189.67	23.67	26.33	274.67	25.57	16.07
T3	87.0	184.00	23.67	30.67	348.67	26.73	15.00
T4	76.0	177.33	25.33	25.67	268.67	22.27	14.23
T5	64.0	179.67	26.33	23.67	249.33	24.33	14.80
SEd	NS	NS	NS	NS	NS	NS	NS
CD	20.57	19.37	6.57	7.54	142.00	5.47	2.67

(p=0.05)

NS - Non Significant

The indications are that the short duration race is more responsive to the added nutrients and the crop needs less amount of nutrients for growth and production of the grains. The application of *Azospirillum* results in higher yield with good harvest index.

The study will be conducted again during 1999-2000 along with the nutrient management related to soil dynamics at Kolli Hills as well as in Namakkal.

301.2.2 Evaluation of Landraces of Little Millets of Kolli Hills

A study was carried out to assess the genetic

advance and heritability parameters of seven races of little millet along with one improved variety for seven direct and indirect characters. The estimated value of the components of variance and their co-efficient, heritability and genetic advance are presented in Table 3.14.

The study has shown that plant height, number of grains/panicle, number of leaves, plant and harvest index can be considered as reliable indicators for selection of ideal plant types as they have high heritability and genetic advance as compared to the other characters.

Table 3.14 : *Evaluation of landraces of little millets for seven characters*

Parameters	Mean	F Value	PCV %	GCV ^s %	ECV ^o %	Heritability	Genetic advance of mean
Plant height (cm)	81.07	11.07	18.02	8.62	15.81	86.5	32.29
No. of leaves/plant	141.04	20.87	16.95	6.20	15.77	77.04	26.87
No. of productive tillers/plant (cm)	27.25	5.90	16.15	9.95	12.72	62.05	20.62
Length of the panicle	26.75	7.24	15.49	8.82	12.73	67.56	21.68
No. of grains/ panicle	332.54	11.01	22.57	10.79	19.7	77.00	35.66
Grain yield/ plant (g)	24.35	6.95	18.57	10.75	15.41	66.50	25.61
Harvest Index (%)	26.55	16.25	35.73	14.48	32.66	83.54	61.05

* phenotypic crop variance, ^s genetic crop variance, ^o environmental crop variance

301.2.3 Diversity and Differentiation among the Traditional Landraces of Minor Millets

The landraces (11) of the millets collected from the field, the same races grown in greenhouse were analysed for the variations in genomic DNA using random arbitrary primers. The 11 random primers used for amplification of genomic DNA scored a total number of 82 loci but did not reveal any polymorphisms between them.

These landraces, based on RAPD analysis, displayed about 30 per cent polymorphic loci on pair-wise comparisons. However, these variations were not evident among all the samples analysed. This has resulted from the discrete variation among the two groups of genotypes. Broadly eight genotypes/landraces showed a similar profile, while the remaining three were distinctly different from them. When the seeds collected from these landraces were grown in the same sets of environmental conditions (*i.e.* in the greenhouse at MSSRF), although phenotypic variations were observed, all the samples displayed a similar profile, pointing to the fact that these samples are absolutely similar. This primarily implies that genotypes grown under similar environmental conditions had no variations with respect to their RAPD profiles.

The observed variability in the field grown genotypes could therefore well be attributed to the physical environment of the areas where these landraces have been grown. This is primarily because of the fact that the selection process practised by the farmers for

particular morphotypes, would obviously have resulted in narrow genetic variation by eliminating large morphological variability. It is therefore expected that the morphological variability as selected by the cultivators would vary to a large extent depending on the local environment and choice of a particular variety. This has however, not been reflected in terms of the genetic variation among them. This is further complicated when the amount of variability in these genotypes is lost when grown under controlled environmental conditions. Whether this could be attributed to "phenotypic plasticity" needs further detailed investigations. Investigations including a number of additional genotypes from diverse eco-geographical conditions are underway. However, based on these preliminary observations, it could be logical to think that the landraces of some of the species of minor millets have a narrow genetic base. Whether this has been due to their long cultivation history needs to be studied in great detail.

301.2.4 Food Fortification Studies

Presence of large-scale micronutrients such as iron, calcium, Vitamin C etc. can provide micronutrient deficient countries like India with a new avenue in strengthening food security. Creating an economic stake in conservation is an important strategy for sustainable development. The nutrient contents of minor millets offer scope for creating an economic stake.

During 1997-98, the project identified a specific land race of little millet, *sadan samai*. In 1998, an attempt was made to make bread

out of little millet on a trial basis with the help of a major bakery. Before testing *sadan samai* with the bread, an attempt was made to study certain parameters, which are essential for food fortification, the results of which are given in Table 3.15.

The absence of trypsin inhibitor activity and aflatoxin offer scope for *sadan samai* in food fortification. However, the Protein Dispersability Index and water absorption capacity may necessitate a critical look, particularly with reference to the bakery industry.

The initial attempt with 25% little millet did not provide stability. The bread turned out to be very crumbly and dry in spite of the

addition of gluten. Hence, in the second round of experiments, 10% flour of *sadan samai* was mixed with regular ingredients of bread. However, the micronutrient solution was not added in the bread with little millet, whereas the regular bread was enriched with vitamins. These breads when further tested for their micronutrient contents revealed that the contents (iron, calcium and vitamins) were substantially high in millet bread compared to regular bread, which was enriched with vitamin solution (Table 3.16). In addition, the bread made with 10% addition of *sadan samai* was more stable and did not show the crumbly quality and dryness as witnessed in the bread with 25% of it.

Table 3.15 : *Various physical and biochemical properties of sadan samai*

Parameters	Results
Water absorption capacity (g/g)*	0.88+0.06
Protein Dispersability Index (%)*	20.99+0.6
Trypsin Inhibitor Activity*	Not Detectable
Acid Insoluble Ash (W/W)**	< 0.10%
Crude Fibre (W/W)*	< 0.10%
Aflatoxin B1, B2, G1 & G2**	Below Detectable Limit (Detection Limit: B1, G1, 5 ppb each; B2, G2, < 1 ppb each)

* Analyzed by Central Food Technological Research Institute, Mysore 1998

** Analysed by SGS India Limited, Chennai 1998

Table 3.16 : *Micronutrients in different types of breads*

Micronutrients*	Regular bread enriched with vitamin (mg/100g)	Little millet bread without enrichment of vitamin (mg/100g)
Iron	3.20	2.5
Calcium	2.0	1.20
Vitamin C	9.49	7.02

* Samples analysed at SGS India Ltd., Chennai, 1999

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For the palatability and the response of the consumer, a test was made with 24 respondents. The response showed that bread with little millet received scores from moderate to poor whereas the regular bread was evaluated from excellent to good. Colour, appearance, taste, texture, aroma and chewiness were the traits which were studied in this exercise.

The experiment indicates that while fortification of bread with little millet is possible, efforts have to be taken to improve the taste, colour, texture and aroma. An improvement in these qualities will enable little millet to find a niche in the organised sector. Such a demand will help in strengthening the role

of little millet in regions like Kolli Hills.

With another leading bakery in Chennai, the project attempted to fortify regular bread with 30% of two landraces of little millet *kattavetti samai* and fox tail millet, *koran thinai*. These breads were compared with the regular bread produced by the bakery for micronutrients. The results are found in Table 3.17.

Koran thinai shows promises for enriching the bread with iron, zinc and protein. Preliminary observations reveal that the different landraces of little millets from Kolli Hills have different potentials in terms of micronutrients. This will be further probed during 1999-2000.

Table 3.17 : *Micronutrients in breads fortified with minor millets*

Parameters*	Samples		
	<i>Kattavetti samai</i> (30%)	<i>koran thinai</i> (30%)	Regular bread
Carbohydrates % (W/W)	81.42	81.15	84.79
Protein % (W/W)	13.61	14.73	10.73
Fat % (W/W)	2.58	1.59	2.50
Energy Value (Kcals/100g)	382.99	377.54	380.58
Calcium as Ca % (W/W)	0.05	0.047	0.07
Phosphorous as P % (W/W)	0.12	0.13	0.13
Iron as Fe (ppm)	29.91	33.83	28.02
Zinc as Zn (ppm)	19.70	24.51	12.21
Copper as Cu (ppm)	3.51	3.35	3.21
Vitamin A (IU/g)	12.68	15.24	14.30
Vitamin B1 (mg/g)	76	220	240
Vitamin B2 (mg/g)	120	89	120

* Samples analysed on dry basis by SGS India Ltd., Chennai, 1999

Attempts were made to mix two landraces of little millets, *mallia samai* (MS) and *thirirkula samai* (TS) with *chapathis*. These *chapathis* were compared with regular *chapathis* made from wheat flour with a brand name (WF). The *chapathis* were checked in room temperature ($33\pm 1^\circ\text{C}$) as well as under air conditioned temperature ($25\pm 1^\circ\text{C}$). WF was used as control. For the experiment, in two samples 20% of MS and TS respectively replaced wheat flour. All other ingredients were the same. With WF substantial amount of bacteria and a few fungal colonies were observed after 48 hours of incubation in the control with 100 and 25% colonisation, at room temperature and air conditioned room respectively.

In the case of MS, the colonisation started only after 72 hours, with 35 and <5% in room and air conditioned temperature respectively. On the other hand the reverse was observed with TS i.e. <5 in room temperature and 15% in air-conditioned temperature. The longer shelf-life of *chapathis* with little millets and the differential performance of the two landraces of little millets from Kolli Hills will

be further studied during 1999-2000.

The present study made an attempt to understand the traditional food items made out of minor millets by the Malayali tribe of Kolli Hills (Table 3.18). Using the methods of Participatory Rural Appraisal (PRA), the method of preparing the following traditional food items was documented.

There has been a major decline in the consumption of these food items. The difficulty in pounding is given as a major reason for avoiding the traditional food items. Common millet, little millet and Italian millet have easily detachable husks while kodo millet has a multi-layered hard husk which makes the pounding operation a more difficult task. The tribals also point out that the poor storage life compared to other cereals and major millets is another reason for the decline in the consumption of minor millet based food items. The project has been trying to develop simple low-cost dehusking units and it has approached technical institutions for support.

Table 3.18 : *Traditional food items of Kolli Hills*

Landraces	Varieties				
	Boiled millet	Porridge	Fried snack	Deep fried snacks	Other items
Little millet	<i>Sorru</i>	<i>Kanji & Kali</i>	-	<i>Murrukku</i>	<i>Upuma</i>
Italian Millet	-do-	-do-	-	<i>Murrukku</i> <i>Athirasam</i> <i>Kachayam</i>	Flour (<i>Mavu</i>)
Common Millet	-do-	-do-	<i>Paniyaram</i>	-	-
Kodo Millet	-do-	-do-	-	-	-

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On 3 August '98, the project took part in the annual temple festival at Arapaleeswarar Temple and exhibited a stall of traditional and modern food items prepared with minor millets. More than 3,000 people visited the stall.

301.3 Kannivadi

Kannivadi and the surrounding villages are in the semi-dry region of Dindigul district of Tamil Nadu. Since 1996, two projects (seed village and farm level biopesticide production) are being implemented in Kannivadi, Srengapuram and Vadugapatty.

301.3.1 Seed Village

The seed village project focuses on adding value to the two assets of rural poor: time

and labour. In Kannivadi, agricultural women labourers and farmers are being trained to enhance their skill in quality seed production. Since the inception of the project in 1996, 2,455 men and women were trained for 19,712 days in different aspects of seed production and management. The intensive training encouraged the farmers to take up seed production. The area under seed production has been increasing steadily from 18.6 ha in 1996-97 to 54.6 ha in 1998-99.

Seed production was done in various horticultural crops (Table 3.19). *Bhendi*, cotton and cluster beans were the most important crops cultivated by farmers. During 1998-99, hybrid *bhendi* in 6.4 ha and open pollinated *bhendi* were cultivated in 16.8 ha.

Table 3.19 : *Crops, area and women labour absorption under seed production*

Crops	Area (ha)	Women labour days/ha	Total women labour days
<i>Bhendi</i> - hybrid	6.4	612.5	3,920
<i>Bhendi</i> - open pollinated	16.8	45	756
Cotton - hybrid	7.2	3,000	21,600
Cotton - open pollinated	8.4	120	1,008
Tomato hybrid	1	1,250	1,250
Cluster beans	9.6	120	1,152
Bitter gourd	2.4	-	-
Ridge gourd	1.6	240	384
Watermelon	1.2	120	144
Total	54.6	5,507.5	30,214

One of the important indicators of development in this project is the labour absorption in agriculture. Women labour absorption exclusively for seed production activities such as hybridisation, seed processing and seed quality management is around 552.5 women labour days/ha.

The average wage rate for hybrid seed production is Rs. 35; for a 6-hour workday with tomato, it is Rs. 40. In contrast, the daily wage for an 8-hour day for regular agricultural operation among women is Rs. 25. During 1998-99, according to the estimate of the project (which includes the imputed wage rate for family labour), more than Rs. 10,57,000 has been paid as wages to women for seed production activities alone.

The project found that the recommendation of the seed companies for fertilisers are very high and hence suggested replacing a major portion of nitrogenous fertilisers with farm yard manure, vermicompost, green manure and other organic fertilisers. In the initial stages, the farmers have replaced 30% of the inorganic fertilisers with organic fertilisers. The project has also made mandatory that all the pesticides should have a neem oil base. The project also specified the area per farmer for seed production keeping in view the issues of biodiversity. In addition to seed production the farmers are encouraged to grow traditional varieties.

A household survey was conducted during 1998-99 in Pudupatti village. All the 340 households were covered by the survey. The preliminary results of this analysis show that the average net income in the case of hybrid

seed is Rs. 15,698 per acre and in the case of open pollinated seed production, it is Rs. 4,936 per acre. Women were involved in 4,997 labour days in hybrid seed production fetching them a total income of Rs. 1,67,300 during 1998-99. In the case of open pollinated seeds (including various other agricultural operations), they were involved in 7,757 labour days with a total income of Rs. 1,81,800.

One of the important objectives of the project is grassroot institution building. Reddiar Chatiram Seed Growers' Association was formed and registered during 1998-99. It has 150 farmers and women agricultural labourers as members. This association is now negotiating with seed industries on behalf of its members. Its objectives are to protect and support its members in seed production activities, human resource development in seed production and management and improving the economic conditions of seed producers and labourers involved in seed production. Centre for Sustainable Agriculture and Rural Development Research & Action (CENSAR) is a non-governmental organisation with farmers and agricultural labourers as its members. This organisation was formed with the support of the project. Its aims are to encourage the villages in and around Kannivadi in sustainable development through participatory research and development. 25 SHGs have been formed with more than 450 members. Using savings and credit as major intervention, the SHGs are involved in developing value addition activities in the agricultural sector. The project is analysing the impact of these interventions in the quality of life of rural poor.

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301.3.2 Farm-level Biopesticide Production

The mass production of *Trichogramma* using *Corcyra* at the farm and rural household level without any major instrumentation and control became the focus of the project. Using the limited resources of farm households, the project identified the production process. While culturing and feed preparation took place at the household level, sterilised using common resources, and UV lamp. During 1998-99, 20 women from Vadugapatty village near Periakulam of Theni district took part in refining the production process of *Corcyra* and *Trichogramma*. A production centre was established at Kannivadi and farmers have been identified to participate in the mass production of biopesticides.

6,000 cc of *Corcyra* eggs were produced from 400 trays. Out of this, 3,000 cc was marketed (as a initial marketing trial), 300 cc was used as inoculum and remaining 2,700 cc was used for trichocard preparation. These trichocards were distributed as per Table 3.20 for the control of *Helicoverpa armigera* in cotton,

tomato, *bbendi* and sugarcane internode borer.

Since the production process takes place at the village level, the project tested the feasibility of certain simple interventions to increase the productivity and parasitisation rate.

The effect of temperature on Corcyra cephalonica at the farm household level

One of the major problems in culturing *Corcyra* is the impact of temperature on production and parasitisation rates. In the absence of temperature and humidity controlling instruments at the rural level, an efficient production process using the low cost local resources is required. Therefore an experiment was launched at the project site.

The temperature was maintained between 30 and 33.2°C by thatching the roof and wetting the gunny bags in the room, twice a day at 8 a.m. and 2 p.m. Control was maintained at normal room temperature. Since the objective of the study was to improve the production of *C. cephalonica* at the farm level, no other equipment was used to control the

Table 3.20 : *Distribution of trichocards to the farmers/sectors*

	Trichocard issues (cc)	Area covered (ha)
Vadugapatty	800	110
Srengapuram	305	40
Kannivadi	375	50
Marketing Agencies	255	-
Inoculum	690	-
Wastage	275	-
Total	2,700	200

temperature and relative humidity. The temperature in the trays and the room were noted at 8 a.m., 12 noon and 4 p.m. daily from the first day of inoculation to the last day of egg harvest and the egg production was recorded. The results are given in Table 3.21.

Though the difference in the temperature ranged between 1-2°C with the RH 2-5%, the peak of production was attained 2 weeks earlier than the control. The study shows the possibilities of increasing the production by using simple techniques. By adopting the same technique, the eggs produced were found to be healthy with higher parasitisation rate.

The influence of card colour on the rate of parasitisation

The objective of this experiment was to

select a suitable colour of cards for better parasitisation. The experiment consisted of six treatments (brown, red, blue, green, yellow and white) with five replications each. Each card was inoculated with 2 cc for parasitisation. After parasitisation, the number of parasitised and non-parasitised *Corcyra* eggs were counted from 1 cm² area as random @ of 5 counts/replication. From replication values, percentage of parasitisation was worked out. Among various card colours, blue and green cards attained maximum percentage of parasitisation. Though the differences between the parasitisation rate among various colours were statistically non-significant, the project has began to use colour cards of green, blue and yellow.

Table 3.21 : *Effect of temperature and RH on mass production of Corcyra*

No. of weeks after inoculation	Control temp. (C)	Treatment RH (%)	Eggs (cc)*	Temp. (C)	RH (%)	Eggs (cc)*
6	33.8	64.4	8.45	32.4	68.2	17.5
7	33.7	69.5	16.0	33.2	76.6	38.7
8	31.7	65.5	37.7	30.7	71.2	77.0
9	32.6	62.9	60.7	31.4	70.5	76.5
10	32.7	64.1	83.2	31.8	70.6	69.0
11	32.9	60.3	63.5	31.9	69.4	40.2
12	33.2	62.1	34.8	32.7	68.6	19.1
13	31.7	67.8	16.7	31.6	73.8	8.0
Mean	32.8	64.6	40.2	31.8	71.1	43.26
	±0.8	±3.0	±26.7	±0.6	±2.8	±27.8

* total from 21 trays

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Table 3.22 : *The influence of card colour on the rate of parasitisation*

Card colour	Parasitisation (%)
Red	83.20
Brown	82.95
Blue	84.46
Green	84.51
Yellow	83.96
White	79.56
F Value	1.832 *

* Not significant

The effect of storage period on the rate of parasitisation

The efficiency of parasitisation reduces as the storage time of treated eggs of *Corcyra* increases. The eggs were treated at zero hours and stored for different periods (0, 12, 24, 48, 72, 96 hours) and tested for parasitisation rate. The zero hours stored eggs were highly efficient (88.5%) compared to all other treatments. As the storage period increases a gradual decrease in parasitisation

rate was noted (67.8% after 96 hrs) (Table 3.23).

This study has helped the project to develop a production plan based on the time of planting of various crops so that cards with high parasitisation rate could be sold to the farmers. This project has already been initiated at Kannivadi, where a SHG called *Poomani Pengal Suya Udavi Sangam*, consisting of 20 women, are planning to take up the production and marketing of

Table 3.23 : *The effect of storage period on the rate of parasitisation*

Storage time (hours)	Parasitisation (%)
0	88.52
12	85.34
24	83.26
48	80.99
72	72.44
96	67.86
F Value	21.50 *

* Significant at 1% level

biopesticide. During 1999-2000, they will be trained in production, management and marketing. During 2000-2001, they will contribute a major portion of the running cost of the Sangam. During the third year, they will buy the infrastructure from the project and contribute the entire running costs.

301.4 Chennai

JRD Tata Ecotechnology Centre conducts many studies in its laboratories at Chennai (Table 3.24) as a support service to its activities in Chidambaram, Kolli Hills and Kannivadi. It has a prawn hatchery operating on the principles of resource recycling. Hostel facilities and training infrastructure make it possible to conduct training programmes regularly. Seminars and conferences at the national and international levels help to strengthen the policies towards ecotechnology.

301.4.1 Farm Level Biopesticide Production: Study of *Helicoverpa armigera* for NPV Production

Helicoverpa armigera is considered to be the world's most cosmopolitan and polyphagous pest, possessing high mobility, high fecundity and facultative diapause. It survives in any habitat. Since 1997, the project has been attempting to study the possibility of host specific variations at the sub-species level. The early morphological studies in the project could not offer any insight into the issues and hence, a detailed biochemical study of the pest was carried out during 1998-99.

The pest *H. armigera* from *bhendi*, cotton and redgram were collected and reared under laboratory conditions up to three generations (hereafter referred as LG1, LG2 and LG3), and its fecundity rate is given in Table 3.25. The cellular constituents, total sugars, reducing sugar and total soluble protein were estimated (Table 3.26).

Table 3.24 : *Activities at the Centre in Chennai*

301.4.1	Farm level biopesticide production of <i>Helicoverpa armigera</i>
301.4.2	Biofertilisers and organic fertilisers
301.4.3	Drumstick seeds for deflouridation efficiency
301.4.4	Low cost green house
301.4.5	Eco aquaculture: fresh water prawn hatchery
301.4.6	Capacity Building

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Table 3.25 : *Fecundity status of Helicoverpa armigera under laboratory conditions*

Host plant	Generation	Fecundity	Hatchability (%)
Bhendi	Wild	800	40
	LG ₁	500	60
	LG ₂	300	50
	LG ₃	100	40
Cotton	Wild	500	50
	LG ₁	400	70
	LG ₂	300	60
	LG ₃	200	40
Red gram	Wild	300	40
	LG ₁	240	40
	LG ₂	150	30
	LG ₃	100	30

Table 3.26 : *Levels of cellular constituents in H. armigera*

Host plants	Generation	Constituents*		
		Total soluble protein	Total sugar	Reducing sugar
Bhendi	Wild	5.2±0.1	0.70±0.1	0.35±0.2
	LG ₁	4.1±0.1	0.64±0.2	0.30±0.1
	LG ₂	3.5±0.1	0.28±0.3	0.15±0.2
	LG ₃	8.1±0.1	0.40±0.1	0.20±0.1
Cotton	Wild	4.5±0.1	0.65±0.3	0.37±0.2
	LG ₁	3.2±0.1	0.35±0.1	0.17±0.2
	LG ₂	4.9±0.1	0.60±0.1	0.29±0.2
	LG ₃	10.7±0.1	0.90±0.1	0.40±0.1
Red gram	Wild	4.1±0.1	0.70±0.1	0.35±0.2
	LG ₁	3.6±0.1	0.47±0.2	0.23±0.1
	LG ₂	3.3±0.2	0.35±0.1	0.16±0.1
	LG ₃	5.50±0.1	0.40±0.2	0.30±0.1
CV		44.03	34.09	30.67

* mg/g fresh wt.

Each value mean of triplicate ± SE

Enzyme activities in *H. armigera*

Different enzymes viz., acid and alkaline phosphatases, isocitrate dehydrogenase, succinate dehydrogenase, malate dehydrogenase, alcohol dehydrogenase, lactate dehydrogenase, protease were assayed in the pest on *bhendi*, cotton and red gram from wild type to LG₃ generation. The result shows no significant deviation between generation as well as hosts.

Phosphatases

The acid phosphatase activity ranged between

193.2-195.0, whereas, alkaline phosphatase activity was slightly higher, ranging between 198.0-200.0 μM of phenol/min/mg protein.

Mitochondrial enzymes

The activity of all mitochondrial enzymes reduced slightly from wild to LG₃ and the reduction was highly significant in isocitrate dehydrogenase (70-50 in *bhendi*, 61-50 in cotton and 71.3-47.3 in red gram) compared to the other two enzymes. There was no major difference in succinate dehydrogenase (9.3-12.2) and malate dehydrogenase (167.0-176.4) enzyme units (Table 3.27).

Table 3.27 : Activity of mitochondrial enzymes in *H. armigera*

Host plants	Generation	Enzymes		
		Isocitrate dehydrogenase*	Succinate dehydrogenase ^o	Malate dehydrogenase ^s
Bhendi	Wild	70.0± 0.1	12.2± 0.2	176.4± 0.2
	LG ₁	68.2± 0.1	11.0± 0.1	174.0± 0.2
	LG ₂	56.3± 0.1	10.0± 0.1	168.0± 0.1
	LG ₃	50.0± 0.1	8.7± 0.1	170.0± 0.1
Cotton	Wild	61.0± 0.1	10.9± 0.1	171.8± 0.1
	LG ₁	56.3± 0.2	10.5± 0.3	169.0± 0.2
	LG ₂	50.0± 0.1	09.9± 0.1	167.0± 0.1
	LG ₃	68.2± 0.1	09.0± 0.1	170.0± 0.1
Redgram	Wild	71.3± 0.2	10.6± 0.2	170.7± 0.1
	LG ₁	68.2± 0.1	09.3± 0.1	168.0± 0.3
	LG ₂	50.0± 0.2	10.1± 0.2	169.0± 0.1
	LG ₃	47.3± 0.1	10.3± 0.2	159.9± 0.1
CV		15.29	9.35	1.57

* nM of a-KG formed/hour/mg protein

@ μM of succinate oxidised/min/mg protein

\$ Number of enzyme units/mg protein

Each value mean of triplicate ± SE

Alcohol dehydrogenase

The activity which ranged between 3.1 - 4.2 nM of NAD converted/min/mg protein was very meagre, with minute difference between the crops. However, the wild pests had slightly higher activity compared to their subsequent generations. In cotton the reduction (4.2-3.2) in activity was more from wild to LG₁ and increased in LG₂ when compared to other crops. Among the other two crops there was a gradual decrease from wild to LG₂, i.e., 3.9-3.2 and 4.0-3.1 in red gram and *bhendi* respectively.

Lactate dehydrogenase

The results clearly indicate that the pest could liberate more or equal amount of pyruvate in all the generations. The highest (240 mM) was found in redgram with significant difference among the other two hosts. The activity reduced by 20 mM in LG₁ generation; however LG₂ did not vary from that of LG₁.

Protease activity

There is no significant difference in the enzyme activity, which ranged between 196.6 nM of acid to 203.0, the lowest in redgram LG₁ and the highest in *bhendi* wild. The increase/decrease trend was not uniform.

The study indicates that while host-specific variations are insignificant, the diet has a major influence on production of constituents and enzyme activities. However, further studies in this line like isoenzymes, allelozymes and their genetic relationship using RAPD and RFLP tools will help to prove

its nature and thus further control measures may become easier. During 1999-2000, the study will focus on the relationship between host enzymes and the enzyme activities in the pest, which will help to refine the production and usage pattern of NPV.

301.4.2 Biofertilisers and Organic Fertilisers

During 1998-99, attention was given to *Azospirillum sp.* and efforts were made to study the various biochemical parameters including production of phytohormones in two different species of *Azospirillum* namely, *A. lipoferum* and *A. brasilense*. As per earlier reports, the mutant strains are more efficient than the wild ones and hence in the present study wild strains mutated under UV radiation were also used.

In the present study, the various C sources (malic acid, succinic acid and citric acid), and presence or absence of tryptophan were tested on these organisms for growth, production of cellular constituents, phytohormones, etc., (Table 3.28). The study indicates that the growth of these strains was influenced only by malic acid in mutant strains of both *A. lipoferum* and *A. brasilense*. The presence of tryptophan did not influence the growth and other cellular constituents except protein. However, IAA and cytokinin contents were slightly higher compared to control.

These basic findings will be linked to the study of certain plant species which are used as green manure and green leaf manure. In combination with phosphobacteria and

Table 3.28 : *Effects of tryptophan on phytohormone production of Azospirillum sp.*

Isolate	IAA*		Cytokinin [@]	
	Control	Tryptophan	Control	Tryptophan
<i>A. lipoferum</i> (wild)	650	670	220	240
<i>A. lipoferum</i> (mutant)	730	855	235	260
<i>A. brasilense</i> (wild)	830	845	205	190
<i>A. brasilense</i> (mutant)	810	860	220	205

* µg IAA released/1; @ µg zeatin released/1
Each value mean of triplicate

Trichoderma, these plant species will be probed for their effectiveness as organic fertilisers.

301.4.3 Drumstick Seeds (*Moringa oleifera*) for Defluoridation Efficiency

During 1998-99, efforts were made to explore the possibility of retarding the fluoride accumulations by plants through soil amendments using lime. Such a possibility may not only help to grow *Moringa oleifera*, the seeds of which can effectively remove fluoride in drinking water but also reduce the risk of fluorosis in human beings by ingesting fluoride through plants. In the present study, *Amaranthus viridis* was used to observe the fluoride uptake in its leaves and seeds.

Plants are exposed to fluoride primarily by two routes vis-a-vis soil and air. Fluoride is taken up from the soil by passive diffusion,

and transported to the shoot system by transportation. Studies have shown that fluoride thus ingested into the system gets accumulated in the leaf margins where there is more water loss (Table 3.29). The physiological symptoms due to fluoride pollution include chlorosis and necrosis. One of the aspects of fluoride damage to leaves is that it is apparently accumulated by the plant and translocated to the leaf tips where it accumulates in concentration several times higher than the average concentration in the leaf. There are very few studies on the effects of fluoride on food crops. In general, broad-leaved species accumulate more fluoride than conifers when they occur together. It has been shown that fluoride has the capacity to inhibit chlorophyll synthesis and photosynthesis. In areas polluted heavily with fluoride, plants accumulate significant amounts of fluoride, which could contribute to higher ingestion of fluoride in human

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Table 3.29 : *Fluoride uptake by leaves and seeds of Amaranthus viridis*

Treatments	Seed level-I (1mg/kg)	Seed level-II (10mg/kg)	Leaf level-I (1mg/kg)	Leaf level-II (10mg/kg)
Fluoride (Positive Control)	24.4 ± 0.75**	61.0 ± 1.08	888.36 ± 3.98	368.96 ± 2.01
Fluoride + Calcium	7.06 ± 1.02*	41.91 ± 1.58*	168.39 ± 1.25*	159.56 ± 1.55*
Fluoride + Phosphorous	60.16 ± 0.45	74.42 ± 1.69	108.46 ± 2.25*	332.48 ± 2.84**
Fluoride + Calcium + Phosphorous	6.96 ± 0.3*	62.57 ± 0.9	148.73 ± 1.37*	191.6 ± 1.31*

* significant at P < 0.05 (t-test with unequal variance)

** Mean of triplicates ± SD

beings and animals. Therefore, plants are important vectors of the element in all eco-systems.

In the present study, the effect of lime was observed in the fluoride uptake of *Amaranthus viridis*.

The study shows that there has been statistically significant retardation of fluoride uptake by the plants treated with lime. On the other hand, plant groups treated with super phosphate increased the fluoride accumulation of the test plants due to the intrinsic presence of fluoride in the fertiliser itself. The study indicates the possibility of retarding the fluoride uptake in seeds and leaves using agronomic interventions such as lime application. During 1999-2000, on-farm trials will be conducted in the fluoride-contaminated regions of Dindigul district in Tamil Nadu.

301.4.4 Low Cost Greenhouse

JRD Tata Ecotechnology Centre has been studying possibilities of using low cost greenhouse techniques for hybrid seed production among the rural landless poor households. Hut type casurina pole framed greenhouses of 5 x 3m wide facing east to west were constructed as follows:

- T1- Roof and sides covered by nylon net
- T2- Roof and sides covered by High-Density Polyethylene (HDPE) sheet
- T3- Roof and sides covered by HDPE sheet during vegetative stage and left open during reproductive stage
- T4- Roof covered by HDPE sheets and sides with nylon net
- T5- Open field condition as control

The study was conducted with randomised

block design with three replications. Two crops viz., *bhendi* (Arka Anamika variety) and capsicum (California Wonder variety) were tested under these conditions. The crops were grown in rows parallel to the length of the greenhouse. Regular practice of cultivation using organic farming was followed. Chemical fertilisers and pesticides were not used. Neem oil (3%) was used to control the pest incidence. Temperature and relative humidity were recorded at 2 p.m. using dry and wet bulb. Biological parameters such as number of leaves, number of nodes and yield were observed and subjected to statistical analysis. Results are given in Table 3.30.

Bhendi was grown from August to November and during this period, the temperature varied highly between treatments from 30°C, 46°C in T3 whereas the relative humidity did not show any significant difference between treatments. However, the maximum production was observed in T3. Capsicum was cultivated during January-March and the temperature ranged between 36-43°C, the highest in T2 and lowest in T4 (36-40°C). RH

ranged between 37-45%. Maximum production was in T2 (170g/plant), which was 2.5 times higher than that of the control.

The study shows that treatment T3 has been consistent in terms of yield/plant followed by T2. These two treatments will be demonstrated at Kannivadi for hybrid seed production among landless rural households. The experiment will be repeated for tomato during 1999-2000.

301.4.5 Eco-aquaculture: Fresh Water Prawn Hatchery

A fresh water prawn hatchery has been established with a capacity for 3,00,000 fingerlings of *Macrobrachium rosenbergii*. The hatchery has been designed in such a way as to demonstrate environment friendly technologies. Precisioning of energy and other resource utilisation and biological remedies of water treatment and recycling are the important aspects of this hatchery. Biofilters have been installed for complete water recirculatory system. The process of purifica-

Table 3.30 : Comparative analysis of crops in low cost green house

Treatments	Bhendi				Capsicum			
	Height (cm)	Leaves (no)	Nodes (no)	Yield/plant (g)	Height (cm)	Leaves (no)	Nodes (no)	Yield/plant (g)
T1	102	8	7	97	43	25	10	104
T2	119	7	6	99	44	21	11	170
T3	108	7	6	138	39	21	11	134
T4	116	7	5	87	36	22	10	105
T5	53	7	5	65	29	15	8	61
CV at 5%	5.68	NS	NS	10.00	6.96	NS	NS	4.6

Each value mean of triplicate

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tion is facilitated by bacteria which naturally colonise on substrates or media constituted in the filtering unit.

The hatchery will be the base for training rural women in aquaculture management. The hatchery is also used for conducting experiments on feed. During 1998-99 an attempt was made to study the feed efficiency, in terms of nutrition content and the growth enhancement potential of larvae of the freshwater prawn, *Macrobrachium rosenbergii*, based on the comparative study of different types of feed constituents vis-a-vis prepared larval feed (includes clam meal), live feed and combined feed. The hydrated cysts of *Artemia salina* were fed to the larval and post larval stages as live feed. The feed was a combination of prepared larval feed and live feed.

The comparison was made through analysing the percentage composition and proximate composition of three types of feed separately. The survival rate of the larvae was recorded and the developmental stages were observed based on the standard methods. The suit-

ability of feed was assessed for 40 days (one larval cycle) based on the percentage survival of prawn larvae, the time taken for metamorphosis and the proximate analysis of the nutrient content. The results obtained from the prepared larval feed and live feed alone were not significantly different. However, the growth and survival of the larvae fed with a combination of prepared larval feed and live feed were significantly higher ($P < 0.05$).

The level of protein was found to be higher in the combined feed followed by the live feed. This result indicates that nauplii of the brine shrimp, *Artemia salina* fed along with that of clam meal and other ingredients has more protein content and high efficiency rate. Studies show that larvae and post larvae fed with protein rich feed tolerate more transport stress and are also resistant to mid larval disease.

301.4.6 Capacity Building

Several training programmes (Table 3.31) were conducted.

Table 3.31 : *Training programmes in ecotechnology*

Area	No. of trainee days
Soil Health Management	8,988
Ecohorticulture	400
Water harvesting	630
Integrated Pest Management	630
Biodiversity conservation	1,600
Informatics for rural development	120
Total	12,368

In addition, the Centre trained more than 300 officials from the Agriculture Department of the Government of Tamil Nadu in multi-media database.

A meeting was organised between the staff of the Centre and 60 women participants of various projects in which tools for understanding and evaluating gender issues were discussed. In this programme, the women participants pointed out that identity and self-confidence are the major outcomes of any good training programme.

On 29 July '98, the President of India inaugurated the new building of JRD Tata Ecotechnology Centre at MSSRF. With facilities such as hostel and training Centre, the new building has added a new dimension to the capacity building process.

The Centre organised an International Consultation with the support of Genetic Resource Policy Committee of the Consultative Group on International Agricultural Research (CGIAR) on "Enlarging the basis of Food Security: Role of Under-utilised Species during February '99. Participants from international research institutions, World Bank, the private sector and government agencies participated in a two-day discussion. The consultation suggested a much stronger role of CGIAR in promoting the under-utilised species like minor millets. Specific action plans were recommended. CGIAR has taken initiatives to follow the recommendations. The report was discussed in the mid-term meeting held at Beijing in May '99.

Sub Programme Area 302

Biovillages

The Biovillage project supported by the United Nations Development Programme is currently being implemented in 19 villages in the Union Territory of Pondicherry. The project is now in the fifth and final year of implementation.

A new project funded by the Department of Biotechnology on integrated nutrient management in cropping systems commenced in February '99, with the objective of testing and demonstration of proven and periodically available biofertilisers (*Azospirillum*, *Phosphobacterium* and *Rhizobium*) in the field.

302.1 On Farm Research and Demonstration

Yield testing of hybrids

Paddy: Hybrid rice technology was introduced in the biovillages to break the yield plateau in paddy. Of the 12 hybrids tested so far in the biovillages, CORH 1 was identified as a potential hybrid recording a 20-23% increased yield over the local check variety, with an additional net income of Rs. 4,000 - 7,000 ha. To demonstrate the superiority of CORH 1, participatory trial plots have been laid out during *Navarai* '99 (January - April.) in 10 villages including one on a large scale (2 acres), covering all the three clusters of

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villages. The other rice hybrids tested during the year were DRRH 1 (*Navarai* '98) and CORH 2 (*Samba* September.-December.). The two hybrids however had no substantial yield increase over the check variety.

Cotton: Six cotton hybrids viz. RCH 1, 2, 11, 19, 36 and NHH 44 were yield tested during *Thai pattam* '98 (February.-July). NHH 44 recorded a 48% yield increase over the check variety. The quality of fibre was also good. It fetched the farmer an increased price of Rs. 2/kg of kapos over the check variety.

Yield testing of new varieties

Paddy: Confirmatory yield trials of ASD 20 (*Navarai* '98), ADT 43 (*Kuruwai* '98), ASD 19, J 18 and CO 46 (*Samba* '98) were taken up. ADT 43 recorded a 20 percent yield increase over the check variety. The trial plots of the variety have been laid in 9 villages covering all the three clusters. The variety has gained popularity in non-project areas as well. J 18 was introduced to suit organic cultivation of paddy. Though the crop was resistant to lodging, fertiliser use was reduced by 80% and the grains fetched a price equal to that of fine varieties, the yield recorded was less (1,725 kg/ha) when compared to the check variety, White Ponni (3750 kg/ha). CO 46 and ASD 19 recorded yield levels equal to that of the check variety, while the pest incidence, particularly leaf folder, was less when compared to the check variety ADT 39.

Groundnut: The groundnut variety ALR 2 was yield tested during *Thai pattam* '98, and 25%

yield increase over the local check variety was recorded. Trial plots have been laid out during *Thai pattam* '99, to confirm previous yield trials. Trials on yield testing of IGG 44, a red kernel variety, is also under progress.

Cotton: The variety Rasi 171, yield-tested during *Thai pattam* '98 recorded a 39% yield increase over the check variety LRA 5166.

Tapioca: New tapioca varieties viz., H 1687, H 2304, S 856, C 1649, C 1731, H 226, H 165, H 97 received from Central Tuber Crops Research Institute (CTCRI), Tiruvananthapuram, were screened for mosaic disease, by raising them in a nursery. Setts from healthy plants were selected and planted in Mr. Vilvalingam's field at Vambupet village in June '98. The crop is being monitored regularly in terms of pest and disease incidence. Due to late availability of planting material from CTCRI, the crop was planted in the off-season and incidence of mosaic was severe, affecting the yield. There was no significant increase in the yield of the hybrids over the check variety.

Seed production

Paddy: Seed production of paddy varieties was initiated in six villages (2 each in the three clusters) involving 8 farmers and the seeds produced were sold locally. The farmers have formed an informal group. Another informal group has been formed in Poraiyur village to take up paddy seed production in an area of 10 acres. The group consists of 6 farmers.

To study the economic viability of CORH 1 hybrid seed production, an experimental seed production plot of 1 acre was taken up in Kizhur village. The parental seed material was obtained from Tamil Nadu Agricultural University, Coimbatore. About 100 kg of hybrid seeds were produced of which half was used for laying the demonstration plots in various villages and the other half for sale to farmers. Involvement of family labour, a minimum of 1 acre land for seed production and production of a single hybrid would make hybrid seed production a profitable venture.

Groundnut: Seed production of VRI 2 groundnut variety has been initiated in an area of 5 acres in the upland cluster to meet the local seed demand.

Integrated Crop Management

The technological interventions for the sustainable use of land, water and human resources for better crop production require the designing of ICM systems. Several interventions in the practice for growing paddy, sugarcane, cotton, groundnut and tapioca were introduced. The interventions are of low cost and generate employment, in addition to being energy efficient, location specific, technically feasible and economically viable.

During *Navarai* season (January–April), several interventions like biofertiliser application, optimum plant population, soil test based fertiliser application and need based pesticide spray were adopted on the farms of seven selected farmers. The yield on their land is given in Table 3.32.

Table 3. 32 : ***Productivity of rice during Navarai '98***

Name of the farmer & village	Variety	Yield (kg/ha)		Difference in yield (%)
		Expt.	Control	
Mr Mayakrishnan Agaram	ADT 37	6,575	6,225	5.32
Mr Shanmugam Agaram	Chinna ponni	6,125	5,700	6.94
Mr Poongothai Agaram	Chinna ponni	6,275	5,675	9.56
Mr Ezhumalai Agaram	Chinna ponni	5,925	5,400	8.86
Mr Kathir Kizhur	IET 1444	6,000	5,675	5.42
Mr Shankar Mangalam	Chinna ponni	6,575	5,950	9.51
Mr Nandagopal Mangalam	Chinna ponni	5,350	4,925	7.94

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Chinna ponni and ADT 37 recorded the highest grain yield of 6,575 kg/ha in this season. Due to the interventions, yield increased in all the varieties in all the villages. The increase is seen to range from 5.32 to 9.56%.

Paddy trials for *Sornavari* '98 (June-September) were conducted by six farmers at Agaram, Kizhur and Sorapet villages (Table 3.33). Certain critical indicators were identified and followed during this season. They helped to increase the yield by 7.9 to 14.5%. The adoption of optimum seed rate resulted in the reduction of seed cost by Rs. 300 per acre, soil test based nutrient supply reduced fertiliser cost by Rs. 600 per acre and need based pesticide spray further reduced expenses by Rs. 300. The optimisation of the inputs have resulted in reduced cost of cul-

tivation, increasing the net profit by Rs. 1,150 per acre. The interventions reduced the indiscriminate use of pesticides, imbalance in the use of fertilisers, and untimely and excess utilisation of water. Soil fertility and productivity have been maintained on a sustainable basis.

Six paddy trials were conducted at Agaram, Kizhur and Sorapet villages during *Samba* (September-December). The variety grown by farmers during this season was ADT 39. Yield increase due to interventions was a maximum of 13.7% as seen in Table 3.34 and generated additional employment to the tune of 13 man days over control. Due to the optimisation of resource use and adoption of cost effective technologies, the cost of producing 1 kg of paddy grains has been reduced to Rs. 2.50 from Rs. 3.60.

Table 3.33 : *Productivity of rice during Sornavari '98*

Name of the farmer & village	Yield (kg/ha)		Difference in yield (%)
	Expt.	Control	
Mr Mayakrishnan Agaram	5,500	4,700	14.54
Mr Shanmugam Agaram	5,155	4,655	9.69
Mr Poongothai Agaram	5,075	4,575	9.85
Mr Ezhumalai Agaram	4,950	4,500	9.09
Mr Pazhani Agaram	5,187	4,650	10.35
Mr Kathir Kizhur	4,805	4,425	7.90

Table 3.34 : *Productivity of rice during Samba '98*

Name of the farmer & village	Yield (kg/ha)		Difference in yield (%)
	Expt.	Control	
Mr Mayakrishnan Agaram	5,975	5,240	12.31
Mr Shanmugam Agaram	5,815	5,125	11.86
Mr Poongothai Agaram	5,400	4,800	11.11
Mr Ezhumalai Agaram	5,700	4,920	13.68
Mr Moorthy Agaram	5,625	4,950	12.0
Mr Kathir Kizhur	5,790	5,100	11.91
Mr.Jeyakrishnan Kizhur	5,250	5,000	4.76

In the villages of Agaram, Kizhur, Sorapet, Poraiyur, Thondamanatham, Keezsathamangalam, Melsathamangalam and Uruvaiyar, crop management trials were conducted in 27 fields during *Navarai* season. The season specific high yielding variety ADT 37 was grown by adopting the interventions. The maximum yield recorded during this season was 6.5 t/ha.

To evaluate the nitrogen use efficiency in transplanted lowland rice, Chlorophyll metre SPAD 502 and Controlled Release Nitrogen (CRN) trials were carried out at Kizhur village during *Sornavari* '98 and *Samba* '98. Under the Crop Resource Management Network (CREMNET) programme field experiments were conducted (in collaboration with International Rice Research Institute, Philippines) to evaluate different nitrogen management practices for irrigated transplanted

lowland rice. The experiments were conducted during January-May '98 (dry season) at Kizhur and Sembampalayam villages and from June-September '98 (wet season) at Kizhur and Mangalam villages.

The experiments were conducted in randomised complete block design. The five treatments evaluated were:

- T1 - P K control plot (no N application)
- T2 - P K + SPAD based N
- T3 - P K + basal 20 kg N ha⁻¹ + SPAD based N
- T4 - P K + Controlled Release Nitrogen (CRN) based N
- T5 - Farmers practice (100 kg N/ha: applied 50% as basal and 25% each at active tillering and flowering)

The results of the treatments are found in Table 3.35

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Table 3.35 : *Chlorophyll meter and controlled release nitrogen trials during January '98*

Treat-ments	Plant height (cm)		Grain yield (kg/ha)		Net returns* (Rs./ha)		Benefit:Cost ratio*	
	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet
T1	81.9	80.1	5,187	5,321	9,498	12,126	2.16	2.39
T2	86.8	86.5	5,414	6,018	13,483	15,010	2.52	2.62
T3	90.8	88.2	5,848	6,312	16,833	18,147	2.84	2.90
T4	93.1	91.3	5,558	5,718	15,730	16,621	2.74	2.76
T5	84.9	83.1	5,171	5,625	14,628	15,858	2.55	2.60

* Data not statistically analysed

Sugarcane trials (Table 3.36) were carried out in Sorapet, Kizhur and Vambupet village. The highest cane yield of 200 t/ha (which was 40% higher than control) was recorded by adopting our package of practices. The economic gain to this farmer was Rs. 52,500 per

ha. On an average the interventions generated an additional employment of 20 man days.

Three cotton trials, carried out at Sorapet village, recorded increased yield (Table 3.37).

Table 3.36 : *Productivity of sugarcane*

Name of the farmer & village	Variety	Yield (t/ha)		Increase in yield (%)
		Expt.	Control	
Mr Moorthy Sorapet	COC 95071	200	120	40.0
Mr Krishnaraj Sorapet	COC 95071	135	125	7.40
Mr Neelamegam Sorapet	COC 95071	120	110	8.33
Mr Kumaralingam Vambupet	COC 95071	140	120	14.28
Mr Jeykrishnan Kizhur	COC 8021	150	115	23.33

Table 3. 37 : *Productivity of cotton*

Name of the Farmer & Village	Variety	Yield (t/ha)		Increase in yield (%)
		Expt.	Control	
Mr Mani Sorapet	LRA 5166	1200	1038	13.54
Mr Devarasu Sorapet	LRA 5166	1125	1050	6.67
Mr Janakiraman Sorapet	LRA 5166	1300	1150	11.54

All the participants adopted the same practices. The adoption of 2 seeds/hole reduced the seed rate considerably and maintained optimum plant population. Seed treatment with *Azospirillum* 400 g/ha, optimum sowing depth of 3cm, thinning and topping at 15 DAS and 35 DAS resulted in significant yield

increase over the control. But the yield difference was less in one of the trial farms due to pollen sterility at the time of pollination.

Table 3.38 describes the groundnut trials conducted at Sorapet and Vambupet villages. The

Table 3.38 : *Productivity of groundnut*

Name of the farmer & village	Variety	Yield (t/ha)		Increase in yield (%)
		Expt.	Control	
Mr Devarasu Sorapet	VRI 2	3380	2863	15.31
Mr Janakiraman Sorapet	VRI 2	3000	2600	13.33
Mr Mani Pollachi	red local	3450	2875	16.66
Mr Krishnaraj Sorapet	VRI 2	2950	2600	11.86
Mr Vilvalingam Vambupet	VRI 2	3075	2700	12.20
Mr Darmalingam Vambupet	VRI 2	2878	2550	11.30
Mr Jeyabalan Vambupet	VRI 2	3285	3040	7.46
Mr Kuppusamy Vambupet	VRI 2	3330	3075	7.66

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yield increase ranged from 7.5 to 16.7%. The net income in this season has increased to an extent of Rs. 2,498/ha and created additional employment of 15 man days.

The interventions such as proper time and optimum depth of sowing of 5 cm have resulted in optimum population of 33 plants/sq.m. Seed treatment with *Trichoderma viridi* @ 4gm/kg of seeds, DAP (Di-ammonium Phosphate) 1 kg spray and setting of light trap have resulted in yield increase over the control and reduced the input cost. The yield in Pollachi red local was high due to boldness of pod. Ready availability of market for Pollachi red local has induced many farmers to adopt this variety in preference to VRI 2 which has high oil content.

Tapioca trials with Mulluvadi variety were carried out at Vambupet village. There was a significant yield increase of 15.2%. But the economic gain was reduced (Rs. 1,740/ha) due to fall in procurement price and heavy rain at the time of harvest (Table 3.39).

A participant for paddy + fish system was selected from the wet lowland cluster (Agaram village). A trench of square shape, with a capacity of 3000 cu. ft was dug and the remaining area was left for cultivation of paddy. About 250 fingerlings belonging to various feeding habits were released in the trench and the trial is in progress.

For the paddy-paddy-crop system and paddy-crop system trials are being conducted in the upland cluster. For monitoring the soil health status in the project villages a "soil health card" has been designed. The soil tests are being done at Southern Petrochemical Industrial Corporation (SPIC) diagnostic Lab, Tambaram, Chennai and at Soil Testing Lab., Cuddalore, Tamil Nadu.

Farm machinery

The bullock drawn puddler was tested for its performance in Agaram village during the *Samba* season and its performance was found to be good. The existing design of ground-

Table 3.39 : *Productivity of tapioca*

Name of the Farmer & Village	Yield (t/ha)		Increase in yield (%)
	Expt.	Control	
Mr Ramalingam Vambupet	35	31	11.42
Mr Darmalingam Vambupet	33	28	15.15
Mr Vilvalingam Vambupet	36	32	11.11
Mr Jeyabalan Vambupet	35	31	11.42
Mr Kuppuswamy Vambupet	35	31	11.42

nut decorticator was improved for better efficiency and three units have been fabricated at the local Engineering workshop. The drum seeder was tested in Sorapet village and resulted in an increase in yield. The application of basal Nitrogen was dropped in this process. It is proposed to conduct further tests on the farm machinery.

Soil and water conservation engineering

On-farm irrigation channels were constructed in Sorapet and Vambupet villages with the farmers contributing 40% of the total cost. The dimensions are 50m x 0.3m x 0.3m. Conveyance loss and time taken for irrigation have thus been minimised. Water management data has been recorded for *Samba* '98 season and the depth of water is being continuously monitored.

Sub-surface irrigation system was installed in Sorapet village in the field of Mr. Visvanathan. This has resulted in increased irrigation efficiency. The treadle pump, introduced to reduce drudgery in irrigating uplands, has proved the most effective.

Post harvest technology

To reduce post harvest losses considerably, two units of SRR-1 Dryer were fabricated at the local engineering workshop and supplied to Indira Gandhi Agricultural University, Raipur and Directorate of Rice Research, Hyderabad for performance evaluation. The Dryer was tested at Sorapet village. It has brought down the cost of drying 650 kg of paddy from Rs. 180 (Sun drying) to Rs. 92.

Bioenergy

As part of the effort to conserve energy and to increase energy efficiency, the efficiency of Tamil Nadu Agricultural University model (TNAU) mud stoves, utilised by 15 participants of Aquaculture, Mushroom and ICM in Agaram and Kizhur villages was worked out. There is an increase of 10.3% from 15.7% (traditional stove) to 26%.

Engineering support service to other projects

The design of the pond near the Biocentre was prepared and sent to the Central Institute of Brackishwater Aquaculture (CIBA) for further Engineering investigations. Two soak pits were constructed for Mr. Chandrakasu and Mr. Ramachandran to dispose of waste water in Kizhur village with 60% contribution from the Block Development Office, Villianur. A mist chamber along with sprinkler irrigation system was set up at Uruvaiyar village and repairing the mist chamber at Mangalam village was completed. Five units of Central Food Technological Research Institute's "Village model Mushroom breeding system" have been fabricated and are being tested.

302.2 Enterprises for Enhancing Livelihood Security

Mushroom production by resource poor rural women

This year the programme was extended to two more villages, Melsathamangalam and Olavaikal and included forty participants. The

Table 3.40 : *Mushroom production*

Villages	No. of participants	No. of producers	Total production (kg)	Gross income (Rs.)
Kizhur	20	10	100	4,000
Sivaranthagam	12	6	200	8,000
Mangalam	21	18	225	9,000
Uruvaiyar	12	5	150	6,000
Melsathamangalam	25	20	*	**
Olavaikal	24	17	*	**
Demonstration centre	-	-	125	5,000
TOTAL	114	76	850	32,000

* New group. ** Marketing themselves

new participants were trained at the Mushroom Training and Demonstration centre (MTD) in Kizhur village and have started production from January '99. A total of 76 participants belonging to 8 groups from six villages are involved in production (Table 3.40).

On an average about 8-10 kg of mushrooms are marketed daily. Monthly, quarterly (techno solidarity) and annual evaluation meetings were held to discuss production, marketing, post-harvest and group problems.

The spawn lab attached to the MTD is run with the help of rural educated youth. A total number of 1,600 spawn bags were produced, fetching an income of Rs. 8,000. A two-day training programme was organised at the Central Food Technological Research Institute (CFTRI) for five participants. The training to enhance production, post-harvest processing and minimising losses included learning by doing. A new rural model for producing large quantities of mushrooms,

drying, processing into pickle, sweet chutney (jam) and soup powder has been developed. It is currently being tested and evaluated for its economic viability both at the MTD and at the participants' households. The Food Links programme of the International Development Research Council (IDRC) funded the training. Rodent problems and contamination were minimised by taking a number of prophylactic measures. A one-day re-training programme for mushroom growers on CFTRI model-based mushroom production technique was organised in the Biocentre on 9 June '99.

Goat rearing

As reported last year, the introduction of Telicherry male goats has created an impact among the goat rearers of the project area. During the reporting period seven more goat rearers were identified in six villages, thus covering all the 18 villages. Many of the goat rearers have been benefited economically. The participants were taken to the Livestock Research Station, Kattupakkam, Chennai, for

training in animal health care and fodder production.

Dairying

Ten landless women in Pillayarkuppam village, seven small and marginal farm women in Melsathamangalam village and eighteen women in Ramanathapuram village are continuing the activity successfully as seen from Table 3.41. This programme has been extended to Sorapet and Sellipet villages where ten small and marginal farmers were selected. The participants were given *in situ* training in the care and management of dairy animals. 60% of the loan amount was repayed to the bank by the Ramanathapuram dairy group. They were also taken to the Livestock Research Station, Kattupakkam, Chennai, for training in animal health care and fodder production. An animal health card has been designed and is used in monitoring the health of the animals.

The milk produced is marketed through the village co-operative milk society. An animal health care centre is functioning successfully three times a week.

Poultry enterprise

Two participants are continuing with this scheme, started last year with assistance from the Department of Animal Husbandry, Govt. of Pondicherry. It is proposed to start a small broiler farm in two villages after the demonstration phase. In Sorapet village 15 participants were selected for "backyard poultry". These participants were given 12 layer birds as part of the government subsidised programme. The participants were given *in situ* training in the care and management of poultry. It is proposed to expand the programme to other villages. Backyard poultry enterprise was extended to Melsathamangalam, Kizhsathamangalam and Uruvaiyar villages.

Fodder plots for small and marginal farmers

Fodder production, which picked up momentum last year, has spread to new villages. The 10 new villages covered are Ramanathapuram, Thondamanatham, Ousudu, Poraiyur, Agaram, Sellipet, Sorapet, Uruvaiyar, Mangalam and Melsathamangalam. During the

Table 3.41 : *Average yield and monthly income of dairy groups*

Villages	Year of initiation	No of participants	Avg. Monthly milk yield (litres)	Avg. monthly income (Rs.)	% of repayment of loan
Pillayarkuppam	1995	10	118.5	829.5	80
Melsathamangalam	1997	7	215.6	1509.2	70
Ramanathapuram group I	1998	10	243.5	1704.5	60
Ramanathapuram group II	1998	8	240.0	1680	60

current year a total number of 124 individual fodder plots (38,800 m²) 11 demonstration fodder plots (8,800 m²) and 1 commercial fodder plot (4,000 m²) covering 17 villages were laid out.

Floriculture

Floriculture has been introduced to supplement income. Jasmine was introduced in five villages and Crossandra in 2 villages. 30 Jasmine and 23 Crossandra flower gardens were established. Due to heavy rain during the north-east monsoon, many of the gardens were damaged. An informal group of Jasmine and Crossandra growers was formed at Pillayarkuppam and Thondamanatham respectively.

Vegetable production

Vegetable production is undertaken by small and marginal farmers. During this year a few hybrid and local varieties of *bhendi*, chillies and *brinjal* were introduced to create an interest in vegetable production. 30 participants took up vegetable cultivation in 7 villages.

The *bhendi* crop raised during September–October '98 was damaged by rain; however, the better price compensated the damage. On an average, a farmer generated an income of Rs. 3,500 – 4,000 from 25 cents of *bhendi*. The *brinjal* crop recorded a higher yield and income. Chillies raised during December '98 are in the flowering stage. A study of the effect of vermicompost on *bhendi* has been initiated at Pillayarkuppam village.

302.3 Access to Common Property Resources : Aquaculture in Community Ponds

The third batch of participants (nine landless women) who were trained last year have been managing the pond. A total of 350 kg of fishes of various varieties was harvested, fetching a gross income of Rs. 18,600 and a net income of Rs. 7,200 after paying back the bank loan. This harvest is low compared to the previous batches. The main cause for the low income was the intrusion of *Thilapia*, a local fish, which came during the floods and did not allow other fishes to thrive. A risk fund of Rs. 10,200 was provided to the group and each participant was able to get an income of Rs. 1,720. One share of the income was given to the village temple.

The work on the new community ponds at Poraiyur and Vambupet villages suffered a setback due to problems arising in the villages. But at present desilting work is in progress in both the community ponds.

302.4 Support Services

Group organisations and management

Six new enterprise based groups, twenty-five credit and savings groups (CMG) and two informal farmers groups were organised, making a total of 33 groups. Periodical training programmes were organised for the benefit of the group members. A special one-day training programme was organised for the group leaders on accounts maintenance, with the assistance of National Bank for Agricultural and Rural Development

(NABARD). Ten inter-group visits were organised so that the newly-formed groups could get an idea of group activities, accounting and decision making. In Sivaranthagam 6 new self-evolved groups were formed.

The Village Development Council (VDC) in Kizhur is functioning successfully. They were awarded a special prize by NABARD for the year 1998-99 for efficient management of VDC.

Savings and credit management

Savings and credit management activities are continuing in the project villages. Accounts-cum-book keeping training has been provided for all the credit and savings groups leaders. As a part of the group activity three members were identified and recommended for sanction of loan from the District Industries Centre for coir rope making. One handicapped person was identified to receive monthly stipend from the Welfare Department. A three day exposure visit to Mysore Rehabilitation Development Agency (MYRADA)/Plan, Dharmapuri was organised for the group leaders and three groups comprising 150 participants from the MYRADA/Plan project visited the credit and savings groups, to learn about the income generating activities of the Biovillage project.

Internalisation of gender issues

In collaboration with the Uttara Devi's Resource Centre for Gender and Development at MSSRF, the project was able to test some

agricultural engineering equipment to reduce the drudgery of women participants. Trials on hand star weeder, groundnut decorticator and uncut straw for growing mushrooms were carried out.

Environmental sanitation

Two soak pits were constructed as a demonstration model in two houses of Kizhur village, for safe disposal of stagnant water. About 65 new participants have been identified from Pillayarkuppam, Ramanathapuram, Kizhur and Mangalam villages to receive a subsidy to construct toilets under the Central Rural Sanitation Programme. 10 vermicompost pits were put up in 4 villages.

Vermicentre

The vermicentre established at Pillayarkuppam village carried out its regular production of vermicompost from the locally available substrates. The youth operating the centre trained the landless women involved in mushroom production and flower production in vermicomposting. The school teachers running the Eco-clubs in Pondicherry were taught the vermicomposting technique. The youth operating the Centre, besides undertaking independent production, also offers private consultancies on this technique. The centre sold vermicompost worth Rs. 35,000 last year.

Biocentre

The Biocentre is envisaged as the centre of activities in the biovillage programme (Fig. 3.2).

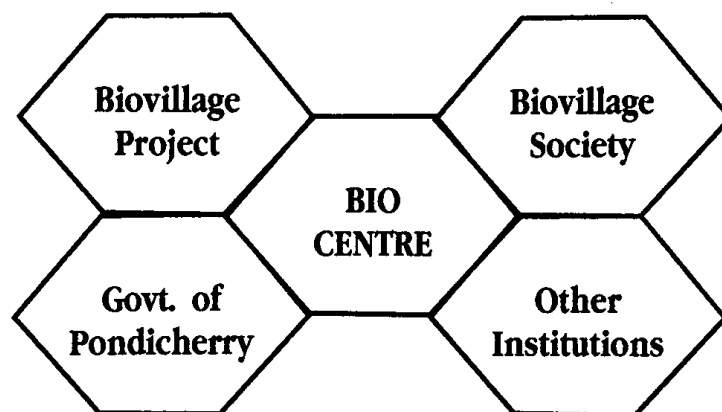


Figure 3.2 : *Biocenter - building bridges*

It preforms the following functions:

- Enables efficient decentralised production through the provision of key centralised services
- Provides the necessary production and market information
- Confers on small scale producers the power of scale in marketing
- Provides the infrastructure essential for training, networking and capacity building
- Provides necessary facilities for the effective functioning of the BIOVILLAGE SOCIETY
- Serves as a meeting place for the exchange of experience and ideas

The following activities were initiated : veterinary clinic, which is run 3 times a week; vermicompost and mushroom demonstration; establishment of information centre. Soil health and mushroom production training programmes were held.

As the biocentre will be managed by the stakeholders themselves, the families of the biovillage are expected to develop a sense of ownership towards it, making it economically sustainable and effective.

Farm model

For the study of Integrated Intensive Farming System, a total of 23 farms were selected. In all the selected farms regular monitoring is being carried out with respect to crops, livestock, labour utilisation, water usage, household details, storage structures, marketing system etc. Similarly resource mapping involving the participating families was done for all the farms. Based on the availability of the resources, suitable enterprises such as fodder, floriculture, seed production, paddy-cum fish production, vegetable production were introduced in some of the farms. One farmer installed PVC pipes from the pump house to various parcels to avoid loss of water by way of evaporation and seepage. It was observed that the whole family was involved in farming activities. Some of

the farm model participants had an exposure visit to Integrated Intensive Farming System, Chidambaram for studying the various farming systems. Time use study is being conducted with the participating families to analyse how the male and female farmer in their family is utilising the time.

Marketing

Market study and support services are being provided for products like mushroom, fish and flowers as a result of which sales have increased considerably.

The flashing of advertisements on vermicompost through local cable Television has created an awareness of its importance and the stall at the Home Exhibition sponsored by the Rotary Club and the Flower Show organised by the Department of Agriculture increased the sales of vermicompost. Vermicompost worth Rs. 18,000 was sold during these occasions.

The market support for the sale of fishes produced by the women participants of Kizhur village was carried out within the village, owing to reduced production. Composite inland fishes worth Rs. 18,000 were sold, @ Rs. 25-30/kg.

Market database

The database on the production and marketing of agricultural products has been updated and the prices documented.

Economic analyses

Economic analyses of all the poverty allevia-

tion programmes, of the project were carried out regularly.

Participant household/farm profile

The detailed documentation of the farm and household profile of the participants is being continued.

Sub Programme Area 303

B V Rao Centre for Sustainable Food Security

The Centre has undertaken various activities in collaboration with other organisations, to achieve the objective of sustainable food security.

303.1 Tamil Nadu Council for Sustainable Livelihoods

Ramakrishna Bajaj Fellowship

The Bajaj Family instituted in 1998 at MSSRF a Distinguished Fellowship known as the "Ramakrishna Bajaj Fellowship for Industry - Community partnership for sustainable End of Hunger" in memory of Shri. Ramkrishna Bajaj, a disciple of Mahatma Gandhi committed to the end of hunger, who was also a Member of the Global Board of the Hunger Project. The objective of the programme is "to promote symbiotic partnerships between the private and public sector industry and resource poor, tribal and rural families, in the areas of increased food production and improved economic access to food".

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Realising that all programmes that address poverty, hunger, food and nutritional activity should be implemented in an integrated manner, the Fellowship has been primarily focusing on:

- Designing and implementing projects for rural prosperity, especially those that provide multiple livelihood opportunities with focus on rural women
- Development of Hunger-Free areas
- Implementation of nutrition based programmes, especially elimination of hidden hunger
- Research on policy imperatives concerning them.

Towards the fulfilment of these objectives and action plans, the Fellowship provides technical help, support and backup services to all programmes, projects and activities of the Hunger Project.

The UN Forum on Nutrition

The UN System's Forum on Nutrition has established a Commission on Nutrition to consider how best to meet the nutritional challenges of the 21st Century. The pattern of nutrition and malnutrition is changing dramatically the world over. Malnutrition impairs the fulfilment of genetic potential and causes serious impairment in the performance of normal activities. These challenges are amplified by the economic crisis and social and environmental needs.

The UN Commission on Nutrition chaired by Prof. Philip James, met at Chennai from

November 23-25, '98 to discuss the draft report of the Commission with special reference to South Asian countries. Delegates from the South-East Asian countries besides experts from India participated in the meet.

It was recommended that the plan of action should focus on the following:

- Prevention of low birth weight by giving special attention to adolescent girls and women in the vulnerable periods of life and children between 0-2 years of age. While breastfeeding is still a common practice, complementary feeding practices are poor and unsatisfactory and have to be addressed through appropriate communication channels.
- Common elements of success and failure in different parts of the country need to be discussed before changes and policies are made to improve the efficiency of delivery of services. More innovative, region-specific, short-term measures with sharp focus on high risk are needed. There is an urgent need to bring about a reduction in the morbidity profile of children.
- Restructuring of the ICDS programme is essential to improve programme efficiency in the light of changing situations and needs. Reduction in the time spent on administrative work and training and communication support to the workers would go a long way in improving the quality of services provided.
- Non-nutritional problems need to be addressed on a priority basis by fostering convergence and synergy among the dif-

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ferent sectors of services. This can be achieved by:

- Adopting a population-based approach, as the number of people afflicted by malnutrition is very high and a better appraisal of adult malnutrition and the problems of the emerging affluent class is necessary
- Combining strategies to achieve food security at the household level that encompass the long-term goal of equitable distribution of resources and taking measures such as double fortification of salt with iron and iodine for short-term effects
- Making technology available at an affordable cost and enhancing synergy between various sectors such as government, NGOs and private bodies
- Providing some solutions beyond food that should receive priority attention such as facilities for adequate sanitation, protected water supply and waste disposal, implementing innovative approaches for improved horticulture and successfully establishing a specially targeted public distribution system
- Attempting social mobilisation to generate community awareness for better articulation of demands and improved participation and deliberation of services
- Focusing on child care support which is an important issue in empowering women to take care of children, especially when many women work in the unorganised sector which has no provision for child care services

- Providing microcredit interventions at the village level which would help in empowering women's groups or 'self help' groups to gain better status within the family and improve the nutritional status of the family.

Implementation Structures

- Effective implementation and improved co-ordination in the various developmental programmes being implemented by different government departments and an increased awareness among the poorest of the poor would go a long way.
- Strategy for ensuring effective implementation of developmental programme at the grassroots could be through a household entitlement card that lists out all the programmes desegregated by age, gender and occupation. This card could be made available to the panchayat at the village level for distribution to the poor/ households. It would also demystify the complicated bureaucratic process and amplify the system of local self-government and decentralisation. Setting up of Panchayat Councils for the elimination of malnutrition could be yet another strategy.

303.2 Hunger Free Area Programme

Operationalising of the Seven Point Action Plan for Hunger Free Area Programme in Gandhigram University:

The Gandhigram University came forward to tackle the problem of hunger in three villages in Vedasandur block using the services

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of various departments of the university. This project started in July '98. The University, having participated in the multicentre study, was interested in field testing the seven action plans in an integrated manner in the Vembur and Nallur Panchayats of the Vendasandur block. The population covered would be approximately 10,000 with 50% being reached in the first phase.

The implementation action covers the following activities:

- Base line survey and evaluation of training needs
- Formation of social development group and activity/enterprise group
- Common property development and individual non-utilised land development by scheduled caste people
- Other activities at the micro level through micro planning exercises.

The programme has been initiated in four hamlets of Kovilur Panchayat of Vendasandur block. The basic strategy of the programme is to see that the people and their representatives are actively involved right from the appraisal and planning stages.

Indicators for measuring the impact of HFAP

The indicators for measuring the impact of HFAP on protein calorie under-nutrition and hidden hunger have been identified as follows:

- Reduction in severe under-nutrition among children

- Reduction in low birth weight babies
- Reduction in infant mortality
- Reduction in maternal mortality
- Reduction in chronic energy deficiency among adult men and women (Body Mass Index)
- Reduction in Vitamin A deficiency
- Reduction in iron deficiency
- Reduction in diarrhoeal episodes
- Reduction in infectious parasitic diseases
- Reduction in female infanticide and foeticide
- Sex ratio in the area
- Age of women at marriage.

Impact analysis based on the data collected will be undertaken once a year in the first two years and once in six months for the subsequent periods.

HFAP in Chitravadi Village of Mathurantakam Taluk

Sri Venugopal Perumal Trust, an NGO has been undertaking development projects with participation from the people of Chitravadi village. Based on the discussions held at the project sites, it has been decided to locate the projects in 9 villages, covering approximately 960 households (Table 3.42). After discussions in the villages, these schemes have been suggested for implementation:

- Growing of vegetables
- Growing fish in the tanks
- Social forestry programme
- Palmyrah industry

Table 3.42 : *Details of HFAP (Chitravadi Village)*

Number of households (approximate)			
Name	Main village	Colony	Total
Sirunallur	40	85	125
Mudukarai	150	50	200
Vilvarayanullur	100	100	200
Nethapakkam	-	-	-
Avirimedu	80	20	100
Chitravadi	80	40	120
Agathipattu	40	-	40
Kandaracheri	85	70	155
Jallimedu	20	-	20
Total	595	365	960

PRA exercise in Avurimedu Panchayat has been completed. A detailed action plan is being drawn, based on the findings of PRA exercise.

303.3 Pilot Project for Elimination of Micronutrient Malnutrition in Tamil Nadu

Micronutrient malnutrition, particularly deficiency in Vitamin A, iodine and iron, is widespread in the state of Tamil Nadu, affecting the health, welfare and productivity of its population. Elimination of this hidden hunger is an integral part of the seven-point action plan of the Hunger Free Area Programme. It was decided to concentrate on the elimination of hidden hunger through supply of micronutrients in the Dharmapuri district of Tamil Nadu. The intervention strategies proposed are as follows:

- Introduction of appropriate vegetables and fruits
- Enrichment of commonly available foods

- Development of kitchen gardens
- Introducing salt fortified with iron and iodine
- Iron and folic acid distribution through health centres

The pilot project funded by FAO will cover 15 panchayats out of the 33 panchayats in the Pennangaram Block of Dharmapuri district.

The overall aim of the project is a practical, community-based contribution to the policy of the Government of Tamil Nadu to improve the nutritional status of the ultra poor populations, with special focus on the elimination and prevention of micronutrient malnutrition.

The specific objectives are:

- Increased availability of micronutrient-rich fruits and vegetables for direct consumption and marketing by ultra poor population groups

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- Provision of expertise in community and household horticulture, food and nutrition education for the public, including food preservation and preparation and the training of nine community members per village to convey practical knowledge and skills in these fields to the ultra poor population groups
- Formulation of an expanded programme proposal, once the results of this project are evaluated, to disseminate its results in other districts in Tamil Nadu.

Salient features of the project:

- Community participation will be an integral part of this project. This will help in the understanding of specific problems and possibilities at the village level, identification of the ultra poor target group and creation of a basis for project implementation through the use of participatory methods. Community participation will further help in the preparation of appropriate training and education material on fruit and vegetable gardening, food nutrition, health and hygiene, food storage and food preparation, preservation, processing and marketing.
- Using and enhancing expertise from different sources in the Tamil Nadu Government at the state, district and block levels as well as inputs from NGOs according to their specific expertise and/or local experiences will improve the possibility of continuing the project activities beyond the two year duration of the project. On a local level, the capacity to take charge

of community and individual development through increased knowledge and awareness and self sustainability, using local opportunities as well as existing schemes and programmes, will grant the ultrapoor and their communities strength and confidence.

Strengthening Rural Livelihoods through Agroindustries

"Strengthening Rural Livelihoods through Agroindustries with specific reference to Tribal and Rural Women" is a collaborative project between MSSRF and the Central Food Technological Research Institute (CFTRI), Mysore. This is financially supported by the Food Links Initiative of the International Development Research Centre of Canada. Prof. J.H. Hulse of Canada serves as the principal adviser of the project. The project formally commenced operations in May '98 in two areas viz. Kolli Hills in Tamil Nadu and the Union Territory of Pondicherry. Activities of the first year focused on the following components:

- Systems studies
- Identification of markets
- Research
- Training and demonstration
- Community mobilisation

Systems studies of the project sites during the current year focused on the socio-economic and ecological profiles in the project sites. In addition to reconfirming the initial targets of the project, the studies enabled the finalisation of the project sub-sites. The profiles were also fruitful in establishing the first

set of impact indicators for the project. In Kolli Hills, it was found to be stability of prices and percentage of distress sale and in the Biovillages, the cash on hand for household expense. The study in Kolli Hills which drew upon the inputs of the local government, Department of Agriculture, village administrative officers, traders and farmers also established the zonal distribution of fruit production within the area. This component was in the latter stages used as input for training and capacity building.

Independent studies on the market structures and mechanisms were conducted in both the project sites. In addition to formal and informal interviews and group discussions, meetings were also held with government departments, local traders, wholesalers and retailers. The farthest point of transport was also

studied in detail. Results indicate that in Kolli Hills there is rampant undercutting of prices thereby allowing only 40% returns to the producer. The study in Kolli Hills also traced the pathway of the produce to four major buying centres viz. Chennai, Salem, Madurai and Tiruchirapalli and the transactional costs incurred at each level. The study in Pondicherry highlighted the need to upgrade the existing marketing facilities to achieve the desired aims of the project.

Identification of post harvest needs in the project sites revealed that in Kolli Hills, the focus has to be at two levels viz. enhancing the harvesting practices of farmers (which currently are cognisant to the shandy days) and superior packaging practices for the buyers. Tables 3.43 and 3.44 explain this.

Table 3.43 : Post harvest losses (%) at field level in Kolli Hills

Fruit	Type of damage	Cause	(% loss)
Pineapples	Physical	Improper harvesting	5-10
Citrus	Physical	Improper harvesting	2-5
Banana	Physical	Improper harvesting	1-2

Table 3.44 : Post harvest losses (%) during transportation to the nearest market

Fruit	Type of damage	Cause	(% loss)
Pineapples	Physical	Improper loading into the nets and bamboo baskets	5-10
Citrus	Physical	Improper handling and overloading	2-5
Banana	Physical	Improper handling	2-5

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Table 3.45 : *Production of fruits in Kolli Hills*

Months	Pineapple (in tonnes)	Bananas (in tonnes)	Guava (in tonnes)	Jackfruit (in numbers)	Citrus (in tonnes)	Pomegranate (in numbers)
January	80	32 to 40				
February	160	32				
March	160	32				
April	80	32				
May	1,200	32		8,000		
June	1,600	32		8,000		
July	1,600	32		8,000		
August	80	32	80		20	
September		32	240		20	9,600
October		32	320		20	9,600
November		32	80			16,000
December		32	40			
Total	4,960	384	760	24,000	60	35,200

Estimates of production were made, using multiple approaches in the absence of validated records. Table 3.45 highlights the production of different fruits during the peak seasons. A range of products have since been developed and the product feasibility analysis has also been completed.

As the first step towards forging a market consortium, a workshop was held from 30-31 July '98 in which representatives from the industrial sector, financial institutions, research stations and non-governmental organisations participated. A similar initiative is also being followed up in the Biovillage project site in Pondicherry.

The project achieved its major success in the area of training, capacity building and community mobilisation. To effectively meet the anticipated output of the project

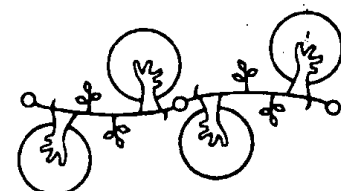
a group of at least twenty entrepreneurs per site have been identified and stepwise selection of volunteers was initiated in the month of June '98. In Kolli Hills, as the first step, the mandate and scope of the project were translated into Tamil and distributed in all the villages. This was followed by village level focus group meetings which resulted in the selection of nominees. The nominees were then assessed by a panel for the following parameters: aptitude and conceptual clarity. Twenty volunteers were finally shortlisted and were trained in the area of group formation and functioning. Simultaneously, a matching group of 20 volunteers were shortlisted to be trained at the CFTRI in the area of Post-harvest Technology. In Pondicherry, the mushroom growers were taken to CFTRI to be trained in improved mushroom production techniques.

Both the training programmes were followed by trial and analysis, where the applicability to local conditions was tested. The results have been used for the retraining process. The training also enabled the participants to identify specific components and infrastructure for further training.

The current year also witnessed the formation of a Farmers Society in Kolli Hills. The process of formation was initiated in the month of June '98. This Society, which is set to function as a cooperative has been christened *Malaival Makkal Palam Padinidum Kutturavu Sangam*. The seven member executive has three elected representatives, two nominees of the local womens' groups and one nominee from the local non-governmen-

tal agency. The executive has been created from a core group of members who have contributed an annual membership fee. This core group in turn is supported by a larger group of second level members. The objectives and byelaws of the Society have been formed through a process of consultation. The MSSRF and CFTRI along with a nominee from the executive will serve as the technical backstopping body. This entire procedure is being taken back to the community for a complete understanding of the mandate of the Society. In view of these developments, the Gram Pandchayat has decided to allot a part of the Panchayat land to the Society. In the coming year, a similar initiative is being planned in the Biovillage of Pondicherry.

Programme Area 400



Reaching the Unreached

Capacity building and strengthening the empirical research base related to realising the rights of young children were emphasised in Project ACCESS. In internalising the gender dimension at the Foundation, GENDEAVOUR moved from orientation to skill development and tools for evaluation. VOICING SILENCE continues to link gender concerns, cultural activism and social issues through theatre, using varied strategies.

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Sub Programme Area 401

Project ACCESS

The activities were related to project Operation Resource Support, sponsored by the Bernard Van Leer Foundation, on the following issues of child care:

- quality of child care services offered by both NGOs and Government
- linkage between women's multiple roles and child care as a support service
- discrimination against the girl child at all age levels
- people's participation and alternative structures for child care services
- care and development of children in the most vulnerable age group (0-2 yrs)

- needs of young children in disadvantaged urban environments.

The major objectives of the project are:

- strengthening the capacity of existing institutions working in these areas, both Government and voluntary, through training and development of training modules
- developing project support communication materials which could also be used for advocacy purposes
- undertaking research studies, the findings of which could be used for advocacy and policy formulation
- developing and maintaining a database on child care issues.

The two major activities (Figure 4.1) are, on the one hand, capacity building, through the processes of training, orientation, skill-building and production of instructional, commu-

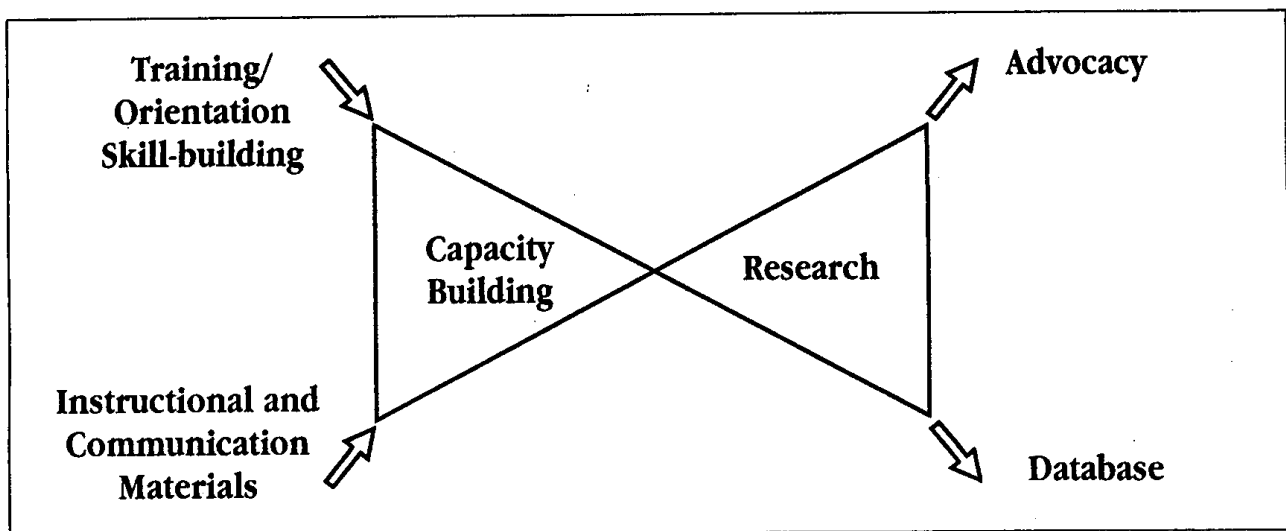


Figure 4.1 : *Project processes*

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nication and resource materials and on the other hand, research on selected issues, leading to advocacy and development of a database. The activities are listed in Table 4.1.

Table 4.1 : *Activities - June '98 to May '99*

Month	Event	Participants	Objectives	Outcome
Jun '98	Networking meeting	NGOs	To facilitate networking among NGOs working on survival of girl child	Articulation of need for building skills in specific areas
Sep '98	Communication workshop	TINP staff, communication and training specialists	To develop communication material on children below three for child care functionaries	10 sets of materials such as counselling cards, songs, charts developed in outline
Nov '98	Methodology workshop in ECCE	Trainers from NGO training institutions	To review the use of training methods and strengthen skills	Preparation of plan for one year internship model training in ECCE
Dec '98	Media workshop	NGOs working on survival of girl child	To help understand the print medium and AIR and learn to work with them	Jingles prepared for radio and manual on working with media bring prepared
Mar '99	Workshop for Panchayat leaders	Elected leaders of the Panchayats	To sensitise them to women & children issues and To help develop an action plan for improving the quality of child care services	Action plan drawn up by the participants Photo archive of existing state of balwadis
Apr '99	Advocacy workshop	NGOs, Govt., donors and others	To highlight the situation of the child care worker in the voluntary sector	Recommendations for improving status of child care worker and plan for recasting of schemes
Mar - Jun '99	20 - session training course	Child care workers of foundling home	To orient them to child development and developmental care of infants and help work out a holistic work plan & programmes	Action plans being prepared

401.1 Capacity Building

The main activities are described in this section.

Training methodology

A trainers' training course was conducted in January '98 for NGO training institutions, to enable them to run summer refresher courses in Early Childhood Care and Education (ECCE) more effectively and to improve the quality of child care services. The usefulness of this course to trainers in planning and implementing training programmes was reviewed in June '98. It was reported by trainers that they had utilised several of the strategies learnt in the course and that these had elicited a good response. Some problems, such as the need for skills and the future course of action, were also reviewed.

In the light of the issues raised by the trainers, a workshop to review training methodologies and strengthen skills was organised in November '98. One of the outcomes of this meet, resulting from the shared experience of the trainers, was that the one-time summer refresher course had to be recast as an extended in-service course in the "internship" mode. Short one-day sessions at periodic intervals throughout the year, along with attention to and guidance for practical problems of implementation, were needed in order to bring about improvement in skills. The cooperation of schools - NGO managements was also required to make the training effective. The trainers also began to be appreciative of the process of training besides the

content orientation, evident in their demand for future training courses that would equip them as professional trainers.

Communication

Tamil Nadu Integrated Nutrition Project (TINP) has been working intensively on improving the overall status of children below three years in Tamil Nadu, with emphasis on combating malnutrition and improving nutritional status. However, lack of suitable materials has been identified as a handicap in aiming for a more holistic and development-oriented programme for the under-threes, especially in reaching out to mothers. A five-day workshop was held jointly with the TINP for their communication and training officers. The objective of the workshop was to develop a package of communication materials on the development of 0-3 year old children for the use of child care workers in the field, and prepare an action plan for field testing and mass reproducing it.

Through a series of discussions between ACCESS and TINP it was decided that about 10 products would be developed to begin with. Participants were given three types of pre-course assignments in advance, namely reading exercises, collection of folk songs, riddles etc., and observation of children below three years of age. Background material was collected on the various stages of development.

In the course of the workshop, 41 messages considered to be important and worthy of dissemination were drawn up. A set of about 10 materials was developed in draft form,

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including a series of 20 counselling cards on various developmental domains, a calendar, posters, charts, songs, plays, skits, and a number of short messages in traditional Tamil forms such as proverbs, riddles, *athi-choodi*, *patti-manram* etc. The materials have yet to be finalised for field testing.

Skills in developmental care

An NGO which runs a foundling home for destitute and abandoned children approached Project ACCESS with a request for a training programme for its child care workers handling infants. The need for such a training was felt by the management as the children in the home, though healthy and well nourished, often fail to reach the age-appropriate developmental milestones. The Home serves as a transit home for the children till they are placed for adoption, with an age-range from new-born to an upper age limit of approximately twelve months. The objective of the programme was to enable the workers to offer more stimulating developmental care to infants in their care.

It was decided that a series of weekly workshop sessions would be held on various issues related to both content and process, with emphasis on the holistic nature of child development. A multi-disciplinary training team consisting of child development specialists, paediatricians, process trainers, nutritionists, psychologists, creche supervisors and teachers were brought together.

Prior to the training programme a needs assessment exercise was undertaken by some of the resource persons through observation

of the daily routines, child care practices and adult-child interactions. A twenty-session course, including aspects such as perceptions of self and attitude towards children and work, interpersonal relations, prenatal development, domains of development, preparation of simple toys, games, songs and lullabies, developmental testing, methods of feeding, physical environment and daily routines was conducted. Field trips to some other institutions were also organised.

Based on observations and interaction with the trainees, it was found that in addition to training inputs, a review of personnel policies and revised work schedules would have to be attempted by the management, to bring about practical implementation of the training and further improvement in the functioning of the centre. A series of meetings with the management is also being held to integrate these two aspects and facilitate change.

Working with media

In yet another capacity-building exercise, a two-day workshop was organised for NGOs working on the problem of female infanticide and foeticide. This was a direct outcome of the networking meeting organised in June '98 by the concerned NGOs to share a common platform for exchange of ideas and experiences. Skills in working with media had been identified as an important area which needed strengthening. This workshop focused on how to approach, understand and work with the print media and with All India Radio (AIR).

Resource persons from both the print medium and AIR participated in the workshop. Exercises such as critiquing journalistic writings, writing press releases, mock press conference, role play, identifying appropriate time slots in radio and preparation of jingles and fillers were undertaken. The major conclusions at the end of the workshop were that it was important to understand how journals/newspapers operated, and help publish information offering the right perspective.

The role of NGOs is not to provide scoops or event-based coverage to the newspapers, but to relate to the medium continuously on the issue. With regard to working with AIR, it was pointed out that the girl child issue should be touched upon by all programmes, and not restricted to those dealing with women and children. The participants took a decision to work more closely with the local press, with a better understanding of the limitations and characteristics of the medium. The group also expressed the need to hold another workshop on street theatre and cultural forms, which can effectively reach the people.

People's participation in child care services

With the advent of the Panchayati Raj system of local self governance, which requires one-third representation of women members, decentralisation of child care services to include people's participation in service delivery is an important route to improving the quality of services. In this context, a

two-day workshop for Panchayat leaders of Athur Block was held at Gandhigram in March 1999 in collaboration with the Gandhigram Trust. The objective of this exercise was to sensitise the leaders about the importance of child care and the role of child care centres in providing holistic development to the young child, to help them evolve an action plan for improving the services at the centres within their area of jurisdiction.

A vertical participation from all levels of the hierarchy was solicited. On the first day all the women ward and block members were included, while on the second day only the Block Chairperson (a woman) and both men & women village Panchayat Presidents and district representatives participated. On both the days resource persons introduced the themes, reviewed the available services, elicited the existing lacuna and helped the participants to draw up an action plan for improving services at the centres. This included improvement in infrastructure facilities, such as toilets, water supply, repair of buildings and playgrounds; provision of play materials and nutritious food, including development of kitchen gardens; and regular supply of fruits and vegetables. Periodic monitoring and support in implementation is being offered to the leaders jointly by the two institutions, Gandhigram Trust and MSSRF.

They key materials developed during this period to support capacity building and advocacy are presented in Table 4.2.

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Table 4.2 : *Products - June '98 to May '99* *

Month	Name	Content	Audience	Outcome
Jun '98	Poster	Messages on development of child below 2 in four main domains	Parents:through paediatricians, health workers, schools, public spaces, ICDS and TINP centres, NGOs, members of TN-FORCES	640 copies distributed through all channels, with multiple copies to institutions, associations and groups
Aug '98	Pamphlets/ fact sheets (English and Tamil)	Maternity entitlements/ Survival of girl child/ Parenting the under-threes	Professionals, parents, NGOs, educational institutions women's organisations, colleges	450 copies distributed at meetings/ workshops, through institutions, associations and groups
Jul - Oct '98	Video spots <i>Enna Pannikkittirundhe?</i> (What were you doing?) <i>Yaar Karanam?</i> (Who is the cause?) <i>Enna Pidikkum?</i> (What does baby like?)	Messages on rural women's multiple roles and burdens/ How sex of child is determined and value of female child/ Young child's need for stimulation	Doordarshan for telecast and as video to NGOs, educational institutions, women's organisations, colleges for discussion	Occasional broadcast on Doordarshan Channel-I 28 copies of video distributed Used in meetings about 2-3 times a month
Dec '98	Audio spots	Two jingles on survival of girl child	For use in radio broadcast	Submitted to AIR for broadcast
Dec '98	<i>Aadipaadi</i> With Song and Dance	Manual of play activities categorised for each domain of development, richly illustrated	Preschool teachers, creche and balwadi workers, all those working directly with children aged 3+	475 copies distributed to TINP and DSW NGOs, schools, members of TN-FORCES
April '99	Overview of Child Care Services in Tamil Nadu <i>Tamizhnattil Thai-sey Urimai Oru Parwai</i>	Briefing document on laws, schemes and services relating to child care with a special 4 page pull-out for legislators	Members of Legislative Assembly and others	500 copies to TN-FORCES for distribution to Tamil Nadu MLAs, MPs, members of TN-FORCES, NGOs, Panchayat leaders

* Language of all products exclusively Tamil except where indicated.

401.2 Research

The child care worker holds the key to providing an effective programme for the child's development. Though there is a large body of literature on infrastructure facilities and quality of programme delivery at the centres, very little attention has been paid to the situation of the worker herself, her motivation, attitudes and perceptions. Data collected on these aspects from 267 child care workers at a convention sponsored by Tamil Nadu Forum for Creche and Child Care Services (TN-FORCES) at Gandhigram in 1994 was analysed and published as a report entitled "The First Teacher". The report, which describes the different aspects of the child care workers' situation in eight chapters, highlights the fact that with increase in service, the motivation level of the worker decreases.

Of the three new research studies carried out during the project period, one pertains to the situation and needs of the community, the second analyses the effectiveness of service delivery and the third addresses policy issues. The first, "Care giving behaviour of mothers and the growth and development of infants in urban slums", attempts to look at the relationship between child care practices of mothers and the development of infants. The study is being conducted in two phases: phase 1 is a broadbased survey of 350 infants; phase 2, which is to include in-depth case studies, will be based on this. The questionnaire developed for the survey was field tested and refined. Thirteen slums were selected through random sampling and data was collected by the principal investigator,

assisted by a second investigator, from 362 mother and child dyads, over a period of four months. Data entry has been completed and analysis begun. The report of phase 1 is expected to be ready soon.

The second study seeks to assess the impact of various models of existing ECCE programmes on children's learning outcomes. Four ECCE programmes operational in Tamil Nadu, namely ICDS, TINP, private nursery schools, and creches and balwadis run by NGOs are being studied, covering both urban and rural areas. A consultant with vast experience in child development as well as a statistical advisor were identified. Through a series of meetings the necessary tools for the study have been developed, based on national and international tools that were already available. The tools would assess the infrastructure facilities in the centre, the activities carried out during the working hours and the child's learning outcomes. The field study will begin in July.

Advocacy, communication and orientation to special groups

A study of the situation of child care workers in Tamil Nadu was conducted by Project ACCESS. Based on the findings of this study and that of a major study by National Institute of Public Cooperation and Child Development (NIPPCD) on the functioning of creches, a one-day advocacy workshop was jointly organised by ACCESS and TN-FORCES in April '99 to discuss the status of child care workers and recommend measures for improving their situation and the quality of service delivery.

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Table 4.3 : *Orientation activities for various stakeholders
June '98 to May '99*

Month	Stakeholder	Issues	Collaborator
July '98	Creche teachers	ECCE	Vivekananda Kendra
July '98	Paediatricians	Maternity entitlements, breastfeeding and survival of the girl child	IAP-TN
August 98	Preschool teachers	Parent teacher cooperation	IAPE
September 98	Panchayat women representatives	Quality of child care services, maternity and breastfeeding	Sathyamurthi Centre for Democratic Studies
November '98	Medical practitioners	0-3 child development, survival rights of the girl child, breastfeeding and burden on the preschool child	Citadel Pharma
April '99	Paediatricians	Breastfeeding and burden on the preschool child	IAP-TN

The participants in the workshop were NGOs, government functionaries from the Directorate of Social Welfare and TINP, and other stakeholders such as donors, academics, women's organisations and trade unions. It was inaugurated by the Chairperson of the Central Social Welfare Board and presided over by the Chairperson of the State Social Welfare Board. The recommendations of the workshop were placed before the Minister for Social Welfare, Tamil Nadu, in the Valdictory Session.

The following conclusions were reached:

The child care worker should be considered a full-time worker and not honorary or part time; the remuneration should be enhanced to equal that of the anganwadi worker and gradually increased to that of the primary school teacher; the creche scheme should focus on young children of poor working mothers. The need for follow up action and continuous lobbying by TN-FORCES was also stressed by the participants.

Advocacy and orientation sessions for various stakeholders were held as indicated in Table 4.3.

Collaboration with TN-FORCES

Collaboration with TN-FORCES, as a member and founder of the network, is an important area of work, especially in terms of resource support. Four major activities were undertaken jointly during the year:

A Training Methodology Workshop was conducted in January '98 to support the summer refresher courses in ECCE and developed into a professional support programme for training institutions. Four summer courses were planned for the summer of 1998 but only one could be held, and one internship course was experimentally launched. This year, all the groups planned one-year internship model courses and three have been launched in April-May '99.

At its meeting in October '98, the preschool sub-group of TN-FORCES decided that in order to lobby effectively with the government for legislation on the content and process of ECCE, it was essential to develop and prepare a basic play-based developmentally-appropriate core curriculum, acceptable to all and capable of adaptation in diverse settings. IAPE took the lead in offering to develop such a curriculum with resource support from Project ACCESS. Through a series of meetings with experienced ECCE specialists and members of TN-FORCES, and utilising earlier materials developed by NCERT and others, the curriculum has been framed in both English and Tamil and is likely to be formally launched soon.

With a view to orienting legislators and policy makers at all three levels (national, state and

local) a briefing document has been prepared for TN-FORCES on the current state of child care services in Tamil Nadu, giving details about current laws and existing schemes for the young child, along with brief critiques of these. The document also contains a special four-page pull-out indicating what legislators can do at the level of the constituency and at the level of the Assembly/Parliament.

Initiating advocacy for the child care worker in the voluntary sector in Tamil Nadu, a workshop was jointly organised with TN-FORCES on the theme. This is expected to be the beginning of a follow-up campaign.

Collaboration with National FORCES

Being a founding member of FORCES, Project ACCESS continues to play an active role at the national level. This year, support was given in the form of a concept paper on "Maternity and Child Care Code" which was the basis for discussion at the policy committee meet held in Delhi in April '98. This was subsequently critiqued, developed and refined by other groups and accepted as the FORCES policy stand at the January '99 meeting, at which also ACCESS played an active role.

The series of video spots entitled "Messages that Move" prepared by Project ACCESS have been dubbed in Hindi by national FORCES, for telecast by Doordarshan if possible, and for use by interested groups.

Sub Programme Area 402

Uttara Devi Resource Centre for Gender and Development

The mandate of GENDEAVOUR (Resource Centre for Gender and Development) includes two types of activities: Core and Internal. Core activities include research studies, interventions in curriculum design and opening up platforms for discussing current and burning issues related to gender, while the latter term refers to the internalisation of gender in all the programmes and activities of MSSRF.

402.1 Core Activities

Research studies

"Women's Participation in Panchayati Raj: A Case Study from Tamil Nadu" was sponsored by the National Commission for Women and coordinated by the Centre for Development Studies and Action, New Delhi as part of a nationally coordinated project entitled "Panchayati Raj and Women's Participation." The study, which attempted "to document the self-image, political awareness and experiences of the elected women in the panchayat institutions" was conducted by Dr. V.B. Athreya, Professor of Economics, Indian Institute of Technology (IIT), Chennai and Ms. K.S. Rajeswari, Ph.D. Scholar, IIT, Chennai. Based on a sample of 100 elected women leaders from Pudukottai and Thiruvallur districts of Tamil Nadu, it has drawn on both quantitative and qualitative

data. Though generalisations cannot be drawn from the study, it has identified already existing areas of strength such as youthfulness, high educational levels and political awareness of the women; as well as areas of concern, namely the need for skills development, structural reforms and containment of male backlash. Remarkable insights came from a special probe into the views held by the women on gender issues. That the political empowerment of women has been well launched in Tamil Nadu has been proved forcefully by the study.

"Health Profile of Women in Three Traditional Occupations in Kerala", a study conducted in collaboration with the NGO Health Action by People, the Kollam District Panchayat and the Gangadharan Memorial Trust, was designed to document the health profile of women engaged in the traditional industries of cashew, coir and shrimp processing in Kerala.

The study could not be conducted this year due to delay in obtaining financial support and efforts are underway to identify other sources and complete the study in 1999.

Education

Considering the general lacunae felt in the curricula of higher education, and the lack of social relevance in general and gender concerns in particular, work was begun in the field of curriculum renewal in the disciplines of Agriculture and other general undergraduate and post-graduate courses in Arts and Science Colleges.

The initiative for integrating gender in agriculture studies grew out of our representation on the Task Force on Women in Agriculture set up jointly by the National Commission for Women and ICAR, which identified 'genderisation' of the undergraduate curriculum as a priority task at its meeting in August '98. A full day workshop sponsored by ICAR was held at National Academy of Agricultural Research Management (NAARM), Hyderabad, in March 1999 in which the Deans of Agriculture Universities participated. The idea of introducing gender dimensions into the core curriculum at the undergraduate level through specialised courses was introduced and accepted. The next step is to frame the course outlines and develop the instructional materials which would enable teachers to handle the new courses. The coordination of this activity has been entrusted to NAARM and work will begin soon. Though incorporation of gender concerns into the curriculum may take time, the first step has been taken.

In December '98, a one-day workshop on "Incorporating Gender" was held in Madras Christian College at the instance of the Women's Studies Centre of that College and with human and academic resource support from GENDEAVOUR. Two more workshops have been held and hopefully this experience will provide a model to be replicated in other colleges for specific disciplines.

Events

- In the context of World Food Day a panel discussion on "Women Feed the World" was conducted on 16 October, '98 at

MSSRF. The publication of a special article on women's roles in agriculture in the October issue of *Indian Farming* and the release of a video-spot on this theme by Doordarshan were the other highlights of the day.

- A public lecture on "Juvenile Sex Ratios in India" by Dr. Satish Agnihotri, IAS, Secretary, Women and Child Development, Government of Orissa was held on 24 November '98 in collaboration with the Madras Institute of Development Studies. The lecture attracted wide interest in academic circles.
- To commemorate International Women's Day, a public meeting on the "Political Participation of Women" was held on 3 March '99 in which a panel of elected women panchayat leaders participated, following a presentation of the findings of the study on women panchayat leaders in Tamil Nadu. The panelists, drawn from different rural and urban panchayats in Tamil Nadu, represented three different political parties as well as independent candidates and spoke about the difficulties they had faced, the strategies they had utilised and the support received from various quarters. All of them emphasised the need for training for elected women members.
- On 8 April '99, at the meeting of the Global Board of the Hunger Project in Chennai, a one-day consultation was held on the theme "Towards a Hunger-Free World: Gender and Public Action". The aim was to bring gender issues into the public

domain. The discussions were based on three issues: the Right to Survival, the Right to Livelihood and the Right to Empowerment. Distinguished speakers from within and outside the country led the discussions. The insights and conclusions reached are expected to help in formulating action strategies at the level of NGOs, governments and international agencies. The proceedings have been compiled as a brief report.

Networking

The Centre is one of the 22 world-wide co-founders of the International Consortium on Gender in Agriculture, Rural Development, Environment and Natural Resource Management (GARDEN). The idea for such a network was initiated in October '98 by the Department of Gender and Agriculture Studies at the University of Wageningen in the Netherlands and discussed with potential partners by e-mail. At a meeting held in April '99 in Wageningen, attended by 37 persons representing international and national organisations, donor agencies, research and development organisations and others, preparatory work for the Consortium was undertaken, including discussion of aims and objectives, activities and structure. The Consortium is expected to focus on information sharing and dissemination, shared databases, consultation and exchange of scholars, collaboration in research, education and training and developing a journal and newsletter. It is hoped that it will grow into a powerful collective voice of rural women in world forums. GENDEAVOUR has taken the respon-

sibility of extending the sub-network at the regional level (in Asia) and for databases in its areas of interest, such as gender, agrobiodiversity and Intellectual Property Rights (IPR) and introducing gender studies in the curriculum of agricultural universities.

402.2 Internalisation Process

The process of internalisation of gender, started last year, continued to focus on orientation workshops for newly recruited staff and new projects. There has been a movement forward from mere orientation on gender concepts to practical action through skill development in tackling various issues relating to gender at the field level. The process of internalisation includes workshops, the Gender Task Force (GTF), capacity building and information sharing.

Workshops

Six workshops were conducted (Table 4.4) of which a few were follow-up activities emerging from earlier ones, but with focus on training for project teams, for example on facilitating group discussions with women's groups, process documentation and gender and impact assessment, so that they in turn could work effectively on gender issues.

The new project "Conservation, enhancement, sustainable and equitable use of natural resources" (CONESUB) was given an orientation towards gender perspectives. This project has a strong gender component built into it. Since many of the project staff were newly recruited, an orientation to gender concepts was seen as essential. The workshop used innovative methodology like drama, group

exercises and group discussions to orient participants towards gender issues. Feedback on the programme revealed the need for field-related skills in gender responsive data gathering and analysis. A follow-up workshop was conducted at Wayanad, one of the project sites, to focus on relating local problems to gender approaches, enhancing field skills in gender sensitive observation, interaction and data collection and analysis. Improving communication strategies in information sharing with local groups was also taken up.

Social and gender audit

A social and gender audit was undertaken

by the various projects of the JRD Tata Ecotechnology Centre, to assess the impact of the project components on social and gender issues. Appropriate social and gender indicators to measure impact were developed.

The methodology was developed by the project team in consultation with a gender specialist during the course of a two-day workshop held at Chidambaram in March '99. The indicators for the assessment were developed in consultation with local women who participated in the concerned programme. The methodology was also field tested during the workshop and is currently being used for the audit. This is the first

Table 4.4 : *Workshops - June '98 to May '99*

Date	Projects	Objectives
30 July '98	Biovillage staff	Review of follow up action on framing objectives and structure of the biovillage society
15 - 17 July '98	Coastal Wetlands Project of Andhra Pradesh, Orissa and Tamil Nadu	Develop skills in process documentation with gender sensitivity
24 - 25 September '98	Staff of the project on CONESUB	Orient participants on gender concepts through innovative methodology like drama, group exercises and group discussions
28 January '99	Biovillages staff	Orient new staff on concepts of gender and indicators relating to it
5 - 7 March '99	Ecotechnology project staff	Evolve a methodology for conducting a social and gender audit of the Ecotechnology project
21 - 24 May '99	Staff of CONESUB	Enhance field skills, data analysis and communication strategies

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major project of MSSRF to undertake a systematic gender audit and the tool is being shared with all projects and will later be made available to interested persons working in this area.

The Gender Task Force (GTF)

The GTF met in August '98 and March '99 to focus on information sharing and knowledge building on gender issues through bibliographies and other tools. At the meeting held in August, detailed presentations were made on most projects at MSSRF and their efforts in mainstreaming gender.

An issue that was discussed at length at the March GTF meeting was the need to build in feedback systems about the information sent out and the support provided by the Resource Centre on Gender and Development in the process of internalisation.

Focal theme workshop on gender

This was conducted in March '99 as part of the annual review. Case studies relating to gender issues were presented, details of which are given in Table 4.5. The discussion at the end of the presentations tackled practical issues relating to gender concerns at the project level. The discussion also brought up the need for a greater understanding of methodologies used in analysis of data in the social and biological sciences so as to facilitate greater synergy of efforts.

Capacity building

Capacity building, with reference to gender issues, was continued this year. In February '98, a member from the CONESUB project

team attended a programme on Gender Issues in Development at the Indian Institute of Forestry Management, Bhopal. The training programme was aimed at gathering gender based information through analysis of activity profiles of men and women, resource access of men and women and constraint analysis, for effective and successful implementation of development projects.

A staff member involved in the Information Village project received the "Gender Matters Award", an award given by the donor group. The awardee participated in a gender workshop conducted by IDRC at New Delhi and subsequently trained other project staff at Chennai and at the project site at Villianur. Training was also imparted to two volunteers from the knowledge centres in two villages and to women from two villages.

Networking

A team of scientists participated as resource persons in the workshop on "Farmer participatory methods in research and development for the semi arid tropics" organised at ICRISAT on 27 and 28 October '98. Experiences in plant breeding, with specific reference to methodologies used for incorporation of gender issues in field level research, were shared. Minimum information needs, impact assessment, voluntary participation, constraints to participatory research and the sustainability of the research programme were discussed.

Information sharing with international agencies

The Centre deputed resource persons for an

Table 4.5 : Papers presented at the gender workshop

Title of presentation	Project
Gender equity: Experiences from the participatory resource management at Pichavaram mangroves	Coastal Wetlands Project
Gender issues in Information Village	Information Village
Strengthening rural livelihoods through agroindustries	B.V. Rao Centre for Sustainable Food Security
Gender issues in biodiversity conservation at Jeypore in Orissa	CONESUB Project
Internalisation of gender issues at MSSRF: the process and the problems	Uttara Devi Resource Centre on Gender and Development

expert consultation on "Participatory research methods and gender data base", hosted by the FAO Regional Office for Asia and Pacific at Bangkok, from 11-14 May '99 to generate recommendations for FAO and participating countries to improve research methods, and information collection processes that are user-friendly, gender-sensitive and reliable, for developing gender differentiated information and programme approaches.

Sub Programme Area 403

Voicing Silence

"Voicing Silence" has widened its scope and reach in the cultural sphere with special emphasis on gender issues in Tamil Nadu.

Workshops

An introductory workshop on communication was held for the young members of the Agrobiodiversity Conservation Corps in Kolli Hills to help them use the local idiom and traditional forms of communication on the theme of biodiversity conservation in their communities.

Continuing its efforts to refine perception and articulation through theatre as part of the process of empowerment, workshops were organised for adolescent girls. Working for 100 hours over a span of 3 months in three schools in Chennai, "Voicing Silence" attempted to concentrate on self-exploration through creative movement with IX and XI grade girls. These workshops involved 17 resource persons from the city, working separately or together, with a shared approach.

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Giving them a free hand to choose the area they wished to address and the mode of expression, such as dance, improvisation, games or puppetry, the workshop concentrated only on the process and not the product.

Being a new experience for many of the resource persons and the students, the workshop brought out the differences in individuals depending on their socio-economic-cultural milieu and that of the school. It was interesting to note that the schools often reinforce these values. The girls were given a chance to share their learnings with a small group of schoolmates and teachers through a simple self-chosen exercise in expression.

There have been requests from the schools to continue this effort, and requests for such workshops from other schools in the city.

Plays

"Vellavi", a play based on the life story of Marudayi, a 76 year old dhobi woman, documented by Parthibaraja, as part of an oral history project for a Master's degree in Tamil, was performed by Pritham Chakravarthy. An experienced artist, she portrayed the energy of a woman whose knowledge, work and experience have sustained her life. The play was set against the colourful backdrop of a dhobi square.

Oral history is a major research tool today in gender and social studies. Drawing its strength from subjective narration, "Vellavi" contextualises the professional life of a dhobi woman. The play was performed in the Dalit

Theatre Festival in Madurai in August '98, twice in Chennai for theatre audiences and once in a city school. Within MSSRF, "Vellavi" was performed as a starting-point for a discussion in the workshop on gender organised for the staff of the CONESUB project. The play has had five shows so far, each leading to a discussion of the basic issues it throws up regarding women's voices.

"Avvai"

The play "Avvai" written by 'Inquilab', a committed leftist poet of Tamil Nadu, who has given the text an unbelievable reach, challenges the image of old age associated with the classical Tamil poet of that name, an image constructed by popular tales, plays and a film called *Avvaiyar*.

The play speaks loud and clear in a female voice which resists restrictions. The first century Sangam woman poet is youthful, sensuous, fearless in expressing her emotions, worldly-wise and adept at political diplomacy. The play explores her psyche and the lifestyle of the ancient Tamils as revealed in her poems.

The play has so far been performed ten times, (Table 4.6) to varied audiences, and also broadcast in a condensed form on AIR.

Networking

"Voicing Silence" organised *KULAVAI '99* a network for theatre workers at the national, State and regional levels in February '99. 5 theatre groups and cultural groups from 11

Table 4.6 : *Performances of "Avvai" - September '98 to March '99*

Date	Organisers	Venue
09.10.98	Karanthai Tamil Sangam	Karanthai Tamil College, Tanjore
10.10.98	Pollachi Tamil Sangam	Tamil Sanga Manram, Pollachi
13.10.98	Voicing Silence & International Institute of Tamil Studies	Tamil Nadu Music College, Chennai
14.10.98	Sri Sankaradas School of Performing Arts, Pondicherry	Kelas Manram, Pondicherry
06.12.98	All India Radio	Vannachudar Programme
14.12.98	Department of Tamil & Centre for Women's Studies, Madras Christian College	Madras Christian College, Chennai
22.12.98	Kerala Sangeet Natak Akademi, Thrissur, Kerala	National Festival of Women's Theatre Thrissur, Kerala
04.01.99	Voicing Silence (with audience support)	Museum Theatre, Chennai
21.01.99	Tamil Nadu Women's Forum	Arakonam
02.02.99	Department of Tamil, New College	New College, Chennai
13.02.99	Vaniyambadi Muthamizh Manram	Vaniyambadi

NGOs from the four Southern States participated in this regional festival-workshop which adopted several interwoven modalities of work. Four papers, one from each State, gave an overview of the existing state of affairs in relation to gender, cultural activism and social issues. 10 demo-presentations by NGO groups were made on modes and styles of working, themes selected and manner of treatment. In the evenings, public performances were given by four theatre groups, one in each of the major Southern languages, each

of which addressed gender issues in a unique way. A panel discussion identified and highlighted major common concerns such as perspectives, representations, form and content, process, and theatre and social/political activism. Finally, the participants worked in groups on these five issues and presented their conclusions in the form of theatrical improvisations, confirming once more the reach of the "language of theatre". The finale was a powerful affirmation of synergy arising from shared creativity and vision and

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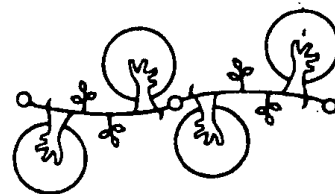
a firm commitment to future networking. *KULAVAI* '99 is being documented in both print and video.

Documentation

A preliminary study of street acrobats in Tamil Nadu in general and Chennai city in particu-

lar has been completed. Least recognised as art, this form in which women participate as members of the family, requires greater attention to its linguistic, gender and performance aspects. Possibilities of working with this community and its art form are being explored.

Programme Area 500



Education, Communication, Training and Capacity Building

Several seminars, dialogues and workshops were organised. "The Hindu" Media Resource Centre for Ecotechnology and Sustainable Development organised a scientists-media interaction on issues relating to genetically modified organisms (GMOs). "The Hindu" centre also organised several Millenium Lectures. The International Society for Mangrove Ecosystems (ISME) has designated MSSRF as the Indian Ocean Centre of the Global Mangrove Information System. Training programmes ranged from village level in situ training to an international training programme on Timber Trade statistics sponsored by the International Tropical Timber Organisation. A computer aided and Internet linked Virtual College was established in several villages of Pondicherry. This unique user controlled and demand driven Virtual College links scientists and information providers with rural families.

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Sub Programme Area 501

Workshops and Conferences

A number of national and international workshops and conferences were organised on topics in which MSSRF has critical interests.

National Level Training Programme on Participatory Assessment and Planning for Natural Resource Management and Community Development (10-17 August '98)

The Farmer-Centred Agricultural Resource Management (FARM) programme sponsored by FAO-UNDP has developed an intervention process for community development called participatory assessment and planning (PAP) approach. The PAP is a social intervention tool that cuts across all development projects, current and future. It is a community planning and management tool that utilises a gender sensitive participatory approach which provides a doing and learning situation.

As part of the ongoing FARM programme objectives, a national PAP training was conducted from 10-17 August '98. The purpose of the training was to facilitate the institutionalisation of the approach. Selected farmer leaders and government officials were brought together as a pioneer group of twenty people to strengthen and build human resource capacity for the institutionalisation process. This pioneer group was drawn from

the FARM sites at Alwar (Rajasthan), Almora (UP) and Coovam (TN), MSSRF and officers from the Ministry of Agriculture, Government of India.

The PAP training was held at MSSRF in Chennai and the field exercises in Kanthoor Village in the Coovam watershed area in Kanchipuram district, Tamil Nadu. The PAP training was conducted by Mr. Bishan Singh, Senior Advisor, Participatory Development, Information and Training of the FARM programme. Dr. Revathi Balakrishnan of the Rural Development and Gender Division of FAO-RAP was the key resource person.

The participants were exposed to the processes of mapping natural resources, assessment of community resources and role of gender in community development. The members of the pioneer group then conducted similar exercises for the villagers in Kanthoor village. One of the significant outcomes of the training process was the formation of a grassroots level committee to assess the key factors affecting community development and ways and means to overcome the development process. The village committee was a multi-sectoral one with participation of key officials of the government departments.

Workshop on Sustainable Forestry Practices (21 September '98)

This workshop was organised on occasion of the release of the report of the World Commission on Forestry and Sustainable Development, and the meeting of the Inter-

national Board of Trustees of the Iwokrama Rain Forest Research Programme. The workshop was addressed by international forestry experts, Dr. B.C.Y. Freezailah (ITTO), Dr. D.S. Cassells (DG, Iwokrama Programme), Dr. Angela Cropper (former Executive Secretary, CBD Secretariat), and by eminent Indian foresters. Hon. Dr. Navin Chanderpaul, Minister for S&T and Environment, Guyana and Sir Humphrey Maud, Deputy Secretary General of the Commonwealth also addressed the workshop which was attended by forest officers from different parts of India.

Discussion Meeting on Traditional Knowledge, Innovations and Culture of Indigenous Peoples, Local Communities and other Holders of Traditional Knowledge and Culture (organised in association with the South Asian Fact Finding Mission of the World Intellectual Property Organisation - WIPO) (30 September '98)

The WIPO organised a mission "to identify and explore the intellectual property needs and expectations of new beneficiaries, including the holders of indigenous knowledge and innovations, in order to promote the contributions of the intellectual property system to their social, cultural and economic development". Further, the WIPO provided for "study of current approaches to, and future possibilities for, the protection of intellectual property rights of holders of indigenous knowledge, innovations and culture, through fact-finding missions to North America, South and Central America, the South Pacific, West and Southern Africa, and South Asia, and

publication and dissemination of information compiled from these missions". The mission was led by Dr. Richard Owens, Director of the Global Intellectual Property Issues division of WIPO. In the discussion meeting held at MSSRF, participants came from a wide range of organisations, from academic/research institutions, NGOs, social activists, and the government. Two former Secretaries to the Government of India, Mr. R. Rajamani (Environment and Forests) and Mr. A.V. Ganesan (Commerce) also participated in the workshop. The topics of discussion included the relation between intellectual property rights (IRP) and the conservation of biological diversity; the need for documentation of farmers' traditional knowledge; philosophical underpinnings underlying the international IPR system, such as certain concepts of property; IPRs and the conservation and use of plant genetic resources for food and agriculture; and the protection of local designs from unauthorised commercialisation.

Workshop on Ending Malnutrition in India by 2020 (23-24 November '98)

The meeting of the UN Commission on Nutrition was held in Chennai in November '98. Taking advantage of the presence of world leaders in the area of nutrition, a workshop was organised during 23-24 November '98. Senior experts and officials from different institutions in the country participated in this workshop, which also discussed the draft report of the Commission. Some of the points that emerged from this meeting are reported in SAP 303.

Workshop on Sustainable Livelihoods and Environment Management of Coastal Ecosystems – in Observance of the International Year of the Ocean (jointly organised with the FAO Bay of Bengal Programme and the India Operational Centre of International Ocean Institute) (10–11 December '98)

The United Nations declared 1998 as the International Year of the Ocean to draw the attention of governments and the public to the various issues related to the oceans and to develop programmes for their sustainable management. Agenda 21 of UNCED has been designed to foster an integrated approach to environmental conservation and economic development. The major objective of this workshop was to standardise procedures for promoting the sustainable livelihood security of coastal communities, particularly fishermen and women, and to develop a voluntary code of conduct for sustainable fisheries. The workshop was also designed to look critically into the threats to sensitive ecosystems such as the Gulf of Mannar Biosphere Reserve, and to suggest sustainable management programmes. The draft document on the "Code of Conduct for Sustainable Fisheries in India" prepared by MSSRF was discussed and adopted at the workshop.

Dr. R. Chidambaram, Chairman, Atomic Energy Commission, inaugurated the workshop and the DAE-Homi Bhabha Chair at MSSRF. In his address, the Chairman of AEC observed that MSSRF's ongoing programme of coastal systems research and the Bhabha Atomic Research Center's (BARC) Vision 2000

programme (Biosciences Group) had several common goals which were complementary. The Department of Atomic Energy (DAE) and MSSRF are implementing a programme to apply nuclear and biotechnological tools in coastal systems research (SPA 102 in this report). Both this project, and the Homi Bhabha Chair, would be based on the principles of "Atoms for Peace", enabling rural communities to derive benefits from nuclear research.

National Consultation on Genetically Modified Organisms: Implications for Environment, Food Security and Human Nutrition (6-7 January '99)

During the 86th session of the Indian Science Congress, MSSRF organised a National Consultation on "Genetically Modified Plants: Implications for Environment and Food Security and Human Nutrition". This consultation was inaugurated by Nobel Laureate Prof. James D. Watson and attended by more than 40 participants representing the scientific community, researchers, government sector, private sector and mass media. The deliberations were organised in four thematic sessions dealing with general issues, regulatory mechanism, role of industry and public perception of biotechnology. The highlight of the consultation was a media workshop on GMOs at which the science journalists representing national and international media groups interacted with the scientists, representatives of international research institutes, regulatory authorities, private sector and non-government organisations. After detailed

Education, Communication, Training and Capacity Building

deliberations, the participants made the following suggestions for intensifying the use of *Biotechnology for the Public Good*:

- Promoting greater interaction between public and private sector scientists, civil society organisations, the media and the judiciary and organisation of interactive workshops for this purpose
- Information empowerment and education at all levels, starting with the village panchayats
- Integration of GMOs within an integrated natural resources conservation and enhancement strategy, such as including GMOs in the context of an Integrated Pest Management (IPM) framework in the case of pest management
- Increasing the national capacity in assessing known and unforeseen risks and in developing an unbiased balance sheet of risks and benefits
- Intensification of research in the public sector and expanding meaningful public-private sector partnerships
- Strengthening the infrastructure for research on microorganisms as well as farm animals, including fish
- Introducing special demonstration, training, credit and extension programmes to take the benefits of transgenics to the economically under-privileged farming families
- Developing coordinating and educational mechanisms at the national, state and

panchayat levels which will inspire public confidence and public acceptance of GMOs

- Promoting a Knowledge System for Sustainable Food Security based on the integration of traditional and new technologies
- Fostering greater international cooperation based on national priorities and interests

The participants also suggested that a *National Commission on Genetic Modification of Crop Plants and Farm Animals* be set up by the Government of India as an apex level coordinating and policy oversight body with its jurisdiction extending to all areas of agriculture, i.e., crop and animal husbandry, fisheries, forestry and agro-processing. They also suggested that the members of the commission should represent the scientific and academic community, private sector R & D, civil society organisations, senior representatives of the Ministry of Environment and Forests, the Union Planning Commission, DBT, ICAR, CSIR, ICMR, ICSSR, DST, Department of Atomic Energy and Ministries of Agriculture, Commerce and Industry, the National Commission for Women, the mass media and a few representatives of State Governments, State Agricultural Universities and Panchayati Raj institutions.

The proposed National Commission should be entrusted with the responsibility of coordinating and enforcing a *Precautionary Package for the safe and beneficial use of GMOs* comprising Bioethics, Biosafety, Biosurveillance, Food Safety, consumer choice and public information. It was also proposed that

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the National Commission on GMOs should have an autonomous status and could be serviced either by the Ministry of Environment and Forests or DBT or ICAR. The Commission should be a statutory body. The National Commission on GMOs should prepare an annual report on the work done during the year in the country and present it to Parliament.

Similarly, the participants recommended that state governments may set up similar bodies at the State level in order to provide a channel for the speedy and effective implementation of approved protocols, regulations and guidelines. The State level *Genetic Engineering Board* should not only have regulatory functions but also promotional and educational functions, including the sponsorship of Biotechnology Parks for providing opportunities to young men and women for remunerative self-employment. The State Boards can prepare an annual report for being placed before the respective State Legislatures. At the village level, *Panchayat Biotechnology Committees* may be set up to monitor field experiments with GMOs and assess their impact on the economic well being of rural families and on the ecological health of the area.

Thus, an organisational structure which extends from the village to the national capital will help not only to promote public understanding of the opportunities and implications of the emerging biological century, but also to allay public fears and apprehensions.

While the above institutional structures are important at the governmental level, every

research institution and commercial company, whether public or private, should have its own *voluntary code of conduct* based on the recommendations of their inhouse Bioethics and Biosafety Committees. Government laws, self-regulation, education and public understanding will all be necessary to ensure that genomics and molecular breeding become powerful instruments for building an environmentally and socially sustainable food security system. The detailed recommendations of the consultation have been published by MSSRF.

Annual Interdisciplinary Dialogue Series: Climate, Biotechnology and Food and Water Security (organised with the support of World Water Vision for the 21st Century and Housing and Urban Development Corporation-HUDCO) (3-6 February '99)

Since its inception, MSSRF has emphasised the need to conduct research in anticipation of global change, especially climate change. The workshop organised in 1995 indicated that climate change will produce highly adverse consequences for agriculture in South Asia. Recent studies in USA by Jeffrey Sachs and co-workers have pointed out that climate change will impose a burden on the developing countries, located mostly in the tropics, while improving prospects of agriculture in the higher Northern latitudes. In this Dialogue the focus was on identifying the tools and methods by which the adverse effects of climate change can be mitigated. Concurrent attention was paid to food as well as water security in the overall context of global change. The role of biotechnology

Education, Communication, Training and Capacity Building

in bringing about water security was considered in great detail. The involvement of political leaders, especially those at the grassroots, was discussed.

The dialogue opened with an analysis of policy issues, such as the follow-up actions on the Kyoto and Buenos Aires agreements. Subsequent sessions addressed food security and climate management, biotechnology and water security. A session on climate management at the micro-level, and another on biotechnology, were set up to formulate rec-

ommendations. Some of these recommendations are provided in a box accompanying this text.

Participants in this dialogue included Dr. Ismail Serageldin (Senior Vice-President of World Bank), Dr. Anil Agarwal (Director, Centre for Science and Environment), Dr. Hans Peter-Schelling (Chairman, Novartis Research Advisory Board), Mr. V. Suresh (Chairman, HUDCO), and Prof. Sulochana Gadgil (Chairman, CAS, Indian Institute of Science), among others.

Global Biotechnology Partnership for Water Security in the 21st Century

Role of Biotechnology in Drought and Salinity Stress

Research Needs	:	Understanding genetic and physiological determinants Perception of stress Signal transduction Gene activation Protein expression
Likely Impacts	:	Crops for marginal land Increased productivity Crops with less chemical and fertiliser inputs Crops which need less water Crops for saline soil
Policies	:	Education for water use Public participation in promoting research Long-term committed and continued support Private and public sector co-operation

Basic Biochemical and Molecular Studies

- Understanding the plant response mechanism to water stress
- Identification of compounds which are expressed under water stress and deciphering biochemical pathways

- Screening of wild relatives and cultivars for stress tolerant genotypes through genomic studies (QTLs)
- Developing probes and markers related to stress tolerance
- Studies related to the biochemical mechanisms including enzymatic pathways in aerobic/anaerobic bioremedial conditions

Identification and Isolation of Novel Genes Including Identification of New Source Material

- Isolation of known stress tolerant genes and comparative studies on their efficiency in transgenic systems
- Identification and isolation of novel genes
- Screening of unexploited genetic material for stress tolerance (for example *Acacia tortolis*, *Prosopis juliflora* for drought resistance); mangroves (*Porteresia coarctata*, *Salicornia sp.*, *Sueda sp.*, *Avicennia marina* etc., for salinity tolerance) and microbes (*Pseudomonas* for biological remediation)
- Understanding the genetic basis for enhancing the capabilities of detectors "biosensors" (to include whole cell, enzymes or sequences), degraders and sequestors of heavy metals

Molecular Breeding and Development of Transgenics for Crop Productivity and Biological Remediations

- Development of delivery systems for targeted species including transformation studies resulting in transgenics with novel genes
- Environmental impact analysis of transgenic organisms and related studies for field applications
- Marker assisted selection and breeding

Consultation on Enlarging the Basis of Food Security : Role of Under-utilised Species (International Consultation organised by the Genetic Resources Policy Committee (GRPC) of the CGIAR) (17-19 February '99).

Today's minor crops were major crops in the past, until they were replaced by a few cereals like wheat and rice, particularly in irrigated areas. Several minor crops are rich in micro-nutrients and can help to address one of the

most serious contemporary food security concerns, namely the widespread prevalence in developing countries of hidden hunger caused by the deficiency of micronutrients like iron, iodine and Vitamin A in the diet.

The Genetic Resource Policy Committee of the CGIAR set up in 1994 has been considering since 1996 the question of extending the base of food security by including minor crops in the farming system research programmes of IARCs. Many of these crops will become "lost crops" if immediate attention is not paid to conserving them and using them in the food basket. Based on a paper prepared by Dr. Robert Bertram, a member of GRPC and on the recommendation of the CGIAR System Review Panel, GRPC decided at its meeting held in Washington in October '98 to convene a consultation on "Enlarging the basis of food security: role of under-utilised species" through the International Plant Genetic Resources Institute (IPGRI), at the MSSRF, Chennai, India from 17 to 19 February '99. Thanks to the generous financial support of the International Fund for Agricultural Development (IFAD) and the US Agency for International Development (USAID), it became possible to hold such a consultation. Several Members of the Commission on Genetic Diversity of the World Humanity Action Trust (WHAT) also attended the consultation.

The participants came from several institutes of the CGIAR and included the Directors General of CIMMYT, (Mexico) ICARDA (Syria) and IPGRI (Rome). Directors of NIN and NBPGR (India) also attended the consulta-

tion. During this Consultation, four working groups, one each for WANA (West and North Africa), rest of Africa, Asia and Latin America were set up, to make concrete recommendations to the CGIAR. These have been brought together and published as a summary of the proceedings by MSSRF. In his summing up, Prof. M.S. Swaminathan made the following points:

The International Agricultural Research Centres of the CG system together with appropriate National Agricultural Research Systems, non-governmental organisations and multi-lateral and bilateral donors could form a CGIAR Forum on Under-utilised Species for Sustainable Food and Nutrition Security for undertaking the following tasks :

- Change the public image of many of the under-utilised species by getting the nomenclature of "coarse cereals" altered into a term which reflects their real nutritional value; FAO could take the lead in this area.
- Compile information on under-utilised crops from the country reports presented at the World Conference on Plant Genetic Resources held at Leipzig and develop an integrated database on the potential that such crops offer in different countries. The 158 country reports presented at Leipzig contain a wealth of information which needs to be compiled, classified and assessed.
- Foster an NGO network on Seeds for Ecological and Nutrition Security for organising demonstrations, training and ex-

tension work relating to under-utilised species. Training should also extend to cooking and the culinary aspects of the use of such grains. The NGO network should promote an end to end approach in dealing with under-utilised species, starting with seeds and extending to the consumer's table and food processing factories.

- It may be prudent to select in the first instance 5 to 6 crops to demonstrate the potential of under-utilised species. The criteria used for the initial selection in different countries could be
 - Market potential
 - Agroecological value in the context of an Integrated Natural Resources Management strategy
 - Gender roles and significance for women's occupations
- Initial activities could include
 - Conservation
 - Seed multiplication and distribution
 - Processing and cooking
 - Marketing
- IPGRI could be the lead centre for servicing the proposed CG Forum on Under-utilised species and the system-wide initiative.

Consultation on "Towards a Hunger-Free World: The Final Milestone" (organised with Global Hunger Project, The Hunger Project - India and Tamil Nadu Council for Sustainable Livelihoods) (7-9 April '99)

The Global Hunger Project and the Hunger Project - India are dedicated to the cause of working towards a world where every child, woman and man can have a productive and healthy life. We find that we have uncommon opportunities for achieving a Hunger-Free World because of the progress made in the spread of democratic systems of governance, and in science and technology. The information and communication revolution helps us to create an environment in every village, town and city which will enable people to work for the end of hunger in their area. The highest priority needs to be accorded to ending maternal and foetal under- and malnutrition, which results in low birth weight children, who suffer from multiple disadvantages including an adverse impact on brain development. It is also necessary to work towards the total elimination of hidden hunger caused by micronutrient deficiencies. By bringing about convergence and synergy among numerous ongoing programmes, these goals can be achieved sooner than generally expected.

To take advantage of this unique opportunity, the Global Hunger Project and the MSSRF organised a three-day Consultation on "Towards a Hunger-Free World: The Final Milestone" at Chennai in April '99.

Board Members, Country Directors from Burkina Faso, Mexico, Senegal and Bangladesh, investors from different parts of the world as well as national participants, local invitees, and in-house experts attended the meeting.

The first day was devoted to a consultation on "Towards a Hunger-Free India—The Final Milestone". As The Hunger Project—India is committed to fulfilling Mahatma Gandhi's vision of India where all people achieve a life of dignity and self-reliance, the day's deliberations included discussions on the ways and means to achieve this objective. The topic of the second day's consultation was "Towards a Hunger-Free World – Gender and Public Action". An understanding of three specific sets of issues that face women – the right to survival, the right to livelihood and the right to empowerment – was sought to be gained. The final day saw a list of recommendations formulated.

The Consultation led to the following conclusions:

- Hunger elimination strategies should view hunger in a holistic manner. Under-nutrition and malnutrition caused by factors determining food availability and economic access to it, as well as hunger for identity and for a space in society, should be taken into account.
- Gandhiji's prescription that development to be meaningful should touch the life of the poorest person in a positive manner is the most effective pathway to achieve the goal of freedom from hunger.
- The growing feminisation of poverty and agriculture suggests that the gender dimension must be internalised in all programmes intended for strengthening the livelihood security of the poor. Without gender justice and equity, hunger elimination will not be possible.

- Since hunger is often related to the loss of livelihoods caused by the degradation of environmental assets, including common property resources, the conservation and enhancement of environmental assets are vital for poverty alleviation. This, in turn, will call for the spread of sustainable lifestyles and the curbing of wasteful and non-essential consumption.
- Food and health security depended in the past on several hundred food and medicinal plants. Gradually the food basket has been getting smaller, with a few cereals like rice and wheat dominating the food security system. Sustainable food and nutrition security can be more readily achieved if the earlier tradition of growing a wide range of millets, pulses, tubers and oilseeds, as well as medicinal plants, can be revitalised.
- Technological progress, particularly since the industrial revolution in Europe, has been a major factor in enlarging economic inequity. It is essential that frontier technologies like biotechnology, space, communication and information technologies and renewable energy technologies like solar, wind, biogas and biomass, are made allies in the movement for economic and social equity. The Biovillage and Information Villages programmes of MSSRF have shown that technological knowledge and skill empowerment can be powerful tools for reducing women's workload and enhancing their income.

The developmental vehicles at the local level should be both the institutions of represen-

tative democracy like panchyats and of participatory democracy like gram sabhas. Voluntary organisations and panchyats could work together to mobilise all government, non-government and bilateral and multilateral programmes for ensuring that they reach the ultrapoor.

Sub Programme Area : 502

Training Programmes

A large number of training programmes covering various interest groups were organised. These have been reported in the relevant sub-programme areas, especially SPA 101, SPA 201 and SPA 301. From these reports, it can be estimated that training programmes took place on about 100 working days, that is for more than one third of the total working days during the year. In this section, two training programmes that took place outside PAs 100 - 400 are reported.

International Training Programme on Timber Trade Statistics (jointly organised with the International Tropical Timber Organisation - ITTO, Japan) (16 November - 4 December '98)

The ITTO has been organising training courses for professional foresters in the government and private sectors, to help them acquire familiarity with preparing standardised returns in the timber trade. The absence of such standardised returns on a global scale prevents comparison of data across timber-

producer nations and over time. The ninth in the series of these training courses (third for English-using countries) was organised by MSSRF jointly with the ITTO.

In the earlier programmes, the ITTO emphasised skills in statistical techniques and elementary time-series analysis of production, sales volume and price data. The trainees, organised in country groups, were requested to obtain such data for their countries, and analyse them towards the end of the course to produce a country case-study. In the programme organised by MSSRF, the course structure proposed by the ITTO was retained to a large extent, with increased emphasis on: (i) use of the Internet as a source of data; and (ii) use of Structured Query Language (SQL) technique in generating reports.

The trainees were nominees of the governments of the following countries: Cambodia, China, Egypt, Fiji, Ghana, Guyana, India, Indonesia, Liberia, Malaysia, Nepal, Papua New Guinea, the Philippines, Suriname and Thailand. Mr. John Joseph and Mr. Sanjay Shukla functioned as academic advisors from MSSRF, while Prof. S. Balaji, Dean, School of Forestry, Tamil Nadu Agricultural University, Dr. P.J. Dileep Kumar, Chief Conservator of Forests, Karnataka, and Mr. M.S.S. Ramanujam, Consultant in database design (Chennai) functioned as advisors from collaborating organisations. Dr. Steve Johnson and Mr. Jain Castano of ITTO functioned as coordinators on behalf of the ITTO. The faculty were drawn from a number of organisations specialising in forestry, forest produce cor-

porations, management information systems and related areas. Every day, a special session was organised, featuring distinguished professionals in areas such as remote sensing & GIS, international conventions, and development research. An extended field trip was organised in the states of Tamil Nadu and Karnataka, covering sandalwood plantations. MSSRF set up a special purpose network of 30 PCs for use by the trainees. The ITTO conducted an evaluation of the course which indicated that the programme received high rating both for content and organisation.

Training in Web Site Design for NGOs (jointly organised with INDEV, a programme supported by the British Council) (14-15 April '99)

INDEV, launched recently, proposes the use of modern IT for dissemination of development information, especially among NGOs and community-based organisations. To enhance the NGO capacity to handle modern IT, the INDEV organised a training programme in collaboration with MSSRF, which stressed the need to build and use sites on the World Wide Web as a key method of dissemination of information. The Informatics Centre provided the necessary operational support, with Ms. Neena and Mr. Shadrach of INDEV serving as resource persons. His Excellency Sir Rob Young, High Commissioner of UK in India, inaugurated this programme. 22 NGOs from South India participated in this programme.

Sub Programme Area 503

Knowledge System for Sustainable Food Security

The information villages research programme has now been renamed "Knowledge System for Sustainable Food Security" to reflect the growing international and national interest (e.g. the Systems Review Process in the CGIAR; the NATP in India) in the role modern information and communication technologies can play in promoting sustainable agriculture. Organised as an experiment, the project aims at building a model for the use of ICT in meeting the knowledge and information requirements of rural families taking into account the socio-economic context and the gender dimension. The model would further enable the understanding of the extent to which effort should be made to transform generic knowledge into locale-specific knowledge that can be acted upon. The project has established a hub at Villianur village where value-addition activity is carried out, so that generic knowledge is transformed to become relevant or useful in the local context.

The value-addition centre at Villianur has access to the Internet through two dial-up accounts. This also functions as the hub of a local area network for data and voice transmission covering the project villages. An EPABX, similar to the ones used in offices for providing intercom facility, is the key instrument in this hub. Every location on the network, including the office at Villianur, is

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a node in this "intercom" network, which functions with VHF radio (full duplex) rather than copper wires as the medium of signal transmission. With the help of regular modems, PCs can be connected to this network.

As of June '99, village knowledge centres (earlier termed "information shops") have been set up in four places other than Villianur. The locations are Kizhur (21 km west of Pondicherry) Embalam, (19 km southwest), Veerampattinam (13 km south) and Pillayarkuppam (13 km northwest). Prior to setting up these Village Knowledge Centres, participatory rural appraisal was carried out in 14 hamlets.

In each case, the community has identified and provided an accessible place and 2 - 4 volunteers. A gender expert, supported by the Gender Matters Award of IDRC, was invited to participate in the inception stages to ensure that gender sensitivity was built into all the operations. All the identified volunteers and the project staff were also given orientation to the importance of incorporating gender sensitivity, through a workshop. The gender composition of volunteers is as follows : Kizhur - 1M : 1F; Embalam - 4F (all); Veerampattinam - 2F:1M.

During the first phase, the volunteers have been trained in all the basic operations of using a PC running MS WINDOWS 95. They are also familiar with despatch/receipt of messages using MS-EXCHANGE which was found to be the optimal protocol for use on the analog wireless network. In addition, they

have been trained in composing documents on MS-WORD 97 (using I-LEAP Tamil fonts and the keyboard layout developed by C-DAC, Pune). Training in elementary maintenance, such as defragmentation of hard disk, has also been provided. It was found that a period of two weeks is necessary to train a volunteer in all these operations, given that he/she has not seen a PC before and that the level of education is limited to 10 years in school. A small number of volunteers, on their own, have picked up the use of HTML; the techniques of recording voice in *.WAV format and the compression of *.WAV files using REALAUDIO for ease of transmission of voice as an e-mail attachment. The trainers were the project staff with occasional help provided by the staff of the Informatics Centre.

Content creation to suit local needs is the key element in this project. Prior to commencing content-building activity, extensive consultations were held with the participating village communities, through small groups. It emerged that provision of dynamic information on prices and availability of inputs for cultivation - seeds, fertiliser or pesticides - was important to all farmers, especially the medium and small farmers. Knowledge of grain sale prices in various markets in and around Pondicherry is critical to farmers during the harvest season. The agricultural labourers, especially women, whose wages are partly in grains, are also anxious to know the sale prices. Detailed surveys revealed that women in rural families are interested in obtaining health-related information, particularly concerning disorders in

the reproductive tract, and in child health. The village centres, according to them, should provide such information in a substantial way. Also emphasised by them is the need for information on opportunities to augment income, such as training in new skills in manufacture (e.g. incense sticks). There is near consensus that the village centres should provide all information on public schemes for rural welfare and the government's list of eligible families living below the poverty line.

The value-addition centre in Villianur has generated a number of databases to fulfil at least some of these requirements. These are:

- Entitlements to Rural Families

This database provides details of about 130 schemes which are operational in Pondicherry UT during the current Plan (upto 2002).

- Families Below Poverty Line

The details of families in the communes of Ariyankuppam, Villianur and Nettapakkam have been provided in this database which has been compiled from the UT Administration and updated till April '99. Approximately 22,000 families are listed.

- Grain prices in Pondicherry region
- Input prices (quality seeds/fertilisers) in Pondicherry region
- Directory of general and crop insurance schemes
- Integrated Pest Management in rice crop

- Pest management in sugarcane crop
- Directory of hospitals and medical practitioners in Pondicherry-Grouped with specialisations such as orthopaedics, paediatrics etc.
- Bus/train timetables-Covering Pondicherry region and two nearby towns.

These databases in Tamil (except the families below poverty line data, which is an official document in English) are available in all the village centres. Updates are transferred using the wireless network. In addition, interactive CD-ROMs for health-related issues have been developed, where FAQs (frequently asked questions) are posed to medical practitioners, whose replies are videographed and converted to REALVIDEO format for retrieval using a PC. Topics related to general hygiene, dental and oral hygiene, and eye have been covered. (Videography was conducted in health camps organised by the village communities). Veerampattinam is a coastal village with 98% of the families involved in fishing. The information requirements in this village are different and more focused on the safety of fishermen while at sea, on fish/shoal occurrence near shore, and on techniques for post-harvest processing.

In addition to such defined content, daily transactions take place covering important public events and government announcements (of significance to rural families). Cricket information is much sought after through well known Web sites. One important service provided is the announcement

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of results of 10th and 12th standard examinations during June '99. The results and the marksheets were available on the WEB, and these were made available to a total of 931 students resident in and near the project sites, cutting short the time of waiting by at least one week.

An analysis of users' registers maintained in the village centres reveals that the proportion of women users varies from 34% (Kizhur) to 50% (Embalam). The proportion of users who are below the poverty line is 16% on the average (the average proportion of rural families living below poverty line is about 21%). Just over 60% of the use is for voice telephony, indicating that voice is still the important medium for transactions in rural areas. It is found that there is increasing differentiation in the information sought over a period of six months (e.g. not only input prices but their availability ex-stock in a specific period; the differences between committee-fixed sale prices and those offered by commission agents, etc.).

This programme has benefited by the visits of eminent individuals. Prof. Bruce Alberts, President of the US National Academy of Sciences, and Dr. R.A. Mashelkar, Director General of CSIR, jointly launched the Knowledge System for Food Security programme, while inaugurating the Embalam centre. The Hon. Dr. Maurice Strong inaugurated the centre at Veerampattinam along with Sir John Maddox, editor Emeritus of *Nature* magazine in April '99. On these occasions, the Lt. Governor and the Chief Minister of Pondicherry presided over the events. This

project received mention both in India and abroad, in detail in the 136th Presidential Address at the US National Academy of Sciences (April '99) by Prof. Alberts. It has also been noticed in the *Communications of the ACM* (November 98), *On the Internet* (January '99), and in *Science* (11 June '99). The *Human Development Report 1999* of UNDP cites this as an example of a creative project in addressing the global information divide.

Recently, a significant new dimension was added with the commissioning of solar-mains hybrid power systems in all the five centres. MSSRF has seven years experience in operating the Informatics Centre with solar photovoltaic system as the primary source of power. Based on this, the village knowledge centres were also provided with solar-hybrid system as the primary source of power. This is the first time that such systems have been installed in the country. They have been designed and supplied by the Bharat Electronics Limited (BEL). The BEL and MSSRF are jointly involved in monitoring the performance of these devices which provide backup power for a PC with a wireless transceiver and inkjet printer for up to 5 hours.

Sub Programme Area 504
***The Hindu* Media Resource**
Centre for Ecotechnology and
Sustainable Development

The Hindu Media Resource Centre for Ecotechnology and Sustainable Development was endowed by *The Hindu* group of pub-

lications in July '98, to promote dialogue between practitioners of ecotechnology and the media. The role of media in promoting public understanding of critical developmental issues in a democratic society is being increasingly recognised and MSSRF organised an Asian regional workshop on the role of media in sustainable development (April '98). Free access to emerging knowledge and open discussion on various sensitive scientific issues will lead to the right public policy to include the excluded. The Media Resource Centre gains relevance by taking scientific issues to the public through the media. Individually people need to be equipped to deal with the choices that new knowledge and technologies offer. In order to make them aware of the choices, information dissemination through media is necessary. The Centre's strategy is to provide data and information services to the media practitioners, thus obtaining possibly more space in the mainstream media on scientific issues of public concern, and to provide a forum for consultations between media personnel and practitioners of frontier science.

The Centre aims at:

- enhanced coverage of ecotechnology issues in the media
- functioning as a clearing house on matters relating to sustainable development
- providing authentic information on issues affecting environment
- establishing a directory of scientists/experts to answer media queries

- conducting training programmes for media practitioners with special emphasis on grassroots level media personnel

The Centre has been conducting public lectures and discussions to engage the public in debates about the ethical and social implications of modern science and technologies and their application to sustainable development. Six such programmes were organised on various themes during this year. *Public Discussion & Forum* and *Millennium Lectures* were the two forums used to interact with the media and public. A *Media workshop* was also organised exclusively for journalists on Genetically Modified Organisms.

Public discussions

These discussions helped the local media and public to gain awareness of the various roles of science and technology. They were generally held in academic campuses in order to increase students' participation. Each discussion was led by a panel of world leaders in the particular field. The following were the topics:

- Forests and Sustainable Development (September '98)
- Ending Malnutrition by 2020: An Agenda for Action (November '98)
- Coastal Systems and Sustainable Development (December '99)
- Genetically Modified Plants - implications for food security and human nutrition (January '99)

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- Biotechnology and Food and Water Security (February '99)
- Where is Science heading in the next century? (April '99)

Key persons such as the Minister for Science, Technology & Environment, Guyana, Dr. Navin Chandarpal, whose country has dedicated one million acres of virgin rainforest to be used as a laboratory for rain forest research, shared their experiences and insights with the public. Dr. David Cassells, Director General, Iwokrama International Centre for Rain Forest Conservation and Development in Guyana, Dr. B.C.Y. Freezailah, Executive Director of International Tropical Timber Organisation (ITTO), were some of the other speakers.

Dr. C. Gopalan, President, Nutrition Foundation of India, Prof. Philip James, Director, Rowett Research Institute and Dr. Richard Jolly, Special Advisor, UNDP, spoke on strategies for ending malnutrition. Dr. Ismail Serageldin, Chair, CGAIR and World Water Commission and Senior Vice President, The World Bank, while speaking on Food and Water security said that the wars of the 21st Century would be fought over water. Other prominent speakers included Sir John Maddox, Editor Emeritus, *Nature*; Sir Humphrey Maud, (then) Deputy Secretary General of the Commonwealth; Dr. Peter Raven, Director, Missouri Botanical Gardens, USA; Dr. Vandana Shiva; and Dr. Usha Barwale, MAHYCO, India.

Millennium Lectures

These lectures are designed to provide an understanding of all the dimensions of key

issues like hunger, poverty, population and environment and sustainable food security. Policy makers of international repute are invited to present their views on the issues and messages on the options for sustainable development. The themes chosen for the Millennium Lectures and the distinguished speakers were:

- *Hunger, Poverty, Population and Environment* - Dr. Maurice Strong, Under-Secretary General and Special Advisor to the Secretary-General of the United Nations
- *The Challenge of Sustainable Food Security in the 21st Century* - H. E. Dr. Jacques Diouf, Director General, Food and Agriculture Organisation of the United Nations.

Hon. Maurice Strong who chaired the Stockholm Conference on Human Environment in June 1972 and the Earth Summit in 1992, made the following points in his speech:

- Today's "world order" is much different from that which prevailed at the time of the Stockholm Conference in 1972. Today developing countries are leading the revitalisation of the global economy. Developing countries are growing.
- The G-7, which today does not include a single developing country, is clearly becoming an anachronism. The current "world order" continues to be rooted in the past, particularly our notions as to north-south relationships.
- It is the industrialised world that must reduce its environmental impact in order

to "leave space" for developing countries to meet their own needs and aspirations. Neither can developing countries be denied the right to grow, nor can they be expected to respond to exhortations to reduce their population growth and adopt stringent environmental controls from those whose patterns of production and consumption have largely given rise to global risks like climate change.

- In a world that produces more than enough food to feed everyone, it is a scandal that people are hungry and malnourished and an affront to the moral basis of our civilisation.... The other issue is how to match food availability with food needs, particularly on the part of the poor.
- Even in times of food scarcity those with the resources to purchase food can usually obtain it. Conversely, even in times of food abundance those without the means are often hungry and malnourished. Poverty, more than lack of availability, is what denies many the access to the food they need.
- The decade of the 1990s has brought the concerns of sustainability to the fore. Sustainable development is not just an option, but an imperative, in environmental, economic and social terms. It requires a major commitment by governments, the scientific and research community, business and industry, and civil society.
- International agricultural research is an imperative. The agricultural research com-

munity must meet this challenge. It requires a shift in priorities and focus of research, involving the full integration of the environmental dimension into agricultural research and social and economic development policies. There has to be real and functional agricultural research partnerships at the national and international levels.

In his lecture, H.E. Dr. Jacques Diouf, Director General, Food and Agricultural Organisation, made the following points:

- There is no reason not to have a hunger-free world some time next century. The world will be able to produce enough food for everyone. It already does so, and it could produce more.
- What is equally important is people's ability to secure food and in particular how to achieve the poor's access to food. Second, hunger is not a question of energy (calorie) deficits only.
- Development of agriculture and the rural economy is an indispensable step in the direction of overall economic development and poverty alleviation. It follows that the widely held view that the persistence of food insecurity and under-nutrition is not a problem of production (or production potential) but rather one of distribution (or access, or entitlements), can be both true and false at the same time. It is largely true if it refers to the world as a whole, but this is not a very helpful conclusion.
- I note that poverty-reducing economic growth and all that goes to make it happen, e.g. debt relief is a must. But growth

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is not enough. Policies are also required in both the economic and social areas that enhance the employment and income earning opportunities of the poor, such as access to land, credit, education and health services.

- To make sustainable improvements, investments will be needed in both of these resources. Investing in people will need to come in the form of education, clean water and sanitation, health and social services, and when needed, direct food and nutrition support.

Media Workshop

A Media workshop on Genetically Modified Organisms (GMOs) was organised as a part of the National Consultation on GMOs (reported in SPA 501). Mr. N. Ram, Editor, *Frontline* chaired the workshop. The workshop comprised a panel discussion, which was followed by an interactive session with media personnel. The participants were:

- Prof. Peter Raven,
Director, Missouri Botanical Gardens,
USA
- Prof. A. Mahadevappa
Vice Chancellor, Karnataka Agricultural
University
- Mr. G. Ananthakrishnan
Environmental Activist
- Prof. Arie Altmann
Hebrew University of Jerusalem
- Dr. G.S. Khush
Principal Plant Breeder
International Rice Research Institute

- Dr. Ganesh M. Kishore
Principal Biotechnologist, Monsanto
- Dr. Usha Barwale
Director, MAHYCO
- Prof. V. L. Chopra
B.P. Pal National Professor,
Indian Agricultural Research Institute
- Prof. I.V. Subba Rao
Vice Chancellor, Acharya
N.G. Rangan Agricultural University

22 journalists ranging from language press to international correspondents attended the workshop. It is the first ever workshop conducted for media persons in the country on GMOs. Considering the widespread public concern about possible unethical uses of genomics and molecular breeding as, for example, the recent apprehension about terminator technology, journalists asked what steps are needed to integrate the ethical concerns and public good with those of biosafety and field testing of GMOs. Some journalists asked if there were existing procedures for assessing benefits and risks adequate to inspire public opinion. They also mentioned that they had begun to suspect technologies, because they received no response from companies like Monsanto, when queries were made. While scientists did agree in principle that such indifference should be avoided, they pointed out that the media more often wage attacks on companies than seek explanations.

They complained that many media reports lack factual information and accuracy and

often sensationalise issues, leading to manipulation of facts. There is a need to make media more effective and carry more balanced views. They also pointed out that when a referendum was made in Switzerland on carrying out biotechnology research, people welcomed the idea overwhelmingly. This is very significant in the context of the vehement attacks being constantly made in Europe. Scientists also urged the media to play a role in harnessing new opportunities and technologies in overcoming chronic poverty and malnutrition.

There was a consensus on the strategy of briefing vernacular journalists as they influence village people and farmers whose life is directly affected by the technology. This requires access to scientific literature in the regional language with little jargon so as to equip the farmers and local consumers to make their own choice.

Sub Programme Area 505

Databases: Design, Maintenance and Dissemination

Significant progress was made in gaining wider recognition of the databases designed and developed by MSSRF. Important linkages with national and international organisations have been established, to ensure greater access to the databases.

Global Mangrove Information System (GLOMIS)

The International Society for Mangrove Eco-

systems (ISME), based in Okinawa, Japan, invited the MSSRF to join the GLOMIS programme of ISME. In September '98, MSSRF was made the coordinating agency of GLOMIS for the Indian Ocean region. The MSSRF programme of MEIS is merged in parts with the GLOMIS, so that the experts directory and bibliography of mangroves developed under MEIS will be accessible through GLOMIS. MSSRF is now a partner in a network of GLOMIS coordinating institutions, namely, the University of the Ryukyus (Japan), University of Niteroi (Brazil) and University of Ghana. The Directory of Experts located in South Asia and Eastern and Southern Africa has been updated. The bibliography database in relation to this area has also been updated.

Farmers' Rights Information Service (FRIS)

The FRIS, which has been in existence since 1997, was completely redesigned during this year. Work on the Farmers Rights' Information Service (FRIS) was carried out and the details are found in SPA 205 in this Report.

Knowledge Systems for Sustainable Food Security

A number of databases for the project on Knowledge Systems for Sustainable Food Security have been designed by the centre (SPA 503 above).

Consistent with our principle of using non-proprietary, open systems for ease of dissemination, Hyper Text Mark-up Language (HTML) has been used in all our databases

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so that the World Wide Web becomes the medium of dissemination. The WEB site of MSSRF has been redesigned to include a number of our publications in both HTML and PDF formats.

During the year, the Informatics Centre received recognition from the Department of Biotechnology, Government of India, as a sub-centre in the national network of Bioinformatics Centres. The DBT has also approved a project for the development of database on plant tissue culture techniques. This will be implemented by MSSRF in partnership with the National Chemical Laboratory (NCL) and the Tata Energy Research Institute (TERI).

Sub Programme Area 506

The Literature Analysis Group

Two projects were completed this year, both for NISSAT-DSIR. One was based on an analysis of publications from India indexed in *CAB Abstracts* 1990-1994, and the other was based on an analysis of Indian work indexed in *Biological Abstracts* 1992-1994.

The important findings are: (i) Both in life sciences and in agricultural sciences, Indian researchers publish a far higher percentage of their collective research output in Indian journals than in physics, chemistry, materials science and medicine; (ii) There appear to

be two clusters of scientists (and institutions), one working in new biology and publishing a good proportion of their papers in medium and high-impact journals published outside India and the other much larger cluster working in agriculture and classical biology publishing their work mostly in low-impact and often in Indian journals. It would be worthwhile to encourage appropriate groups from these two clusters to work on common problems and thus facilitate intermingling across the cluster divide.

Currently, work is in progress on international collaboration in new biology as revealed by co-authored papers indexed in *Biochemistry and Biophysics Citation Index*. In this work, Mr. Jinandra Doss of CLRI, who has competence in both computing and statistics, is assisting us. In this analysis, we are looking at papers from India, Israel, Italy, China and a few other countries. Preliminary results show that between 1992 and 1998, the percentage of Indian papers resulting from international collaboration has increased from about 10 to 12.7. More than 40% of these papers are in collaboration with authors in the USA. The number of papers from China is increasing at a much faster pace and China also collaborates more with Western authors than India does. More than 40% of papers from Israel have a foreign collaborating author.

We have carried out an analysis of more than 11,000 papers from India indexed in *Science Citation Index* (SCI) 1997. Unlike in the United States and the world as a whole, where biology (including classical and new

biology, biomedical research and agriculture) accounts for more than half the published work, in India chemistry and physics account for a larger number of papers than biology. Overall, the findings are not considerably different from our earlier analysis based on SCI 1992-1994.

Sub Programme Area 507

Library and Information Services

The print library now has a base collection of approximately 8,100 books and 120 professional journals. The library operations have been computerised fully, using a package of software applications developed on Microsoft Visual FoxPro. This package, named MATHURAM, enables automation of circulation, membership services and provides access to the library catalogue. The catalogue can be accessed on the MSSRF Intranet. The library section also provides access to the World Wide Web to enable users to consult journals on-line wherever possible.

The CD-ROM collection is regularly updated. The CAB-CD collection of CD-ROMs in agricultural sciences has been updated till the first quarter 1998, making available a set of records in every area of agricultural sciences

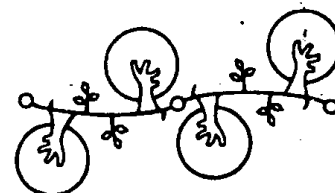
from 1972 onwards. The collection *Biophysical and Biochemical Citation Index* CD-ROMs has also been updated. The entire collection is available on a stand-alone PC at MSSRF.

The staff of the library and information services programme helped about 800 research scholars from 13 different universities with queries for search of technical literature, during the reporting year. To improve our reach among the research students in the broad area of life sciences in India, special efforts are being made to offer information services through the network of 38 Bioinformatics Centres supported by the Department of Biotechnology, Government of India. The following organisations donated used PCs for use in various outreach projects;

- American Chamber of Commerce in Japan
- Ford Motor Company, Japan
- Union Bank of Switzerland, Japan
- Price Waterhouse, Tokyo
- Allied Pickfords, Tokyo
- First Union National Bank, Tokyo Branch
- Shipping Corporation of India, Tokyo Office.

The donation was coordinated by Dr. Geeta Mehta of Tokyo.

Programme Area 600



Special Projects



***A**ssistance was provided to the Government of Mizoram in preparing an Agenda 21 for the State. A detailed project proposal was prepared for the conservation of the unique biological wealth of the Gulf of Mannar area which was approved by the Council of the Global Environment Facility. Under the B.P. Pal National Fellowship, an ecorestoration plan was developed for the Eastern Ghats Region.*

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Sub Programme Area 601

Conservation and Sustainable use of the Gulf of Mannar Biosphere Reserve's Coastal Biodiversity

Preparation of a proposal for Conservation and Sustainable use of the Gulf of Mannar Biosphere Reserve's Coastal Biodiversity was taken up by MSSRF on behalf of the Ministry of Environment and Forests, Government of India, for submission to the Global Environment Facility (GEF). This task was guided by a steering committee comprising all the major stakeholders including the Government of Tamil Nadu and the relevant Central Ministries. The proposal envisions the formation of a *Gulf of Mannar Biodiversity Trust*, which will be a policy-setting and fund-administering body, comprising representatives from the key stakeholder groups. The Trust, through its Project Coordination Unit, would ensure integration at the ground level of all the relevant line departments' activities and provide broad direction towards strengthening the sustainable management options in the area. Demonstration and dissemination of new, technology-based options for livelihood security for the families in the vicinity of the Gulf will be an integral component of the project.

In the review of the proposal carried out on behalf of the Science and Technology Panel (STAP) of GEF, Dr. Michel Batisse made the following comments:

- The Biosphere Reserve Trust/Foundation and the Long Term Funding Mechanism appear fully appropriate and consistent with the importance, complexity and stability of the project. It is understood that the Trust/Foundation with the Project Coordination Unit constitutes the managing authority for the entire Biosphere Reserve, including the National Park.
- The presence of a permanent research and observation station within the national park, possibly in Krusadai Island, would be of significant advantage, and would constitute a visible symbol of the importance attached to the area.
- The provision for a Biosphere Reserve Trust/Foundation together with a Long Term Funding Mechanism, with an overall Project Coordination Unit (covering the National Park) and a Board of Trustees representative of all stakeholders (Tamil Nadu Government, Central Government Departments as well as appropriate NGOs seems to constitute an original and valid pattern for a complex project of that type. The operation of this mechanism should however make sure that not only a top-down approach is followed but that satisfactory arrangements are made for a parallel bottom-up approach through which the views and expectations of the village councils and of the panchayats are properly taken into account.
- There is no doubt that the project can provide considerable demonstration values for other coastal regions, which represent probably the most difficult challenge for

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biodiversity conservation and land water management. Coastal regions in the northern coast of Cuba, Belize, Papua New Guinea, Indonesia or the Philippines for instance, could benefit from the experience acquired in the Gulf of Mannar.

The proposal, after official approval of the Government of Tamil Nadu and the Union Ministry of Environment and Forests, was approved by the GEF Council in May '99. In its note circulated for the Council meeting, the GEF Secretariat described the project proposal as *exemplary* in the way the cost calculations have been carried out. In the process of approval, it was mentioned that the concept of a Biosphere Trust was an innovative one. The GEF will extend a grant of USD 7.85 million to the project with a contribution of USD 1 million from UNDP (channelled through the Ministry of Rural Areas, Government of India). The Tamil Nadu Government and the Union Government will make contributions in both cash and in kind.

The GEF procedures require the transformation of the project brief into a work plan based on which the credit flow will commence. This process will be completed by August-September '99 so that the project could commence within the Fiscal Year 1999-2000.

Sub Programme Area 602

B P Pal National Environment Fellowship

Under this Fellowship, a study of the changing profile of Sirumalai Forest Hills, Dindigul

District, Tamil Nadu and development of an Eco-Friendly Restoration Plan of Eastern Ghats were taken up.

Sirumalai is a range of mountains, forming part of the Eastern Ghats in Tamil Nadu with several villages depending heavily on the health of its ecosystem.

The objectives of the study are:

- To study the changed/changing forest cover of the Sirumalai Hills (from the beginning of the century) based on secondary official data and aerial survey (satellite) pictures
- To record the initiatives taken by the Government to conserve and increase the forest cover and the level of success including Joint Forest Management strategies
- To have a ground level check at three elevation levels to assess the (i) changes, (ii) quality of life, and (iii) participatory potential for Joint Forest Management

Methodology

The study is an analysis of secondary data relating to historical perspective, policy changes, management approach and strategy affecting natural resource status and an interpretation of satellite data on changing natural resource status. It is complemented by data on socio-economic groups, their use of forest produce, perception, utilisation, ecological history and management options, collected through a structured socio-economic field survey of select variables relevant to the objectives of the study. All the necessary data related to deforestation and social re-

sponses including the determinants such as livelihood needs, demand and supply compulsions, market-forces, particularly the socio-economic perspectives having a bearing on natural resource management and other relevant aspects have been considered (Figure 6.1).

Action

1. A critical analysis was made of secondary data on Sirumalai Forest Area available at Archives, erstwhile Board of Revenue, the Office of the Chief Conservator of Forests, Chennai, District Forest Officer, Madurai District Gazetteer (several editions), season and crop reports (series published by Government of Tamil Nadu), Swedish International Development Agency (SIDA) aided Social Forestry reports, Forest Manuals, Official Orders, Circulars, etc.
2. A study was made of available Remote Sensing Data/SOI Sheets on changing the forest cover in Sirumalai Hills. Satellite images of the area under study were gathered from National Remote Sensing Agency (NRSA), and the data was interpreted using digital methodology.
3. A socio-economic field study was designed to analyse the forest resource status, causes of deforestation and the possibility of an eco-friendly management approach.

A change monitoring study was carried out for the Sirumalai forest to find changes in land cover/vegetation cover during 1990-94 and to understand the factors responsible for these changes. From the observed changes in vegetation density at two different times,

backed by ground and field verification, it is possible to deduce the causes with some degree of reliability.

For the socio-economic study, a Stratified Random Sampling Design was employed. Stratification and selection of villages formed the first stage and selection of individuals within the villages formed the second stage.

The study sites differ widely with respect to ecological conditions and corresponding man-nature relations. An attempt has been made to highlight the distinguishable common elements of ecological relationships as well as those which show marked variation.

The villages studied were chosen from 3 distinct attitudes: (i) top level villages near forests; (ii) villages in Sirumalai area plateau lying within forests; and (iii) villages lying scattered around the foot of Sirumalai Hills, to gain a broad appreciation of the lifescape and peoplescape of the study site.

The field study included one or more members familiar with the study area, preferably a tribal or a local low level functionary (Fire Watcher). To guide and focus the interview, a comprehensive questionnaire which covered all the parameters and variables relevant to the socio-economic study was used. Individual interviews, field visits and mapping were also carried out. At the final stage, another grama sabha was called to brief the entire village about the outcomes of the study and desired follow-up.

Conclusion

The hands-off approach to conservation

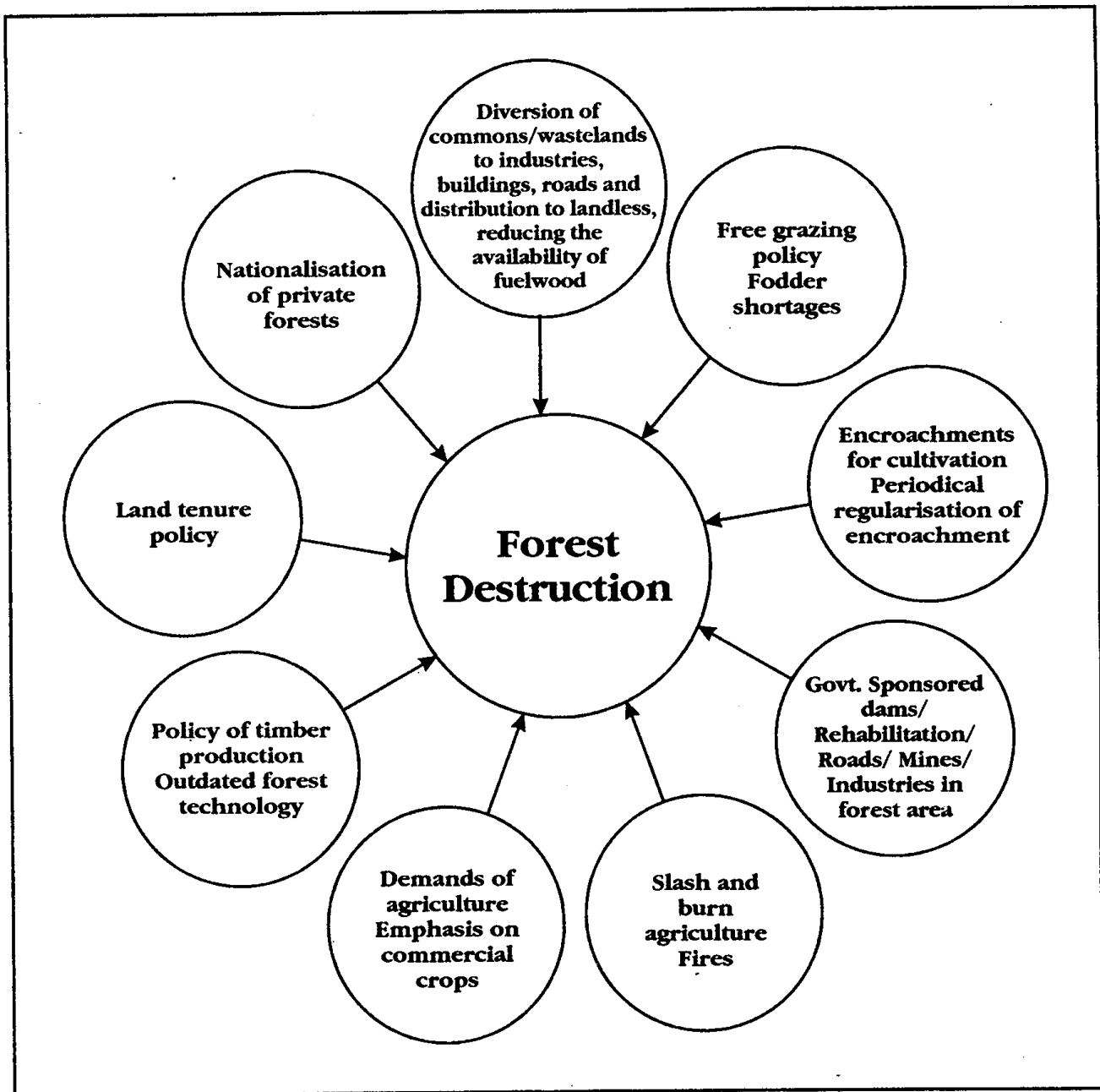


Figure 6.1 : Causes of forest destruction

which tries to keep people away from natural resources is proving to be ecologically flawed. It leads to loss of local support for conservation and helps mis-appropriation by powerful outsiders. Management of resources should hinge upon eliciting the support and participation of all stakeholders and where feasible be inducted into the new Panchayat Raj System. Conservation is possible if most, if not all villagers evolve and support eco-friendly development plan. So an eco-friendly participation development plan, with the required modification to suit traditional approaches and empowerment of local people based on successful JFM, strategies is drawn up for Sirumalai hills of Eastern Ghats.

Sub Programme Area 603

Agenda 21 for Mizoram State

The current livelihood and resource use systems (land and human) of Mizoram are unsustainable. Degradation/deterioration has taken place on an alarmingly large scale. High rainfall combined with deforestation has led to severe top soil erosion.

MSSRF was specially requested by the Chief Minister and Governor of Mizoram State to draft a Project entitled "Mizoram's New Agenda for Sustainable Economic and Rural Development" considering that the Mizoram mountain ecosystem and traditional primary producer systems are under increasing stress due to population growth, heavy use of natural resources, lack of appropriate poli-

cies and financial resources for their sustainable development.

New strategies and approaches have to be designed, to create an alternate sustainable livelihood and to improve land use and natural resources use practices which are appropriate to and harmonious with the ecosystem.

Objective

To design strategies and proposals for raising financial support for an integrated development programme aimed at reducing *Jhum*.

Approach

- Policies favouring the informal sector and activities which provide linkages of villages to the regional and national economic network
- Improving infrastructure to cater to the marketing needs of rural produce
- Provide a firm foundation and lend firm support to less exploitative local production systems, caring for the wellbeing of the human and ecosystem needs by:
 - a) Environmental conservation
 - b) Sustainable livelihoods
 - c) Eradication of poverty
 - d) Improving the existing agricultural system, and
 - e) Promoting micro-enterprises.

Key components proposed are:

- Introduce new environmentally sound crops, trees and practices

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- Aggressive promotion of crops like tea, coffee, rubber, pineapple, oranges, other citrus fruits, passion fruits, arecanut, peppervine, spices, tung oil and orchids
- Development of agroforestry system which can give high economic returns
- Development of supplementary environmentally sound activities like apiary, pisciculture
- Marketing infrastructure as support to the local production system
- Financial system which will provide modest levels of credit
- Training and extension by government and NGOs to support small-scale enterprises and agricultural innovations
- Aggressive government policy to promote regional growth and encourage local production and marketing.

Implementing mechanism and institutional mechanisms: Recognition and support to appropriate departments to promote ventures and activities.

Monitoring and correction: In this unique process of development a social mobilisation would ensure transparency and accountability.

Two initiatives are considered necessary for this. The village level organisations should be empowered to plan and execute proposals. The second initiative is to enhance the role and participation of women in such enterprises.

Bearing this in mind a specially constituted team of experts comprising Dr. K. Kanungo (Team Leader), Mr. E.S. Thangam (Deputy Team Leader), Dr. S. Sambandamurthi, Mr. V. Lakshmanan, Mr. C. Ashok Kumar and Mr. S. John Joseph (Coordinator) undertook this mission. This team toured the various areas of the State, deliberated upon the issues at various levels and drafted a report: "Agenda 21 for Mizoram State". This was refined and forwarded to the Mizoram government. The Report was acclaimed as a path-breaking comprehensive strategy report and the Governor of Mizoram expressed his satisfaction and appreciation in his Annual Budget Speech in January '99.

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M.S. Swaminathan Research Foundation (MSSRF) was registered in 1988 as a non-profit Trust, recognised by the Government of India, Department of Scientific and Industrial Research, New Delhi, and by the Director General of Income Tax Exemptions, for the purpose of exemption of contributions from Income Tax under Section 80G and section 35 (1) (ii) of Income Tax Act, 1961, read with Rule 6 of Income Tax Rules, 1962. The Ministry of Home Affairs, Government of India, has recognised the Foundation for receiving funds from sources abroad under the provisions of Foreign Contribution (Regulation) Act, 1976.

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*Director, Radioisotope Group, Bhabha Atomic
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Head, NA&BT, BARC

Dr. S. K. Apte
Cell Biology Division, BARC

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Director, JRD Tata Ecotechnology Centre, MSSRF

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Senior Administrative Assistant

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Receptionist cum Telephone Operator

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Mr. L.R.A. Narayan
Distinguished Fellow

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Agronomist, Mahanadhi

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Project Associate (Remote Sensing)

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Research Fellow, Muthupet

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Library Assistant

Ms. Seyda Habi Banu Begum

Technical Assistant

Mr. B. Senthil Kumar

Technical Assistant

Mr. G. Suresh Kumar

Technical Assistant

Ms. S. Geetha

Project Assistant

Ms. R. Karpagam *

Project Assistant

Mr. R. Baskar

Accounts Assistant

Ms. R. Jayashree

Accounts Assistant

Mr. T.E. Krishnan

Driver

Mr. Subodh Ranjan Das

Consultant (Agriculture Specialist)

Mr. B.N. Mishra

Consultant (Social Scientist)

Nuclear Tools for Coastal Systems Research

Ms. M. Lakshmi

Research Associate

Mr. M. Parani

Research Associate

Mr. P.V. David

Project Associate

Mr. M. Muniyandi *

Project Associate

Mr. M. Nageswaran

Project Associate

Ms. Lilly M. Saleena

Junior Research Fellow

* Left During the year

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DAE-Homi Bhabha Chair

Ms. K. Sheela Pankaj
Secretary

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Research Associate

Mr. M.N. Jithesh
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Ms. Priya Pillai *
Junior Research Fellow

Mr. M. Kadirvelu
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Technical Assistant

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Dr. M.S.S. Mohan
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Mr. Ajith Anand *
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CSIR Senior Research Fellow

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Ms. R. Latha #
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Junior Research Fellow

Ms. Sandhya Mohan
Junior Research Fellow

* Left During the year

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Mr. M.M. Saravanan
Technical Assistant

Mr. R. Sunil Kumar *
Technical Assistant

Mr. E. Thiruvengadam
Technical Assistant

*Community Biodiversity Programme and
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Mr. S. John Joseph
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Project Leader (Participatory Plant Breeding)

Ms. M. Geetha Rani
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Mr. Rajesh Jacob
Junior Research Fellow

Mr. M.K. Rateesh Narayanan
Junior Research Fellow

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Ms. Elsy Mathew
Technical Assistant

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Dr. R.D. Iyer
Consultant

Dr. V.P.K. Nambiar
Consultant

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Mr. Bibhu Prasad Mohanty
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Mr. Trilochana Ray
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Mr. Saujanendra Swain
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Mr. Sukanta Kumar Sarangi
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Ms. G. Anuradha
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Mr. M.V. Ravi Kumar
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Mr. Jyothi Ranjan Mohanty
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Project Assistant

Mr. C. Thilagar

Project Assistant

Mr. C. Nagaraja

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Technical Assistant

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Project Associate

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Mr. S. Anand
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Field Assistant

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Prof. Joseph H. Hulse
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Project Associate

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Ms. K. Umarani
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Technical Assistant

* Left During the year

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Library Assistant (CD-ROM)

Mr. M. Madhan
Library Assistant

Mr. R. Chendil Kumar
Research Assistant

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Office Assistant

Information Villages Programme, Pondicherry

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Address:
M. S. Swaminathan
Research Foundation
III Cross Road
Institutional Area
Taramani
Chennai-600 113. India.