

The Future We Want

Journey of MSSRF



M S Swaminathan



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About this Publication

M.S. Swaminathan Research Foundation takes pride in bringing out this publication authored by Prof. M.S. Swaminathan, the Founder Chairman of MSSRF. This is a reproduction of the Chairman's introduction in the twenty-second annual report (2011-2012). This document highlights and chronicles the journey of MSSRF over the last twenty five years. It also highlights the genesis, growth, directions and achievements of the Foundation and its programmes. I wish to place on record our deep sense of appreciation and gratitude to Prof. Swaminathan for the untiring support and strategic direction he has provided to the Foundation, and its staff and scholars. I am confident that the readers will find this document both informative and useful.

Ajay Parida
Executive Director



Prologue



It was way back in 1970 that Professor C. V. Raman seeded the idea in my mind that I should be involved in establishing a research and training centre in the field of applied ecology, relating to the improvement of the productivity, profitability and sustainability of small-farm agriculture. I decided that I could put this into action when I received the first World Food Prize in 1987. On my return in February 1988 from the International Rice Research Institute, the Philippines, I started preparations for the setting up of a research centre with major focus on the sustainable management of coastal ecosystems. Both the governments of Karnataka and Tamil Nadu were kind enough to offer facilities for setting up such a research centre. Chennai was more suitable since Tamil Nadu has a long coastline of nearly 1000 km. The World Food Prize was followed by several other prizes like the Honda Prize for Ecotechnology, Tyler Prize for Environmental Achievement, Sasakawa, Volvo and Blue Planet Environment Prizes, as well as the Indira Gandhi Prize for Peace, Disarmament and Development, all of which helped to meet the financial requirements.

Shri N. Ram, Dr. M.V. Arunachalam and Dr. V.C. Kulandaiswamy played key roles in getting MSSRF established at Chennai by helping to get land and other facilities. I was helped by Dr. Manibhai Desai, Founder President of the Bharatiya Agro Industries Foundation (BAIF), in drafting the trust deed of the Foundation and by Professor V.L. Chopra in registering it at New Delhi. At Chennai, Shri C. Subramaniam was a source of both inspiration and guidance. Right from the beginning my wife Mina has been a partner in this adventure and has played a key role in shaping MSSRF's priorities and core values.

Inauguration of the centre in April 1993



The Foundation was registered in New Delhi on 17 May 1988 as a not-for-profit scientific trust, with me as the Founder Chairperson and Professor V.L. Chopra and Dr. V.K. Ramachandran as the Founder Trustees. The Foundation thus enters its twenty-fifth anniversary this year. Based on a series of scientific consultations, it was decided that MSSRF should be more on the model of a translational research centre devoted to converting scientific discoveries into field applications. This called for research at two ends of the spectrum: participatory research with farming families, on the one hand, and policy research designed to achieve synergy between grass-roots experience and public policy, on the other. It was also decided that the Foundation should concentrate on imparting a pro-nature, pro-poor, pro-women and pro-sustainable livelihood orientation to technology development and dissemination.

MSSRF is designed as an equal opportunity centre for all socially-committed scientists, regardless of gender, age, religion, caste or community — verily a *Vasudhaiva Kutumbakam* in action. It is also a “centre without walls”, generating synergy and symbiosis in partnership with similar institutions with similar goals. Mahatma Gandhi’s advice that we should keep our windows and doors open so that fresh ideas come from all directions, but that we should keep our feet firmly on the ground, has guided the research philosophy. Above all, participatory research with tribal and rural women and men and anticipatory research to scientifically checkmate the adverse consequences of climate change and sea level rise were chosen as pathways for shaping the future we wanted.

Based on several inter-disciplinary consultations during 1988-89, the following seven areas were chosen for attention by the scientists and scholars of MSSRF:

- * Coastal Systems Research, involving concurrent attention to the landward and seaward sides of the coast
- * Biodiversity conservation, enhancement and sustainable and equitable use, leading to an era of biohappiness
- * Biotechnology as applied to the development of the biological software essential for sustainable agriculture as well as to the creation of novel genetic combinations for resistance to salinity, drought and grain quality
- * Ecotechnology based on the integration of traditional ecological prudence and knowledge with frontier technologies and its spread through the biovillage model of human-centered development; the biovillage paradigm also helps to promote an ever-green revolution in agriculture leading to an increase in productivity in perpetuity without associated ecological harm
- * Food and Nutrition Security as related to achieving freedom from endemic and hidden hunger
- * Information Communication Technology involving the integrated use of the internet, cable TV, community radio, mobile telephony and print media
- * Training, capacity building and networking, beginning with children and extending up to fisher and tribal communities



Even at the outset, I must acknowledge the outstanding support received from national and international donors and different scientific departments of the Government of India for undertaking research on the lines mentioned above. Financial sustainability is a must for the sustainability of autonomous institutions. At the same time, the achievements of a scientific institution are based on the innovative spirit and dedication of its scientists and scholars. I have often said that in building institutions, we should move away from an obsession with bricks and concentrate on brains. In his Presidential Address to the US National Academy of Sciences in 2012, Dr. Ralph J. Cicerone made the following comment on the importance of institutional support to creative scientists: 'Institutions can enable the ideas and energies of individuals to have more impact and to sustain efforts in ways that individuals cannot. Good examples are the successful Green Revolution research, field testing and realisation of large increases in agricultural crop yields, as well as current efforts to achieve more effective worldwide immunisation.'

From a small beginning in 1989, MSSRF has grown into a nationally and internationally recognised institution with its own research and training infrastructure at Chennai, Koraput in Odisha, Kalpetta in Wayanad district, Kerala, Puducherry, and Kaveripoompattinam in Tamil Nadu. A laboratory-cum-training centre is also coming up at Chidambaram for the coastal research programme. In addition to the well-developed regional centres in Koraput and Kalpetta, a third major research and training hub is being established in Vidarbha, a region suffering from serious agrarian distress.

I am stepping down as Chair of the MSSRF Board of Trustees on 6 August this year and this will be my last "Chairman's Introduction" to Annual Reports. Hence for the sake of record, I would like to chronicle some significant facts relating to each Programme Area.



Rented Centre in Kotturpuram

Our field offices (Top right to left – clockwise) – Wayanad, Puducherry, Jeypore, Poompuhar



Coastal Systems Research



Coastal Systems Research

Nearly one-third of the human population live near the coast. Seawater is also the dominant source of water in our planet. Research on coastal ecosystems has generally been carried out by forestry specialists with reference to coastal silviculture and mangrove wetlands. Fisheries scientists have been concentrating on marine fisheries, both capture and culture. Marine biologists have been studying coastal biodiversity and marine national parks and biosphere reserves. However, a holistic approach to the sustainable management of the landward and seaward sides of the coast has been lacking. MSSRF hence started in 1990 a Coastal Systems Research (CSR) programme in order to give concurrent attention to coastal forestry and agro-forestry, coastal agriculture, capture and culture fisheries and marine biodiversity. This has the following major components:

- * Conservation and rejuvenation of coastal mangrove wetlands and the development of mangrove bioshields, which can provide protection against coastal storms and tsunamis
- * Revival of coral reefs and seagrass beds
- * Organisation of coastal biovillages to provide income and work security through both on-farm and non-farm occupations
- * Seawater farming involving agri-aqua culture techniques in order to derive benefit from the vast seawater resource of our planet
- * Identification of genes for salinity tolerance in mangrove species and the transfer of such genes to rice and other crops through recombinant DNA technology
- * Joint Mangrove Forest Management and the management of the Gulf of Mannar Biosphere Reserve on a trusteeship mode

Integrated mangrove-fish farming as well as integrated coastal zone management has been taken up along the coasts of Tamil Nadu, Andhra Pradesh and Odisha. Seawater farming techniques have been standardised and demonstrated at several locations. A genetic garden of halophytes has



Restored Mangroves



Artificial reef



Mangrove fishery farming system



been established near Vedaranyam in order to provide raw material for seawater farming as well as for the isolation of genes for salinity tolerance. As a starting point, a survey of halophytes of Tamil Nadu and Andhra Pradesh coast was conducted, which revealed the presence of 19 species of obligate halophytes. Several species were selected in consultation with local communities for cultivation as commercial crops in seawater farms.

In 1989, I delivered a lecture in Tokyo on anticipatory action to meet the challenge of sea level rise, pointing out the need for immediate action to conserve mangrove wetlands and for initiating research on the identification and transfer of genes for salinity tolerance from mangrove species to rice and other crops of importance to coastal agriculturists. Taking up this idea, the late Dr. S. Okhita, a former Foreign Minister of Japan, got the Japanese government to grant US \$ 500,000 through the International Tropical Timber Organisation (ITTO) for MSSRF to initiate the mangrove conservation and genetics programmes. The Japanese government also helped in establishing an International Society for Mangrove Ecosystems (ISME) under my chairmanship. This initial support helped MSSRF to launch a well-planned mangrove research programme in 1990 and also to undertake a survey of mangrove genetic resources all over Asia and West Africa. With the help of the Department of Biotechnology, a genetic garden of mangrove species was established at Pichavaram. The major achievements of the coastal systems research programme over the last 20 years are:

- * Nearly 3000 hectares of degraded mangrove forests have been rejuvenated and revived along the coasts of Tamil Nadu, Andhra Pradesh and Odisha.
- * A joint mangrove forest management strategy has been developed so that the local communities are fully involved in the management and restoration of this unique ecosystem.
- * Genes for salinity tolerance have been identified in *Avicennia marina* and have been transferred to rice and other crops. These genes have been patented, as part of the defensive patenting policy of MSSRF.



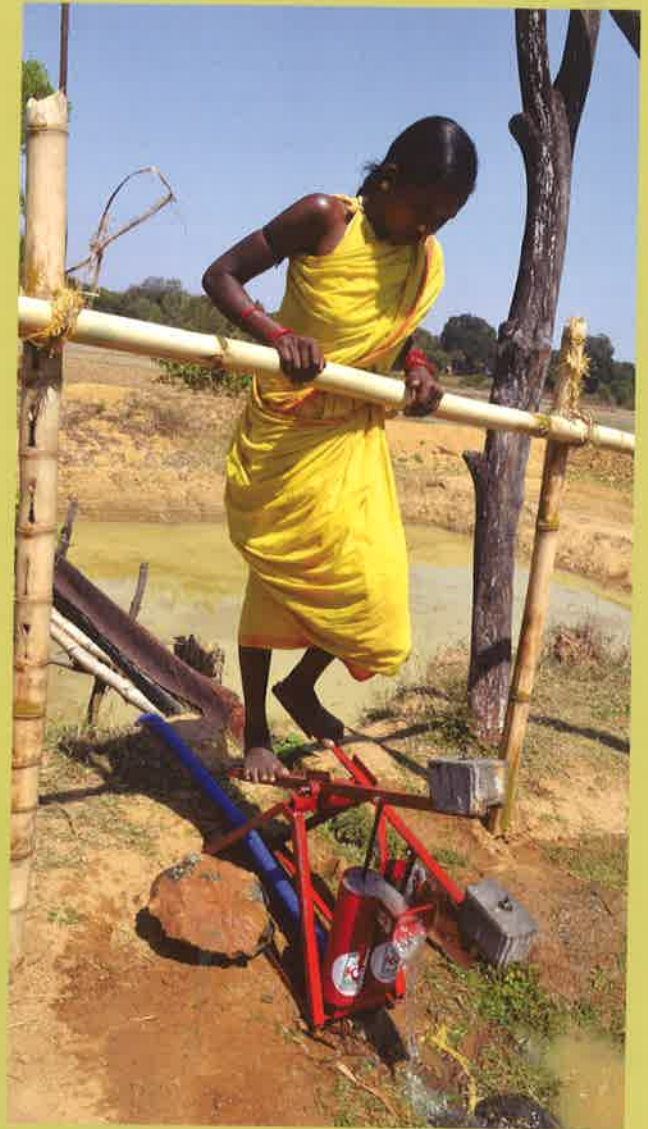
- * The management of the Gulf of Mannar Biosphere Reserve has been transferred to a Biosphere Trust so that the local population regard themselves as trustees of this unique biological paradise.
- * Steps have been taken to restore degraded coral reefs by establishing artificial coral reefs.
- * A genetic garden of halophytes has been established in order to preserve for posterity these salt-tolerant species, whose importance will grow with a rise in sea level as a result of climate change.
- * Coastal systems research is providing the basic information needed for the Integrated Coastal Zone Management Policy notified by the Government of India.
- * A Fish for All Research and Training Centre has been established at Kaveripoompattinam to promote sustainable marine fisheries and their safe handling and value addition through fish processing.
- * Village Knowledge Centres have been established along the coast in order to give timely information on weather and wave heights, location of fish shoals, fish marketing, value addition, etc. Mobile telephony has proved to be of particular value in communicating the right information at the right time and place and to the right persons. Such information has helped artisanal fishermen to go into the ocean with courage and confidence and return with a good harvest.

On the basis of MSSRF's proposal, FAO gave recognition to the Kuttanad Below Sea Level Farming System under its Globally Important Agricultural Heritage System Programme. MSSRF also prepared a detailed eco-development plan for Kuttanad and got a proposal for the establishment of an International Research and Training Centre for Below Sea Level Farming in Kuttanad approved by the Government of Kerala.

It will not be incorrect to say that the whole concept of CSR is a major contribution of MSSRF to the strengthening of both coastal ecological security and the livelihood security of coastal communities nationally and internationally.



Biodiversity





MSSRF's research on biodiversity began in 1989 with a study of genetic diversity in mangrove species and seagrasses. The greatest genetic diversity in mangroves in India was found to occur at Bhitarkanika in Odisha. From 1990 onwards, the biodiversity programme centered on community biodiversity conservation and enhancement. The study areas were Kolli Hills in Tamil Nadu, Koraput in Odisha and Wayanad in Kerala. Kolli Hills and Koraput are in the Eastern Ghats, while Wayanad is in the Western Ghats range. In all the areas, the emphasis was on the revitalisation of the *in situ* on-farm conservation traditions of tribal and rural families. All along, *in situ* and *ex situ* conservation undertaken by State Forest Departments, universities and research institutions, had been receiving attention from biodiversity experts. Unfortunately, community conservation and selection efforts in rural and tribal areas did not receive the same attention. As a result, genetic erosion became severe in such areas. For example, in the Koraput region there were nearly 3500 strains of rice 50 years ago. Now, this number has come down to less than 300. It is estimated that there may be about 150,000 varieties of rice in the world. Such rich intra-specific variability is largely due to human selection, based on genotype x environment interaction.

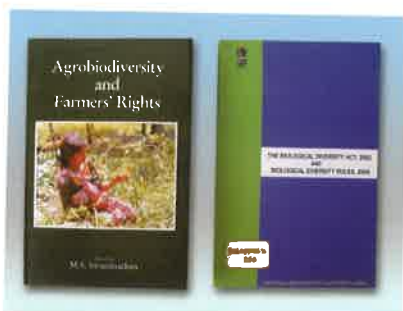
It is only in recent years that attention to community conservation, particularly with reference to agro-biodiversity, has started gaining momentum. MSSRF's strategy in this area has been based on the following principles:

- * There is need for creating an economic stake in conservation through a 4 C model of sustainable management of agro-biodiversity involving concurrent attention to conservation, cultivation, consumption and commerce.



- * The community tradition of creating Gene, Seed, Grain and Water Banks should be revitalised and promoted. This will help to develop sustainable food and water security systems at the local level.
- * The concept of farmers' rights should be converted into legally binding rights.

The rapidity with which local genetic resources were disappearing through habitat destruction, land use change, alien invasive species and changes in culinary habits and climate made it clear that unless community efforts in *in situ* on-farm conservation and *ex situ* preservation are recognised and rewarded, precious genetic resources may get lost. This led to the concept of farmers' rights in the fora of FAO in the 1980s when I served as Independent Chairman of the FAO Council. MSSRF's early work in Kolli Hills from 1991 to '95 showed that the rich reservoir of genetic material in nutri-milletts will vanish in the near future as a result of a change in land use in favour of tapioca and pineapple. In two Dialogues organised by MSSRF – Farmers' Rights and Plant Genetic Resources: Recognition & Reward in January 1994 and Biodiversity and Farmers' Rights in January 1996 – I presented a draft of a Plant Variety Protection and Farmers' Rights Act stressing, that the rights of breeders and farmers should be mutually reinforcing and should not be set one against the other. My draft provided the basic text for the Government of India's legislation titled Protection of Plant Varieties and Farmers' Rights Act, which was approved by Parliament in 2001. The International Union for the Protection of New Varieties of Plants (UPOV) recognises plant breeders' rights, but unfortunately not the contributions of those who have preserved genetic resources for public good at personal cost. This is why I had proposed as far back as 1990, when I delivered the Sir John Crawford Lecture in Washington DC, the need for restructuring UPOV as the International Union for Breeders' and Farmers' Rights. Breeders and farmers are allies in the struggle for sustainable food security and the eradication of hunger. The Indian legislation is the only one of its kind in the world which deals simultaneously with breeders' and farmers' rights and MSSRF was the first to produce such an integrated Bill.



Several other steps have been taken to revitalise farm level conservation. Participatory plant breeding in the Koraput district with farm/tribal families for the purpose of improving the yield potential and agronomic qualities of local strains led to the development of the *Kalinga Kalajeera* strain, which is both high yielding and has a high market value. Similar participatory breeding work is in progress in millets in Kolli Hills and in medicinal plants in Wayanad. The basic approach in biotechnology research has also been for MSSRF to remain as a pre-breeding centre and work with farm families in a participatory breeding mode. Such a combination of pre-breeding and participatory breeding will help to combine genetic efficiency with genetic diversity.

On MSSRF's suggestion, the Government of India has instituted two recognition and reward systems: The Genome Saviour Award for tribal and rural families who have conserved rich genetic diversity and the Breed Saviour Award as recognition and reward for rural women and men for their contributions to the conservation of indigenous animal breeds. A programme for the collection and conservation of rare, endangered and threatened species (RET) was initiated 7 years ago for preventing the disappearance of RET species.

The first draft of the National Biodiversity Act was prepared at MSSRF under the auspices of a National Committee set up by the Ministry of Environment and Forests under my chairmanship in 1968. The unique features introduced in this Act included:

- * The management and governance of biodiversity will be at three levels – panchayat level through a Biodiversity Management Committee, State level through a Biodiversity Board and national level through the National Biodiversity Authority.
- * The local panchayat committee will have the power to grant prior informed consent in collection as well as benefit-sharing arrangements in utilisation.
- * Local biodiversity management committees will be empowered to recognise sacred groves and other important conservation areas as heritage sites.

Thus the Biodiversity Act also incorporates the concept of farmers' rights with reference to the recognition and reward system for local conservers.

The Biodiversity programme of MSSRF, now 22 years old, has been able to generate awareness of the importance of community biodiversity conservation and of the need for mainstreaming the principles of ethics and equity in benefit sharing. It is to be hoped that such steps will not only halt genetic erosion but will lead to an era of biohappiness arising from the sustainable and equitable use of biodiversity for creating new jobs and income.

Among other significant contributions of the Biodiversity group, mention may be made of the establishment of the Community Gene Bank to provide data support to the implementation of the farmers' rights programme. The Community Gene Bank also promotes awareness and capacity building in relation to the PPV&FRA. The Koraput agricultural system was recognised by FAO for inclusion under its Globally Important Agricultural Heritage Systems (GIAHS) on the basis of the documentation prepared by MSSRF.



Genome Saviour Award



Kala Jeera rice



RET species



This is in recognition of the conservation of both agro-biodiversity and local knowledge systems.

More recently, two significant programmes have been initiated to integrate agro-biodiversity conservation with the alleviation of poverty and malnutrition. The project supported by the Canadian International Food Security Research Fund through the Canadian International Development Agency (CIDA) and the International Development Research Centre (IDRC) aims to overcome malnutrition in agro-biodiversity hot spots in Odisha, Kerala and Tamil Nadu by providing agricultural remedies to nutritional maladies. The project aims to enhance food and nutrition security at individual, household and community levels, taking into account the gender dimensions of poverty and malnutrition. Another important project initiated recently is Leveraging Agriculture for Nutrition in South Asia (LANSA), supported by the Department for International Development (DFID) of UK. MSSRF is the lead agency for implementing this multi-country and multi-institutional project. The other partners of the consortium are International Food Policy Research Institute (IFPRI), Institute of Development Studies (IDS), Leverhulme Centre for Integrative Research on Agriculture and Health (LCIRAH), Bangladesh Rehabilitation Assistance Committee (BRAC), Bangladesh, and Collective for Social Science Research, Pakistan. This project is designed to promote nutrition-sensitive farming, which involves the design and adoption of cropping and farming systems to help overcome protein-energy under- or malnutrition, hidden hunger arising from the deficiency of micro-nutrients in the diet such as iron, iodine, zinc, vitamin A, vitamin B₁₂ etc., and transient hunger arising from either natural calamities or civil disturbances. For ensuring adequate nutrition of the right quality to an individual, a life-cycle approach is being adopted, starting with pregnant women up to old and infirm persons.



It will be appropriate to recall the contributions of MSSRF to biodiversity conservation and sustainable and equitable use at the international level. In 1988, a legal framework for a Global Biodiversity Convention was approved at the IUCN General Assembly held at San Jose, Costa Rica, under my chairmanship. During 1988-90, the procedures for operationalising the concept of benefit sharing with primary conservers at national and international levels and of farmers' rights were developed at the Keystone International Dialogues on Plant Genetic Resources held under my chairmanship. The crucial resolution, which broke the stalemate in getting the agreement of the private sector for implementing farmers' rights, was achieved at the Chennai Dialogue, held at MSSRF in January 1990. These steps paved the way for the adoption of the Convention on Biological Diversity at Rio de Janeiro in June 1992.

Development of procedures for the sustainable management of tropical rainforests constitute another significant contribution of MSSRF. In 1989, I was invited by the then Secretary General of the Commonwealth, Sir Shridath Ramphal, to help in developing a programme for demonstrating the concept of sustainable management in the one million acres of prime rainforest offered by the Government of Guyana to the Commonwealth for this purpose. This project, known as the Iwokrama International Centre for Rainforest Conservation and Development (IIC), demonstrated how a prime rainforest can be managed sustainably by adopting methods which can help to conserve and enrich biodiversity and at the same time provide jobs and income to the indigenous Amerindian population as well as the people of Guyana. Thus, the biodiversity programme of MSSRF from 1988-2002 has had profound influence in shaping the concept that "good ecology is good business".

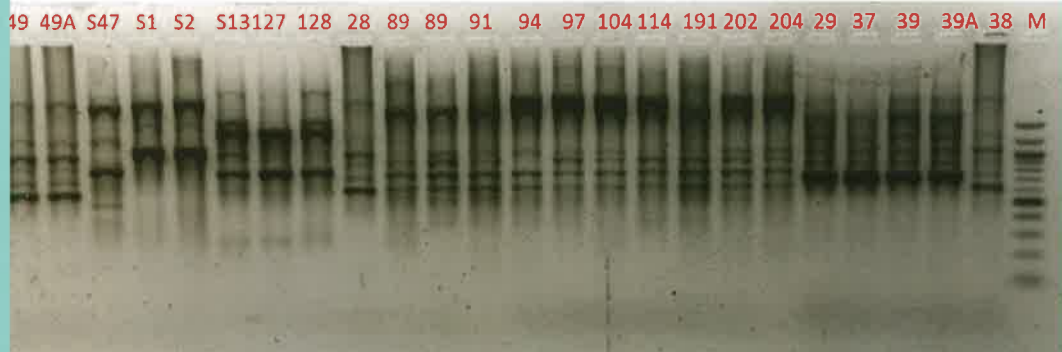
Some of the world leaders in this field have participated in the different dialogues and discussions held at MSSRF. I would however like to name one – the late Professor Gian Tommaso Scarascia Mugnozza, who helped MSSRF to establish a Community Gene Bank and guided our work in many ways. We are deeply indebted to him for his guidance, support and friendship. In recognition of his monumental contribution to genetic resources conservation, MSSRF's Community Gene Bank is named after him.



Biotechnology



BOX PCR PROFILING

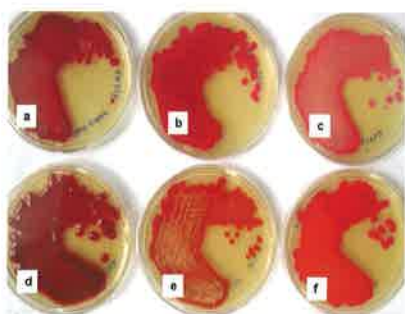


Biodiversity is the feedstock for biotechnological enterprises. Therefore, from the beginning MSSRF has tried to harness the tools of modern biotechnology like micro propagation, bio-prospecting, bio-monitoring, bio-remediation and recombinant DNA technology for the effective use of biodiversity, involving both strategic and applied research. The necessary infrastructure including the needed equipment has been set up with the support of the Department of Biotechnology (DBT), Government of India. The studies undertaken have provided significant insight into the understanding of the mechanism of salt tolerance in mangroves and other halophytes. Tolerance to abiotic stresses have been studied in *Prosopis juliflora*, *Jatropha curcus*, millets and some lichen species. Through large-scale sequencing, the group has been able to identify, characterise and study the regulation of several novel genetic combinations with implications for salinity and drought tolerance, bio-remediation, and nutritional enhancement. A number of specific promoters governing the expression of the identified genes have been identified and isolated. Using genetic combinations related to osmoprotectants, ion transporters, heavy metal accumulation, compatible solutes and secondary metabolite accumulation, several transgenic pure lines have been generated. These have been evaluated under contained conditions for ascertaining their level of tolerance to abiotic stress as well as the level of enhanced micronutrients, particularly iron. Some of these purelines have been introgressed into locally adapted varieties and these are in T6 generation. Two limited field trials have been conducted. MSSRF has obtained two US patents for these inventions: US patent for the Dehydrin gene from *Avicennia marina* responsible for conferring salt tolerance in plants (Drs. Ajay Parida, Preeti Mehta and Gayatri Venkataraman) and US patent for the Glutathione-S-transferase gene from *Prosopis juliflora* conferring drought tolerance in plants (Drs. Ajay Parida and Suja George). Thus, the programme that was initiated nearly two decades ago has resulted in generating location-specific varieties for abiotic stress tolerance as well as nutrition enhancement. Following national regulatory requirements, biosafety trials will be undertaken to take these important discoveries for product development. The scientists working on these problems have published several research papers in internationally peer-reviewed journals.



Salt/drought genes are mined from –
Avicennia marina, *Prosopis juliflora*, *Porteresia coarctata*,
Sesuvium portulacastrum





The bioprospecting programme in lichen species resulted in the isolation and characterisation of 11 compounds, of which 4 are novel molecules. These have been used for anti-tuberculosis and anti-cancer screening in partnership with the Cancer Institute, Chennai and the Tuberculosis Research Centre, Chennai. The novel molecule MSSRF 009 inhibits all the tested 7 tuberculosis strains, including the multi-drug resistance strain, at a considerably low concentration. It also was found to be safe on human macrophage cell lines. Culture protocols for fungal, algal and whole thallus culture of 36 lichen species have been standardised. During the year, DBT approved a national network programme on lichen bioprospecting for secondary compounds and establishing cultures and collections involving 6 national laboratories, of which MSSRF is the coordinating institution.

The research undertaken by the microbiology group for exploring the genetic and functional diversity of the mangrove-associated rhizobacteria has resulted in the identification of four novel *Vibrio* spp. A total of 326 *Micromonospora* spp., 51 denitrifying bacteria, and a *Halomonas* (MSSRF176) strain capable of degrading benzene have been identified. More than 25,000 bacterial isolates were screened by high infectivity throughput screening (HITS) for anti-cancer, anti-diabetic, anti-inflammatory and anti-infectivity properties.

In 2003, I was asked to chair a committee to develop guidelines for the further progress of agricultural biotechnology. I had then recommended that we should have a Parliament-approved National Biotechnology Regulatory Authority. I maintained that the bottom line of our national agricultural biotechnology policy should be the economic well-being of farm families, food security of the nation, health security of the consumer, biosecurity of agriculture and health, protection of the environment and the security of national and international trade in farm commodities.



I also chaired meetings convened by DBT on the structure of an effective Biotechnology Regulatory Authority. As a result, draft legislation for setting up such an authority is now ready for being introduced in Parliament. There is considerable work in progress in the country in the areas of basic and applied biotechnology and a very large number of young scholars are doing creative work in this field. Therefore, the sooner a regulatory system which inspires public, political, professional and media confidence is established, the greater will be the opportunity for deriving benefits from the enormous progress made in the areas of molecular biology and genetic engineering.

A survey by MSSRF in villages revealed that the understanding of the advantages and disadvantages of genetically-modified crops was poor. It was clear that there is need for greater efforts in the areas of public education and information. In 2004, MSSRF therefore started Genome Clubs in schools, to familiarise young students on the characteristics and implications of the genomes of rice and other crops as well as of the human genome. This genetic literacy programme was so effective that DBT came forward in 2006 to make it a national programme – DNA Clubs. MSSRF coordinates this programme in the south Indian States. There is need for more investment in informing farmers about the special features of genetically-modified crops, including the need for growing refuge in order not to put pressure on the pathogen/insect to mutate and develop more virulent forms.

The MSSRF programme in the field of genetic engineering is unique in the sense it has used plants which have not been so far investigated from the molecular standpoint, but which are very important donors of genes for abiotic stresses like salinity and drought. Bio-fortification is another field where original work has been done in the breeding of rice varieties rich in iron. The policy of MSSRF is not to worship any tool because it is new and novel, but to choose those, whether new or old, which can help in achieving the desired goal speedily and surely.

Another major contribution of the Biotechnology group has been the design and establishment of the first Womens' Biotechnology Park in the country with the generous assistance of the Government of Tamil Nadu and the Department of Biotechnology of the Government of India. It would be appropriate to refer in particular to the contributions of Dr. Sudha Nair and Dr. Manju Sharma in converting the concept of a Womens' Biotechnology Park into reality.



Ecotechnology



The implementation of a pro-nature, pro-women, pro-poor and pro-sustainable livelihood mandate required a field-level operational model. The biovillage model of sustainable human development emerged at an inter-disciplinary dialogue held in 1992 on taking the benefits of biotechnology to rural India. The biovillage model has three major objectives: the first relates to the conservation and enhancement of common property resources and natural resources like land, water, and biodiversity; the second aim is to increase the productivity and profitability of small farm agriculture on an environmentally sustainable basis, and the third component aims to improve non-farm income through value addition to primary produce and through the expansion of the services sector.

The biovillage programme was started in 1992 in three villages in Puducherry. The initial effort was in the area of enhancing non-farm income through market-driven micro-enterprises like mushroom cultivation, vermiculture, manufacture of biopesticides and biofertilisers, dairy farming, aquaculture in village ponds as also various other micro-enterprises supported by micro credit. The Biovillage Council comprising representatives chosen by rural women and men provides overall guidance to the work of the families living in biovillages. It also provides policy oversight to the micro-credit programme. The biovillage aims to address concurrently all the three major components of sustainability: economic, environmental and social. It is a human-centered programme, with community involvement and control at all stages in the production-consumption-marketing chain.

The studies so far done reveal that the biovillage has opened up new opportunities for ensuring income and work security to the village population and more particularly to women. The biovillage model has spread to Odisha as well as to neighbouring countries like Bangladesh. Ultimately, the goal is to convert every village into a biovillage. The technologies used in biovillages fall under the broad category of ecotechnology.

Inauguration of the JRD Tata Ecotechnology Centre





Ecotechnology involves the blending of traditional wisdom with frontier technology. With the help of Tata Trusts, the JRD Tata Ecotechnology Centre was established at MSSRF in 1998. As part of the effort to conserve soil and water, community-led watershed management projects were introduced. The Tolla watershed in Odisha received this year the *Rashtriya Jal Puraskar* (National Water Prize) and the watershed project in Pudukottai in Tamil Nadu received the *Bhoomijal Samvardhan Puraskar* ((Groundwater Augmentation Award) from the Ministry of Water Resources, Government of India. The local families were happy and felt encouraged that their work in the sustainable management of water received national attention. The community system of natural resource management in Koraput, Odisha also received the Equator Initiative Award at the UN Conference on Environment and Development held at Johannesburg in 2002.

To provide the scientific back-up necessary for promoting an ever-green revolution approach in farming, a laboratory for integrated pest management (IPM) and a mobile soil testing service has been established. The IPM laboratory at Chennai has developed several bio-control agents as well as techniques for the mass multiplication of egg parasitoids. Women SHGs have been enabled to take up the multiplication and sale of bio-control agents and other biological software essential for an ever-green agriculture.

The biovillage model of sustainable rural development will help to retain youth in farming and farm-related activities. The supplementary income received through non-farm employment will be a stimulus to *yuva kisans* and *mahila kisans*. The most urgent need in biovillages is to link products





with assured markets. Other initiatives in biovillages include the introduction of information communication technology and the mobilisation of renewable energy systems, including solar energy. In many biovillages, women have mastered the technology of vermiculture and mushroom production. Jointly with the OCP Foundation of Morocco, steps have been taken to organise Pulses Villages in order to increase the production and availability of pulses.

The Fish for All Research and Training Centre at Kaveripoompattinam is another important initiative of the JRD Tata Ecotechnology Centre. The aim of this Centre is to promote sustainable fisheries and the addition of value to fish through hygienic processing. Food safety based on *Codex Alimentarius* standards is given high priority. Every step in the fish capture-to-consumption chain receives concurrent attention. The Kaveripoompattinam Centre was the outcome of the support extended by Tata Trusts and corporates to the unfortunate victims of the 2004 tsunami. Thus a calamity became an opportunity for improving the safety and well-being of fisher families on a long term basis.

The biovillage methodology of sustainable rural prosperity can be suitably adapted in different States and countries. It will provide a platform for partnership among all involved in promoting agrarian prosperity and rural development.



Food and Nutrition Security

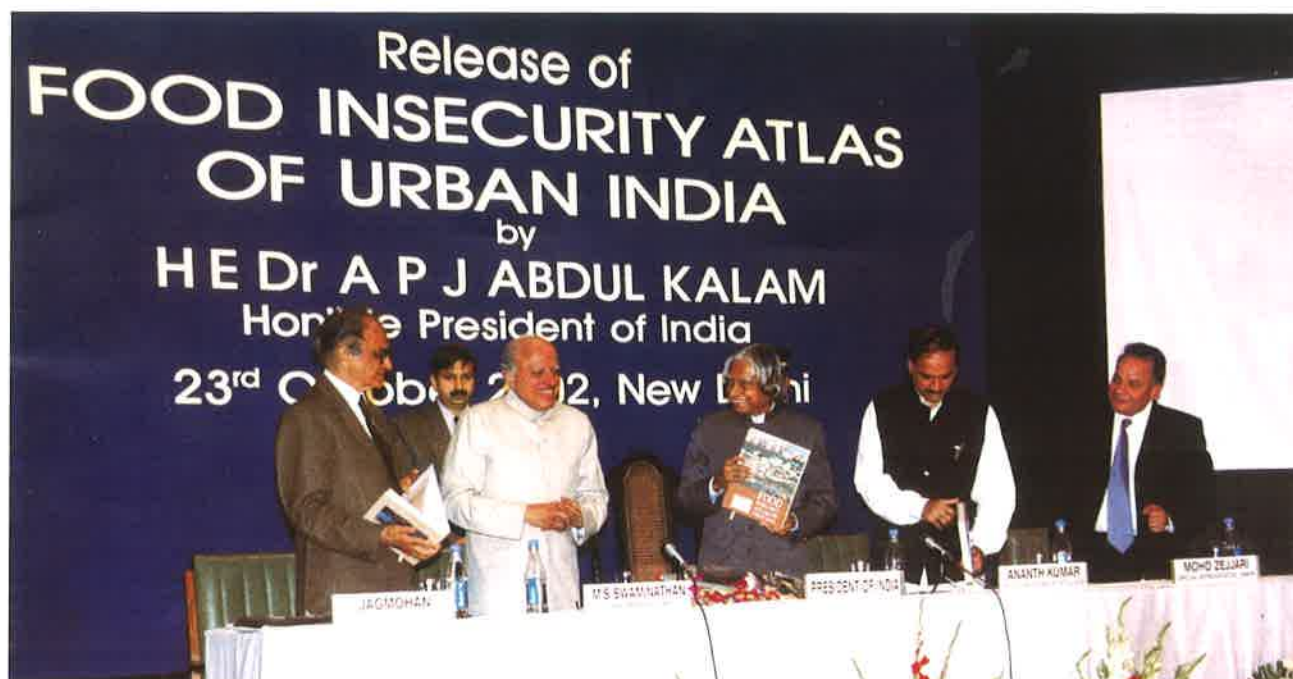


Helping to achieve the goal of a hunger-free India has been one of the important aims of the programmes of MSSRF. In the year 2000, this work was intensified in association with the World Food Programme. Food Insecurity Atlases of rural and urban India and an atlas on the sustainability of food security were brought out during 2002-03. The atlases looked at the different indicators of food insecurity under three broad categories, namely, availability, access and absorption. These atlases have since been updated. The atlases help policy makers to identify the food insecurity hotspots and develop social protection measures which can help to ensure sustainable food security. Based on a request from the Government of Cambodia, a Food Security Atlas of Cambodia was prepared by the MSSRF Food Security group. Similarly, assistance was given to South Africa in preparing a Food Insecurity Atlas.



MSSRF also helped to organise a National Coalition for a Nutrition Secure India. The Secretariat of the Coalition functioning under my chairmanship from August 2007 was initially hosted by VISTAAR and it is now being hosted by Save the Children. The Coalition is helping to bring about convergence and synergy among the programmes operated by government departments, UN and bilateral agencies and civil society organisations.

The malnutrition burden in India is very high. It is clear that we need to attack this problem from the village upward. For this purpose, MSSRF has initiated a Community Hunger Fighters programme, to start with in the Koraput district of Odisha. Community Hunger Fighters (CHF's) are a cadre of community volunteers at the grass-roots level mobilised to address hunger and malnutrition in their villages. The team comprises both men and women, with minimal or no literacy, selected by the village *palli* or Gram Sabha. In addition to the Community Hunger Fighters programme, a project titled the Healthy Child has also been initiated in the Kundra block of Odisha. The



aim of this project is to reduce the infant mortality rate and the morbidity pattern in children.

MSSRF is engaged in the development of methodologies for promoting nutrition- sensitive agriculture. One approach lies in improving the productivity of small-farm agriculture, which is the backbone of the livelihood security system of a large proportion of the population of India. Another involves the design and adoption of cropping and farming systems which can provide agricultural remedies to prevailing nutritional maladies, such as protein-energy under- or malnutrition, hidden hunger (deficiency of micro-nutrients in the diet) and transient hunger arising from either natural calamities or civil disturbances. To mainstream the nutrition dimension in agriculture, a programme termed Farming System for Nutrition (FSN) is being designed and introduced in Koraput, Kolli Hills, Wayanad, and Vidarbha where there is a high burden of malnutrition.

The National Food Security Bill under consideration in Parliament aims to ensure economic access to food to everyone requiring social protection for food security. Even if access is ensured, there is still need for promoting effective absorption of food in the body by providing clean drinking water, sanitation, primary healthcare and nutritional literacy. As suggested by the High Level Panel of Experts on Food Security and Nutrition of the World Committee on Food Security, chaired by me, the right to food must be based on a food security floor approach, which will help to identify the minimum essential interventions necessary to ensure food security for all. The MSSRF approach to food security involves social protection both at the inter-generational and intra-generational levels. The inter-generational approach aims to eliminate maternal and foetal under- and mal-nutrition. I hope that such an integrated and holistic approach to food security will help to accelerate progress in the elimination of endemic and hidden hunger.

Exhibition of Wild food diversity



Available data indicate that women and girl children tend to be relatively more undernourished, leading to several health problems. Also women farmers will need gender-specific support services like crèches, day care centres and noon meal programmes. In order to address these issues in a holistic manner, a *Mahila Kisan Sashaktikaran Pariyojana* (Programme for the Empowerment of Women Farmers) was initiated by MSSRF five years ago in the Wardha and Yavatmal districts of Vidarbha. Impressed with the success of this endeavour, the Union Finance Minister provided funds in the budgets of 2011-12 and 2012-13 for initiating a national Mahila Kisan Sashaktikaran Pariyojana programme under the Rural Livelihoods Mission. I introduced in Rajya Sabha in May 2012 a 'Private Member's Bill' titled "Women Farmers Entitlements Bill 2011" for addressing the important requirements of women farmers such as access to land, irrigation water, technology, credit, insurance and markets.

Today's children are tomorrow's citizens. Their care including nutrition, healthcare and education will determine the future of a country. MSSRF has placed considerable emphasis on looking holistically at the problems and needs of women and children. The project, Action for Child Care and Education Strategies and Services (ACCESS), with support from the Bernard van Leer Foundation, has been the area of concern, expertise and achievement of the Director, Mina Swaminathan. The target group was young children, the below sixes, belonging to the underprivileged sections of society. The aim was action to advocate, promote, and support services for the care, welfare, development and education of children, especially services which address the intersecting needs of women, children and girls. Attention was concentrated on children in difficult or stressful circumstances, such as children of working mothers, children of migrant and itinerant labour, children in poverty, girls, and working/street children. The basic strategies were seven in number: action-research, training, networking, communication, documentation, development of resource materials, and resource expertise.

MSSRF has derived immense advantage from the operation of this project as an integral part of its programmes and priorities. Project ACCESS has generated a considerable amount of resource material for the education of young children. The lessons from Project ACCESS are now being incorporated in the other programmes of MSSRF, more particularly in the biovillages.



Information Communication Technology



MSSRF's work in the field of ICT started in 1992 with the concept of Village Knowledge Centres (VKCs). The term knowledge centre was chosen in preference to information centre since knowledge is the product of interaction between scientists and rural families, while information is passive and is mostly one-way communication. The major goal is to make the VKC a centre of information and discussion relating to important programmes like the National Rural Health Mission, National Horticulture Mission, National Food Security Mission and all other schemes of the Government of India, the State Governments and local NGOs. Such convergence among different programmes at the field level helps to generate synergy among them and thereby enhance their benefit to rural families. The content is location-specific, dynamic, demand-driven and delivered in the local language. It is also gender sensitive, with emphasis on the specific needs of women in relation to health care and flexibility with regard to place and duration of work. Capacity building is carried out in the local language, and in such a manner that rural women and men are able to participate in the programmes after completing their daily chores. Fortunately, software for a variety of topics of importance to rural families is now available in different languages and connectivity has now become relatively easy since there has been a large investment in this field. The community VKC is established in accommodation provided by rural families and is managed and operated by trained rural women and men. They serve as volunteers and the management is done by rotation among a group of rural volunteers. There are 73 such community-managed and -owned knowledge centres in Tamil Nadu, Puducherry, Maharashtra, Andhra Pradesh, Odisha and Kerala. They are extremely popular with adults for the relevance and timeliness of the information they provide, and with schoolchildren as centres where they can gain computer literacy.



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In addition to VKCs, MSSRF initiated in 2004 a Village Resource Centre (VRC) programme jointly with the Indian Space Research Organisation (ISRO). VRCs have satellite connectivity and telecommunication facilities. MSSRF operates 15 VRCs and they have proved to be very effective for communication among farmers, since they provide audio-video conference facilities.

MSSRF's knowledge empowerment programme involves lab-to-land, land-to-lab, land-to-land and lab-to-lab approaches. The land-to-land, i.e., farmer-to-farmer learning is a very powerful method of extension since farmers have faith in the economic data provided by fellow farmers. In order to facilitate such sharing of experience and ideas, MSSRF has initiated steps to establish Farm Field Schools in five locations, two in Tamil Nadu and one each in Odisha, Maharashtra and Kerala, with the support of Indian Overseas Bank. The main objective of the schools is to impart practical training to farmers on crop management and to transfer new and innovative technologies to improve crop production. Each farm school will have both training and hostel facilities.

MSSRF's experience shows that bridging the digital divide in rural areas also helps to bridge the gender divide. The self-esteem and pride of women volunteers who are running VKCs and VRCs have gone up enormously. In order to give social prestige and recognition to rural women and men who



have mastered digital technology and who are running VKCs and VRCs, MSSRF started in 2005 the Jamsetji Tata National Virtual Academy. This Academy has currently over 1500 Fellows from 22 States in India. In addition, there are 31 Fellows drawn from six neighbouring countries.

I must also refer to two other initiatives in the field of information, education and communication. *The Hindu* Media Resource Centre, established with generous assistance from *The Hindu* group of newspapers, is helping to bring science and the media into close partnership in order to ensure that information on scientific discoveries of value to rural families reach them. Another initiative is the Every Child a Scientist programme. Here children are exposed to various aspects of science relevant to their day-to-day life. One part of this programme is for visually-impaired children, who regularly visit the Touch and Smell Garden set up in the Chennai campus of MSSRF.

A great asset of MSSRF is its Library, printed and digital, which has a rare collection of books in the fields of environment and sustainable development. This open access library provides opportunities for research scholars from various universities in India to carry out their review of literature studies.

2012-13 has been designated by the Government of India as the Year of Science in India. The most urgent task is to spread what Jawaharlal Nehru used to emphasise – the scientific temper. Modern technology is helping to convert ordinary rural women and men into extraordinary individuals. The small VRC programme initiated by MSSRF following the Dialogue in 1992 has now become a mass movement with the active involvement of the public, academic and private sectors and Panchayati Raj institutions.



Looking Back and Forward

This is a brief account of 24 years of adventure in science designed to bring a message of hope to the economically and socially underprivileged sections of our rural society. MSSRF's approach to poverty alleviation has been asset building, particularly imparting new skills and promoting community organisations. Sustained donor support has ensured sustained efforts in implementing the pro-nature, pro-poor and pro-women mandate. Currently, the emphasis is on consolidation and concentration of programmes.

During the period 1988-98, I functioned as Executive Chairman, building the scientific infrastructure, recruiting staff, finalising programme priorities and above all gathering donor support both for on-going work and for building a corpus fund, which will help to provide bridging funds whenever a project comes to a close and a new one is yet to begin. Looking back, funding has not been a major problem. The principal challenge has been to identify young women and men scientists who combine scientific excellence with social commitment. Fortunately, MSSRF has a large number of young scientists who possess this combination and who are able to identify themselves with the rural and tribal poor. This has helped MSSRF to become a global leader in humanistic science and scientific humanism.

As mentioned at the outset, MSSRF has had the benefit of financial support from a wide range of donors, whose generous contributions have been acknowledged in Annual Reports. Among non-government donors, my special thanks go to Shri Ratan Tata, Shri R. M. Lala (who also served as Trustee of MSSRF for 10 years) and the Tata Trusts; Ms. Susan Berresford and the Ford Foundation, New York; Drs. Geeta and Krishan Mehta and Friends of MSSRF, Tokyo; and Ms. Vicki Corbett and Ms. Barbara Wolveridge of Friends of Swaminathan, Australia.

The board of trustees in 2002





MSSRF has also been fortunate to have Executive Directors totally dedicated to the mission of the institution. I would like to express my gratitude to Professor P.C. Kesavan (1999-2003), Dr. M. Velayutham (2003-2007), Shri Achyut Gokhale (2007-2009) and Dr. Ajay Parida (2009 onwards) for their dedicated leadership and their commitment to the core values of the Foundation. The most important core value is that integrity, whether in science or in financial management, is not negotiable.

MSSRF has been very privileged in its Trustees. Twenty eminent scientists and scholars have served on the Board so far. Among them, Dr. K. Kanungo and Dr. K.N. N.S. Nair are no more. Dr. Kanungo served as the Chair of the Audit-cum-Finance Committee during 1995-2005. Dr. K.N.N.S. Nair, who served as Trustee from 2001-2005, spent a considerable amount of his time to develop the biovillage methodology and to impart a pro-woman orientation to technology development and dissemination. We miss their encouraging smiles and practical wisdom.

My special thanks are also due to Dr. Uma Lele and Dr. Kavita Gandhi for undertaking a thorough review of the progress made during the first 20 years. Dr. Sudha Nair did a superb job facilitating the review with appropriate documentation. Dr. Uma Lele also served as a Trustee for two years and played a helpful role in developing the LANSAPROJECT. Another past Trustee, Mr. Vijay Mahajan, helped MSSRF at an important stage in its evolution with sound management advice. To me, it has been a learning experience to have worked with such a group of eminent humanists and institution builders. It has been a pleasure to interact and work with several hundred scientists and research scholars, as well as administrators and technical staff, during the last 22 years. I have learnt much from their spirit of innovation and scientific enquiry.



Some of the Magsaysay awardees at MSSRF





N Parasuraman, first staffer of MSSRF, gets his PhD. from Madras University

Dr. N. Parasuraman has been with MSSRF from the beginning and has been a source of important archival material. His memory is phenomenal and he maintains historical records with meticulous care. Dr. Rajeswari Anand, the first scientist to join MSSRF, was a pillar of strength in getting the Foundation operational. My secretaries Ms. R. Malathy and Ms. Y. Dilhara Begam have helped to maximise my output and the value of my time by extending extraordinarily efficient assistance. Ms. Gita Gopalkrishnan has been a wonderful editor, with attention to both expression and authenticity of information.

As I step down from the Chairmanship of MSSRF, I wish to welcome our new Trustees – Dr. Manju Sharma, Former Secretary, Department of Biotechnology, Government of India, Professor Virander S Chauhan, Director, International Centre for Genetic Engineering and Biotechnology, Dr. Narayan G. Hegde, former President and currently Trustee and Principal Adviser of BAIF, and Dr. Kezevino Aram, Director of the Shanti Ashram at Coimbatore. They all bring life-long experience in taking the best in modern scientific knowledge to the service of rural families.

It has been both a pleasure and a privilege to have had the opportunity to work with the current Trustees, – Shri N. Ram (Chair, Ethics Committee), Shri V. Namasivayam (Chair, Finance and Audit Committee), Dr. Suman Sahai (Chair, Programme Committee), Shri K. Rajiv (Chair, Administration and Personnel Committee), Dr. Tushaar Shah and Dr. Rita Sarin. I am indebted to them for the time they are so generously sparing for MSSRF. My best wishes go to Dr. Madhura Swaminathan, incoming Chair of the Board of

The first annual report release function



Trustees. The Trustees have kindly invited me to serve as Emeritus Chairman and Chief Mentor and I shall do my best to continue to be of help to the Trustees, Executive Director and Staff and the research scholars in their efforts to serve both science and society.

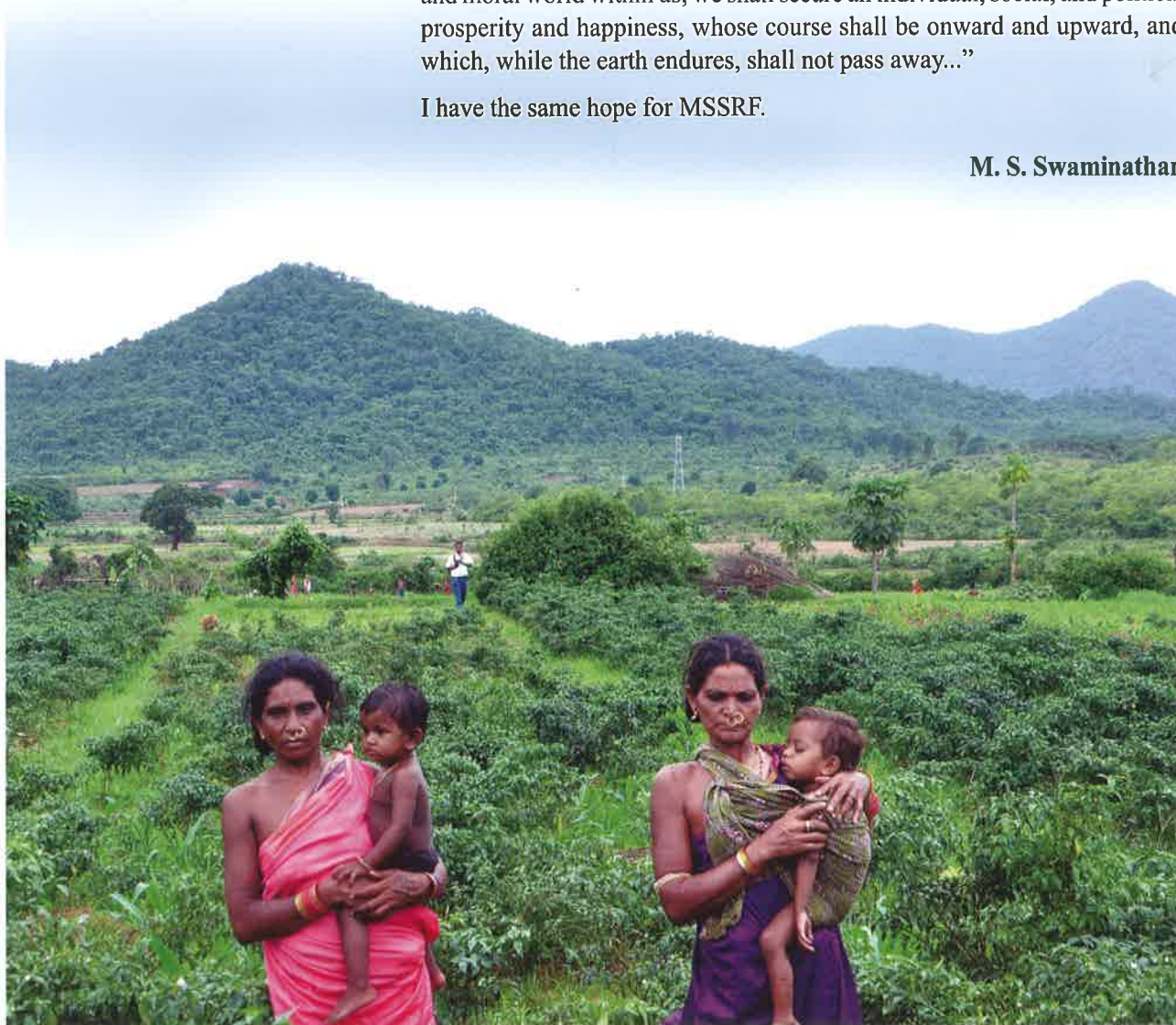
My sincere gratitude goes to the Government of India as well as to the Governments of Tamil Nadu, Odisha, Kerala, Andhra Pradesh, Puducherry and Maharashtra for their support to the work of MSSRF. Particular thanks go to Dr. M. Karunanidhi and Dr. Selvi J. Jayalalithaa, former and present Chief Ministers of Tamil Nadu, for their encouragement and invaluable support during the last 24 years.

I end with a quotation from a speech delivered by Abraham Lincoln before the Wisconsin State Agricultural Society in 1859:

An Eastern monarch once charged his wise men to invent him a sentence, to be ever in view, and which should be true and appropriate in all times and situations. They presented him the words: "*And this, too, shall pass away.*" How much it expresses! How chastening in the hour of pride! How consoling in the depths of affliction! "*And this, too, shall pass away.*" And yet let us hope it is not *quite* true. Let us hope, rather, that by the best cultivation of the physical world, beneath and around us, and the intellectual and moral world within us, we shall secure an individual, social, and political prosperity and happiness, whose course shall be onward and upward, and which, while the earth endures, shall not pass away..."

I have the same hope for MSSRF.

M. S. Swaminathan



First World Food Prize Ceremony, Smithsonian Institute, Washington DC, October 6, 1987



From Left to Right: Mr. Lyng, US Secretary for Agriculture; Prof. M. S. Swaminathan;
Dr. Norman Borlaug; Mr. Kaul, Indian Ambassador to US



Prof. M.S. Swaminathan, Ms. Mina Swaminathan, Mr. John Denver (left to right) at the above function



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