mssrf

IMPACT REPORT
2023-2024

M S Swaminathan
Research Foundation
SCIENCE FOR SUSTAINABLE DEVELOPMENT

Empowering Communities, Enhancing Ecosystems - A Year of Impact and Innovation

MSSRF's efforts over the past year have continued to impact the most marginalized communities, reaching nearly 3 lakh including small farmers, fishers, and tribal families. The goal is to identify and respond to these communities' needs through a scientific and participatory approach, bridging the gaps through appropriate technologies and strategic advice.

A strong focus on gender equity runs through all our programs and we pay special attention to the needs of women farmers and fishers. Working in diverse environments such as mangroves, marine and coastal areas, drylands, and biodiversity hotspots, MSSRF has conserved and restored hundreds of hectares of degraded land, enhancing environmental health and resilience for these communities.

Additionally, thousands of farmers and fishers experienced increased incomes through Integrated Farming Systems, demonstrating MSSRF's pivotal role in boosting local economies and improving livelihoods. Digital skilling, the use of remote sensing and GIS technologies, Agromet advisory services at the block level, and mobile apps to provide real-time information have been some of the applications of new technologies in the field. Our educational outreach programs continue through the Village Knowledge Centres (VKCs) as well as through the recently introduced ECHO platform, which has enabled a reconnect with the Jamshetji Tata National Virtual Academy fellows. Science education for middle school children has been expanded to more sites, with generous CSR support.

The impact of MSSRF's specific programs has been noteworthy.

The Coastal Systems Research Programme planted nearly 5.5 lakh mangrove saplings, restored over 65 hectares of coastal land, and removed nearly 7 tons of marine debris. Addressing marine plastic pollution is a relatively new area of work, which offers a win-win opportunity for the local economy and ecology. This initiative also trained over 12,000 individuals in marine conservation, and new technical skills on fisheries and coastal resource management. With a renewed focus on post-harvest value chain enhancement, skilling of fisherwomen with digital and financial skills has been launched.

The Biodiversity Programme distributed nearly 9 lakh saplings and 1000 quintals of seeds, and restored approximately 18 hectares while training 11,300 people, across multiple regions. An emphasis on nature-based solutions with the involvement of local communities and the use of new tools like Artificial Intelligence to monitor biodiversity and carbon sequestration will enable more effective restoration of degraded landscapes. An assessment of our work with sacred groves in the Wayanad district showed that over 75% of the plantations of endemic plants have survived, even those planted 10 years ago.

The Biotechnology Programme focussed on understanding abiotic stress in plants, validated crop agronomic performance in the field, based on microbial inputs and agroecological practices, and explored the use of gene editing for introducing needed traits like salt tolerance in food crops.

In Ecotechnology, MSSRF facilitated approximately Rs. 20 crore in credit and generated Rs. 17 crore in revenue, benefiting roughly 1.75 lakh women and children across 10 regions. A team from the Tanzanian Agricultural Research Institute (TARI) spent a week in the field with MSSRF scientists, learning about new ways of cultivating rice that improve yields and reduce greenhouse gas emissions. TARI is keen to collaborate with us to impart training and skills to Tanzanian scientists and farmers.

The Agriculture, Nutrition, and Health Programme is based on the farming systems for nutrition principles and trained almost 50,000 individuals and improved the incomes of 2,500 small and marginal farmers through seven projects in five regions. The goal is to improve the health and nutrition of farming families through better dietary diversity, while at the same time increasing the incomes of farmers, and protecting soil health. The programme has a lot of experience in establishing both community and household kitchen (nutrition) gardens and training Community Nutrition champions and has found this to be a sustainable and scalable model.

Last year, we initiated a programme to improve health outcomes of remote tribal communities in Koraput district, by strengthening primary health care services, improving health literacy and creating a conducive environment to address local health challenges at the village/panchayat level.

The Climate Change Programme continued to focus on policy support and technological solutions, driving research and innovation. While climate change is a cross-cutting theme across all our programs, the unit focuses on policy inputs and also maintains the Climate Equity Monitor, an initiative that has been appreciated by the Government of India. At the request of the Ministry of Women and Child Development, we produced a report on the Impacts of Climate Change on Women and Children, which highlighted the many adverse impacts on health, nutrition, education, and livelihoods, and also brought out knowledge and data gaps that require further research in India. We have worked collaboratively with many government ministries and state departments and made efforts to disseminate our research findings simultaneously.

Our Every Child A Scientist (ECAS) Programme now operates in Chennai, Poompuhar and Pudukottai, with plans to expand to Kolli Hills and Koraput. We had

almost 1000 government middle school children participate in this program, enhancing their interest and curiosity in science and exposing them to the latest concepts in life sciences.

MSSRF's communications and outreach efforts are reaching more people by the year. For instance, our social media channels attracted over 60,000 new visitors and nearly 2 lakh web page views via platforms like Twitter, Facebook, Instagram, and LinkedIn, with media interactions resulting in 29 press releases and over 400 news articles. Events such as the National Media Dialogue on Climate Change and the Millennium Lecture series further amplified our work, spreading awareness and enhancing their impact.

We owe a debt of gratitude to our generous donors, who contributed approximately Rs. 40 crore in the financial year 2023-24. This support enabled us to reach and empower thousands of farmers with better knowledge, skills and tools. We are also thankful to our board of trustees, members of various advisory committees, NGO and academic partners, collaborating institutions and numerous friends and wellwishers who have been on this journey with us. With climate change increasing vulnerabilities across rural, urban and tribal populations, our commitment to solving societal problems has become stronger than ever.

Dr Soumya Swaminathan
Chairperson, M S Swaminathan Research
Foundation

Impact Metrics

40
Crores were raised for new projects throughout the year

300,000
Farmers, fishers and tribals directly benefiting from MSSRF's programs in the past year.

Research and Innovation

39 Projects initiated during the year
80 Projects executed during the year
12 MoUs signed in the past year

Geographical Reach

Tamil Nadu
Andhra Pradesh
Karnataka
Telangana
Odisha
Maharashtra
Kerala
Puducherry
Madhya Pradesh
Assam

Specific regions of impact

Marine ecosystems
Coastal ecosystems
Dryland Agriculture
Biodiversity Hotspots

New Partnerships and Collaborations

5 Government agencies
4 NGOs
3 Academic institutions

COASTAL
SYSTEMS
RESEARCH

550,000

Saplings of mangroves and non-mangroves saplings were planted under this programme significantly contributing to habitat restoration in the coastal regions of Tamil Nadu and Andhra Pradesh.

12,300

Individuals received support to mitigate marine pollution, recycle ghost gear from the ocean, disease management, seabass nursery rearing, post-harvest fish management, and technical skills from educational programs like Python programming and scientific inquiry.

Preserving coastlines, sustaining life

65

Hectares of degraded ecosystems were restored, to improve the coastal biodiversity and resilience against natural disasters.

07

Geographic regions covered include Tamil Nadu, Andhra Pradesh, West Bengal, Odisha, Puducherry, and additional coastal areas from Krishna and Godavari Mangroves and Villupuram and Dharmapuri (Tamil Nadu).

07

Tons of marine debris was cleared thereby reducing human impact on coastal and marine environments.

COASTAL SYSTEMS RESEARCH

This year the Coastal Systems Research group made significant strides across a diverse range of coastal environments such as mangroves and non-mangrove ecosystems. 65 hectares of these ecosystems were restored by planting 550,000 mangrove saplings in Tamil Nadu and Andhra Pradesh. This extensive restoration and conservation effort will not only protect the coastal community from disasters but also enhance biodiversity and livelihoods.

Partnerships with the District Forest Officer and Veerank oil Mangrove Forest Protection Committee (MFPC) played a crucial role in restoring the mangrove ecosystems in Tamil Nadu.

The Fish for All Research and Training Centre, not only trained about 8,900 individuals in crucial areas such as marine pollution mitigation and ghost gear recycling but also tackled the pressing issue of marine debris. Their efforts led to the retrieval of 7 tons of marine debris, including 5 tons of ghost gear, thanks to the dedication of 464 fisher volunteers.

A new feature on the India-Bangladesh Maritime borderline alert has been introduced in the Fisher Friend Mobile Application (FFMA) in the West Bengal and Odisha states. It is a transformative feature to alert our Indian fishers through an audio and vibration alert when they are moving towards a 5km radius close to the International Maritime Border Line (IMBL). In total, 8,200 fishers were newly registered into the FFMA bringing the overall

registered users of the application over 1 lakh.

Nutrition profile for dry fish species like Anchovy (*Stolephorous sps.*), Rainbow Sardines (*Dussumierinae acuta*), Silver belly (*Leiognathus insidator*), Croaker (*Kathala axillaris*), Ribbon fish (*Lepturacanthus savala*), and Scads (*Alepes apercna*) was done. Stability assessments of dry fish from solar dryers revealed a shelf life of one year, a significant improvement compared to the commercially available dried fish which typically have a shelf life of one to two months.

Through 172 intensive training sessions, a total of 4900 fisherwomen from six coastal districts of Tamil Nadu and Puducherry were equipped with essential digital skills and educated on cyber safety.

A comprehensive remote sensing and GIS mapping study of mangrove ecosystems along 60,000 hectares of India's eastern coast was conducted to show trends in mangrove coverage in Krishna, Godavari and Pichavaram.

The GIS study under the coastal plantation project identified suitable sites for mangrove (90 hectares) and shelterbelt (127 hectares) along the Chengalpattu district coastline of Tamilnadu. This has now been extended to Sorlagondi and Pulicat in Andhra Pradesh and Muthupet in Tamilnadu for potential mangrove restoration.

A comprehensive seagrass and seaweed distribution GIS study in Palk Bay and Gulf of Mannar was undertaken. Potential sites of 3800 hectares were identified for seaweed restoration and 10,000 hectares for seagrass beds. In addition 120 hectares for mangrove restoration sites were

This resulted in 2,500 fisherwomen successfully creating email IDs and establishing WhatsApp Business accounts for promoting their post harvest fish business allowing them to efficiently manage online fish orders and promote their products on social media platforms. Moreover, 2,000 women embraced UPI transactions, enabling them to securely receive instant payments for their fish products from various states and localities. The programme promoted and nurtured three Fish Farmers Producer Companies (FFPOs) across three coastal districts of Tamil Nadu and Puducherry for promoting fish based business opportunities among small scale fishers and fish farmers.

BIODIVERSITY

8.7

Lakh saplings supporting widespread reforestation and conservation efforts.

1000

Quintals of seeds distributed, supporting better yield.

18

Hectares of Orchards were enriched and restored, improving ecosystem health and land quality in Kolli Hills

Boosting ecosystem health and diversity

11,000

individuals benefitted, enhancing their skills and knowledge in conservation and sustainable practices

15

Species were revived and restored in Wayanad

BIODIVERSITY

Our Biodiversity efforts continue to resonate with grassroots communities across India, bringing tangible benefits to farmers, fishers, and tribal groups.

In Kolli Hills, Tamil Nadu, the Integrated Tribal Livelihood Enhancement project has been a beacon of change. By restoring 106 hectares of bunds and planting saplings on 18 hectares, this initiative has enhanced agroforestry. Mini percolation ponds and bio-enriched manure have ensured high survival rates for new trees, and a nursery has generated Rs. 77,600 in just three months. Through training and awareness programs, 765 participants have gained new skills, improving their agricultural and health practices.

The JIVA Agroecology Programme has made its mark with natural resource management and crop diversification. Conducting 42 training sessions for 33 lead farmers, it distributed 3,300 saplings and supported livestock integration, improving soil health and pest management. The restoration of 810 bunds and the establishment of seed banks have further bolstered these efforts.

In Namakkal, the Groundnut Production Project has led to remarkable results. Improved seed varieties have driven a 15% increase in yields and a 43% rise in net returns. The project's seed festivals and marketing partnerships, alongside training for 155 farmers, have fostered sustainable practices and strengthened local economies.

KHABPCOL in Kolli Hills has been a model of financial success, marketing 432 quintals of millet and other products, resulting in an

annual turnover of nearly Rs. 1 crore and a profitable ROI. This success has positively impacted over 1000 tribal households, enhancing their economic stability.

In Koraput, Odisha, the Alternative Seed System Model (ASSM) and the Crop Diversification Programme (CDP-MLIP) have been instrumental in boosting agricultural productivity. Seeds were provided to about 200 farmers and the expansion of CDP-MLIP to 815 hectares, these initiatives have generated Rs. 80,000 in profit from maize. The Odisha Millet Mission's focus on improving yields and marketing local finger millet variety 'Bati Mandia' seeds has further advanced local agriculture.

The Community Agrobiodiversity Centre (CAbC) in Wayanad has made significant strides over 25 years, conserving 250 threatened plant species and raising 305,000 seedlings. With survival rates of 69% to 90%, CAbC has propagated red-listed tree species and established 30 seed villages for on-farm conservation of 12 traditional paddy landraces. Their outreach, including the Wayanad Community Seed Fest 2024 with over 6,000 participants, has emphasized the importance of agro-biodiversity.

Technological advancements have also played a crucial role. The GIS and Remote Sensing Lab has mapped Rare, Endangered, and Threatened species across multiple regions, supporting improved conservation strategies. Through collaboration and innovation, MSSRF has enhanced agricultural productivity, improved seed quality, and fostered agro-biodiversity conservation, leading to significant socio-economic and ecological improvements.

BIOTECHNOLOGY

759

Farmers trained in preparation and application of biological inputs in agroecological farming systems.

5

New genetic variants of HKT1;5 identified in cultivated rice for further functional studies (in planta, and heterologous systems to understand salinity tolerance mechanisms to increase yield.

982

Number of middle school students attended the 'Every Child A Scientist' (ECAS) program, enhancing their understanding of science across three MSSRF sites.

Implementing biotechnological solutions for agriculture

05

Peer reviewed publications and book chapters

03

Millet species compared with barley for above and below-ground growth under salinity.

24110

Bacterial Operational Taxonomic Units (OTUs) detected in healthy rice plants compared to 20997 OTUs in sheath blight infected rice plants

09

Ongoing projects, focusing on various aspects of environmental and community improvement (plant abiotic stress, improving crop agronomic performance using microbiological inputs and agroecological practices) and promoting science education

HS-Healthy Soil; HR-Healthy Root; HN-Healthy Node; IS-Infected Soil; IR-Infected Root; IN-Infected Node
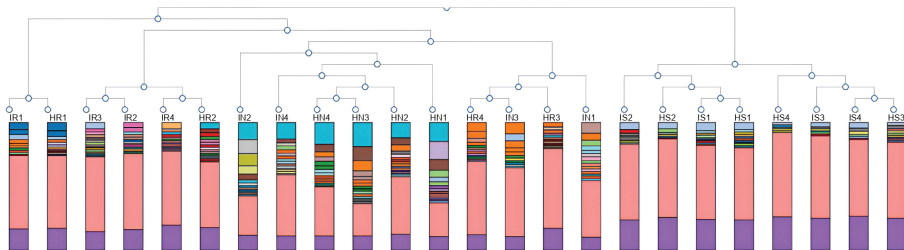
Microbiome of Paddy (Healthy and Infected) rhizosphere soils, roots and nodes

BIOTECHNOLOGY

Avicennia marina   Avicennia officinalis

Avicennia marina and *Avicennia officinalis,* occupy seaward and landward regions in mangrove habitats. The research correlated species specific root growth strategies to the ecological niches in which the species occur.

Thus, *A. marina* grew longer roots to reach greater depths, while *A. officinalis* developed taller plants with thicker roots due to their larger seed reserves.

In rice plants, a study focused on the HKT1; 5 gene that is associated with salinity tolerance. By analysing fourteen different genetic variants, researchers will gain insights into how rice grows under saline conditions.

Another study compared the growth of various C4 crops—pearl millet, finger millet, barnyard millet, with a C3 crop, (barley— under saline conditions. Thus, C4 crops like pearl millet grew better and tolerated increased salinity more effectively, while barley showed higher root numbers.

The discovery of a specific HKT1;5 haplotype gene in barley could lead to improved salinity tolerance in this species.
Researchers used detailed scans to understand how rice roots adapt to survive under saline conditions. This will help in developing more saline resilient rice varieties.

The SuATI project being implemented in Sagar District, Madhya Pradesh improved small-scale farming by providing inputs on natural farming methods. A resource centre was set up to provide training on preparation of biological inputs and their utility in managing pests and diseases. 756 farmers benefited from this initiative.

The microbial profile of healthy rice plants shows more beneficial bacteria (*Flavobacterium, Pseudomonas*) compared to sheath blight infected rice plants.

Bacterial species Acinetobacter plantarum and Pseudomonas hunanensis, identified in soils contaminated by oil spills (Ennore creek) offer green solutions for environmental clean-up of polluted soils.

The Every Child a Scientist (ECAS) Program across three MSSRF sites engaged middle school students in science through interactive learning, fostering a love for learning science.

ECOTECHNOLOGY

19

Crore rupees was facilitated to practice different sustainable agricultural technologies and practices among 20,600 farmers (over 65% women).

2,08,000

Farmers' (37% women farmers) knowledge and skills were enhanced of over 15 different site-specific production and value addition technologies, and access to other productive resources and services for sustained adoption and innovations.

Combining technology with ecological solutions

3000

Gram Panchayat based water resource management plans using the GIS platform were developed in partnership with the Department of Rural Development in five states to improve water security at the local level by harnessing different government schemes under convergence.

75%

Six Farmer Producer Organisations (FFPOs) increased their scale of business up to 75% and strengthened small participation in value chain and market linkages.

ECOTECHNOLOGY

The Biovillage initiative, spearheaded by the Innuyir Grama Sangam (IGS) Federation in Puducherry, empowered women through a blend of technology, financial support, and market access. Mobile advisories on bio-inputs boosted support for women entrepreneurs, while new crop varieties, quality seeds and sustainable production technologies bundled with finance facilitated by the Pasumai producer collective transformed productivity and farmers' income along with market linkages. These efforts led to access of finance worth Rs. 2.5 Crore for about 2900 women producers for on-farm and off-farm activities. The annual turnover of women-led organizations has increased: the IGS Women Farmer Producer Organisation saw a turnover of Rs. 16 lakh, while the Pasumai Farmer Producer Company Limited achieved an 80% increase to Rs. 25 lakh.

In Kannivadi, Dindigul, MSSRF's work with community-based organizations like the Kulumai SHG Federation, Kulumai Milk Producer Company Limited (KMPCL) and the Reddiarchatram Sustainable Agriculture Producer Company Limited (RESAPCOL) resulted in significant economic gains by promoting access to productive resources as a bundle of services to small farmers. RESAPCOL alone saw a turnover of over Rs. 2 crore, thanks to enhanced agricultural technologies, credit support and market access. Kulumai SHG federation and KMPCL have facilitated access to finance of nearly Rs. 8 crore to strengthen the livelihoods by expanding their skills, institutional and market access to about 4300 women farmers.

Further north, the Nallavur Farmer Producer

Company Limited (NAFPCL) achieved a turnover of Rs. 1.3 Crore, with a fair trade premium of Rs. 2.5 lakh, highlighting the economic impact of MSSRF's support. The organization's efforts in sustainable agricultural technologies, seed production and black gram and groundnut processing, along with credit and market access, showcased MSSRF's role in driving economic, social and environmental progress.

A study on Community Seed Banks (CSBs) underscored their crucial role in preserving traditional crops and varieties/landraces, especially among women. Despite challenges in seed quality and social networks, need-based support and recognition emerged as key to enhancing informal seed systems and biodiversity conservation in which women have primary stake. The study mapped how the informal seed system is undergoing gendered changes and impacting the on-farm conservation and household food security. The study provided inputs to strengthen the women's leadership in informal seed systems operated through community seed banks and networks.

The Agro Meteorological Field Unit (AMFU) contributed significantly by producing 434 weather-based Agro-Advisory Service bulletins and 1,428 block-level advisories, reaching over 129,000 farmers. Training programs on weather-based farming and sustainable agriculture further empowered 1,150 small farmers to adapt to the changing weather patterns.

In the climate vulnerable regions of Assam and Odisha, adaptive capacities of 16,000 farmers (30% women) have enhanced through building their knowledge and skills on context-specific climate-smart agricultural technologies along with access to demand-based information through a set of digital tools through virtual VKCs in KVKs and improved the rate of adoption by up to 58%. Farmers saw substantial income boosts, and gender inclusion efforts elevated women farmers' participation in decision-making in farm operations.

The Water Security and Climate Adaptation initiative enabled the preparation of approximately 3000 Gram Panchayats to develop water resources management plans by building the capacities of district functionaries in nine districts of five states in India. Besides, over 20 climate resilient models are being demonstrated to build the resilience for water and linked sectors.

Jamsetji Tata National Virtual Academy's VRCs and VKCs reached over 29,000 farmers (over 35% women). The Farm School's training improved crop yields by 18-22%, while Video-Based Learning (VBL) and Plant Clinics advanced plant health information access, enhanced skills to adopt integrated pest management and higher productivity.

Together, these initiatives not only advanced adoption of climate-resilient agriculture and rural water management technologies but also uplifted thousands of farmers across India, embedding sustainable practices and technology at the core of small farmers' livelihoods.

AGRICULTURE,
NUTRITION AND
HEALTH

45,000

Individuals benefited from training programs, gaining essential skills and knowledge.

2500

Small and marginal farmers' income was enhanced through the Integrated Farming Systems (IFS) by the establishment of 102 aqua-based and 479 non-aqua-based IFS units. These units improved crop yields and fish production, with comprehensive training and support in diverse agricultural practices.

Enhancing food systems for better health

5

geographic regions were covered through initiatives, including Koraput, Ernakulam, Idukki, Wayanad, and Kanthaloor.

AGRICULTURE, NUTRITION AND HEALTH

At the heart of MSSRF's efforts, grassroots communities—farmers, fishers, and tribals—have experienced transformative impacts this year. Across a spectrum of geographical regions, from the rich mangrove landscapes to the diverse marine environments, the Agriculture, Nutrition and Health Programme group has woven a story of resilience, growth, and hope.

In the Koraput District, a project improved the dietary diversity by introducing nutrition gardens in 1,675 households across 75 villages. This initiative not only provided essential gardening tools and training but also established model gardens, directly benefiting about 900 farmers. This endeavor was a strategic move to combat micronutrient deficiencies and promote organic farming, significantly enhancing the nutritional quality of life for local communities.

At the same time, the Integrated Farming Systems (IFS) model in Koraput has significantly uplifted the economic conditions of 2,500 small and marginal farmers. By setting up 102 aqua-based and 479 non-aqua-based IFS units, MSSRF has bolstered both crop yields and fish production. The training and support provided have led to marked improvements in income for these farmers, showcasing the practical benefits of integrated farming practices.

The dedicated training and support programmes have enabled farmers and rural communities to increase their incomes significantly. For example, the Rice Fallow Management Project, which began in 2022-23, has transformed pulse production in Odisha's rice fallow areas, covering 18,700 hectares and involving nearly 43,000 farmers.

This initiative has led to impressive yield increases for green gram and black gram, underpinned by extensive training programmes. Collaborative projects have also resulted in deep impact. The Parivartan Holistic Rural Development Programme, supported by HDFC Bank, implemented transformative changes across 34 villages in Ernakulam, Idukki, and Wayanad.

This programme provided plant and animal clinic sessions, training in bio-inputs, and established various entrepreneurial units. Efforts in natural resource management, such as planting 1,000 fruit tree seedlings and 625 mangrove saplings, have furthered environmental sustainability and community well-being.

The Integrated Rural Development Initiative in Kanthaloor, funded by the SBI Foundation, has also made a notable difference. This initiative focused on holistic development, establishing smart classrooms, science labs, and water purification systems. Additionally, it supported self-help groups with training and agricultural machinery, enhancing both educational opportunities and agricultural practices.

Technological advancements have been pivotal in the team's approach. The integration of cutting-edge technologies and best practices in agriculture has empowered communities to adopt more efficient and sustainable methods. For instance, educational programs have introduced skill-based training in bamboo crafts and agricultural machinery, benefiting about 40 participants and fostering innovation.

HOW DOES CLIMATE CHANGE IMPACT WOMEN AND CHILDREN ACROSS AGROECOLOGICAL ZONES IN INDIA:
A SCOPING STUDY

karmannya

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Towards a new dawn
Ministry of Women and Child Development
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BILL & MELINDA
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CLIMATE CHANGE

05

Policy documents for India and international organisations were facilitated, bridging land-use and energy sectors to guide sustainable agricultural practices and support India's decarbonization efforts.

95%

Advanced machine learning models and multi-sensor satellite imagery increased the accuracy of paddy crop identification to 95%, aiding precise predictions for sowing and harvesting dates.

Tackling climate change with pragmatic solutions

150

Experts in climate change, agricultural sustainability, and greenhouse gas mitigation strategies were engaged in workshops enriching project insights and policy recommendations.
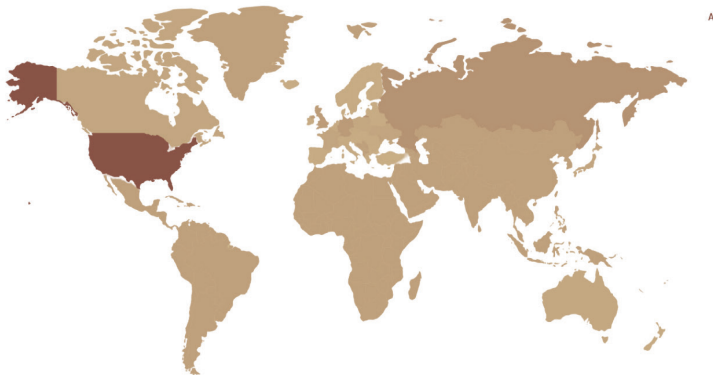
CLIMATE CHANGE

The Land Use and Land Cover Modelling IND01 Activity project embarked on a journey to transform India's approach to energy and agriculture. In partnership with The Energy and Resources Institute (TERI) and supported by Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), the project began with a clear mission–to map out the intricate patterns of energy and fossil fuel use across the agricultural and livestock sectors. This foundational work was essential for envisioning a greener future.

Two pivotal publications in the Economic and Political Weekly (EPW) emerged from this endeavor, shedding light on global strategies for greenhouse gas mitigation and the evolving role of agriculture in climate policy. These articles were not just academic exercises but beacons guiding India's path towards a more sustainable agricultural sector. By bridging land-use and energy sectors, the project sought to unveil the true impact of these sectors on India's decarbonization journey.

Funded by the National Innovations in Climate Resilient Agriculture of the Indian Council of Agricultural Research (ICAR)–Central Research Institute for Dryland Agriculture (CRIDA), the team began estimating the carbon footprint of Indian agriculture. This included both direct and indirect emissions, providing the first detailed regional breakdown of these emissions. Presenting these preliminary findings to the NICRA Steering Committee and ICAR, the project received enthusiastic support, marking a milestone in understanding India's agricultural emissions.

Parallely, efforts to track paddy cultivation took off with the initial support of Google's AI for Social Good program. What began as

a small-scale effort to model the impact of aridification on rice cultivation in the Cauvery Delta soon blossomed into a comprehensive project.

Collaborating with Machine Learning (ML) experts, the team set out to develop sophisticated ML models and datasets to predict key crop parameters with unprecedented accuracy. Leveraging advanced ML techniques and multi-sensor satellite imagery, a remarkable 91% accuracy in identifying paddy crops was achieved while also making precise predictions for sowing and harvesting dates. Research was conducted to enhance yield prediction accuracy, initially set at 65%, and tackled broader issues of climate change and crop sustainability. The results were shared in the WACV 2024 proceedings.

The team also helped craft detailed policy briefs and research analyses for the SBSTA 58 and SBI 58 sessions of the UNFCCC. These documents tackled global mitigation strategies, financial aid for loss and damage, and technical dialogues on equity. Efforts extended to supporting the Ministry of Environment, Forests and Climate Change (MoEFCC) and providing technical advisory to the Government of India during COP28 of the UNFCCC.

The 'Media Dialogue on Climate Change towards COP28: Equity, Science, and Policy' event was more than a mere meeting; it was an opportunity for scientists and media professionals to engage and deepen the understanding of critical climate issues. Journalists gained insights into climate science, the global agenda of the UNFCCC and Paris Agreement, and India's role in the global climate landscape. Supported by Third World Network and Climate Trends, this dialogue paved the way for more informed and impactful communication on climate change. Through these interconnected efforts, the project not only advanced scientific

knowledge and policy insights but also fostered a collaborative spirit essential for tackling climate change and building a sustainable future.

In addressing climate change impacts, a comprehensive study funded by the Bill and Melinda Gates Foundation revealed the exacerbation of health issues and socio-economic vulnerabilities among women and children in India. The study emphasized the need for enhanced social safety nets and climate-resilient health systems. Additionally, a GIS-based analysis identified critical areas where climate hazards intersect with poor health indicators, underscoring the necessity for targeted interventions.

GIS and Remote Sensing Lab

The GIS and Remote Sensing Lab has made significant advances in environmental research and conservation planning during the 2023-2024 period, leveraging advanced geospatial technologies to address critical ecological challenges.

A foundation of the lab's work has been the comprehensive study of mangrove ecosystems along the eastern coast of India. Using satellite imagery spanning from 1990 to 2023, spatial and temporal variations in mangrove coverage were analysed in key areas such as Krishna and Godavari mangroves. This study revealed a positive trend, with mangrove areas increasing substantially over the three-decade period. The Tamil Nadu coast also showed an overall increase in mangrove cover, although the Muthupet region experienced a decline due to the impact of Cyclone Gaja, highlighting the vulnerability of these ecosystems to extreme weather events.

Mangrove Area Distribution
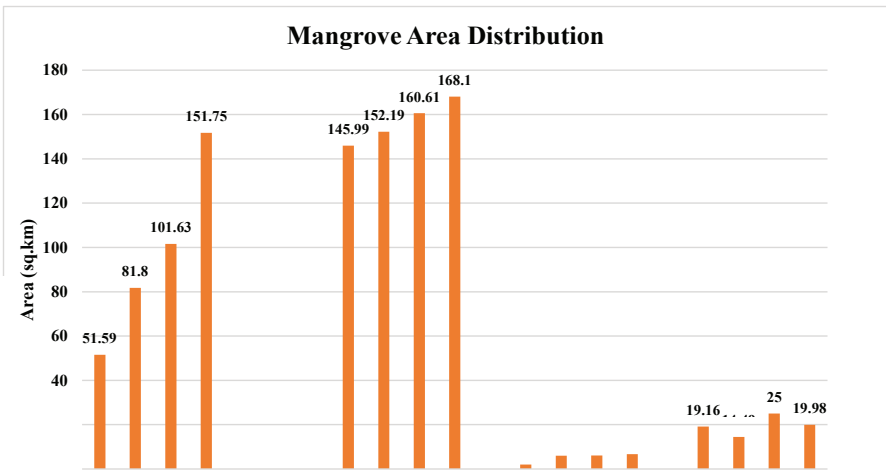
The assessment of mangrove cover from 1990 to 2023 reveals an increase of over 100 sq.km in Krishna, 22 sq.km in Godavari, and 5 square kilometers in Pichavaram.

In a proactive effort to enhance coastal resilience, a coastal plantation project was undertaken in Chengalpattu District, Tamil Nadu. Suitable sites for mangrove (90 hectares) and shelterbelt (127 hectares) plantations were meticulously identified using satellite imagery.

This initiative was further extended to other critical areas, with the identification of potential mangrove restoration sites in Soralgondi, Pulicat, and Muthupet, demonstrating a commitment to ecosystem rehabilitation.

The lab's expertise in marine ecosystem mapping was evident in the seagrass and seaweed distribution study in Palk Bay and the Gulf of Mannar. This comprehensive mapping exercise led to the identification of 3,800 hectares suitable for seaweed restoration and 120 hectares for mangrove restoration. Additionally, approximately 100 sq.km of seagrass beds in these areas were estimated to be in a degraded state, providing crucial data for marine conservation efforts.

Addressing the pressing issue of climate change, an in-depth study on the impact of climate-related hazards on women and children across India's diverse agro-ecological zones was conducted. This research provides valuable insights for targeted interventions and policy-making in vulnerable regions.

Under the WASCA Project extensive GP GIS planning was carried out across multiple states. GIS plans were completed for 59 Gram Panchayats (GPs) in Andhra Pradesh, 688 in Villupuram and 251 in Dharmapuri (Tamil Nadu), 88 in Palakkad and 36 in Kasaragod (Kerala), and three in South Andaman. To support this large-scale initiative, capacity-building workshops on GIS planning for engineers and rural development officials were conducted across these states and a GP GIS field verification app was developed, enhancing the practical application of the work. In Anantapur district, a vegetation cover assessment revealed a remarkable increase in green cover from 530 sq.km in 2007 to 1900 sq.km in 2022, showcasing the potential for positive
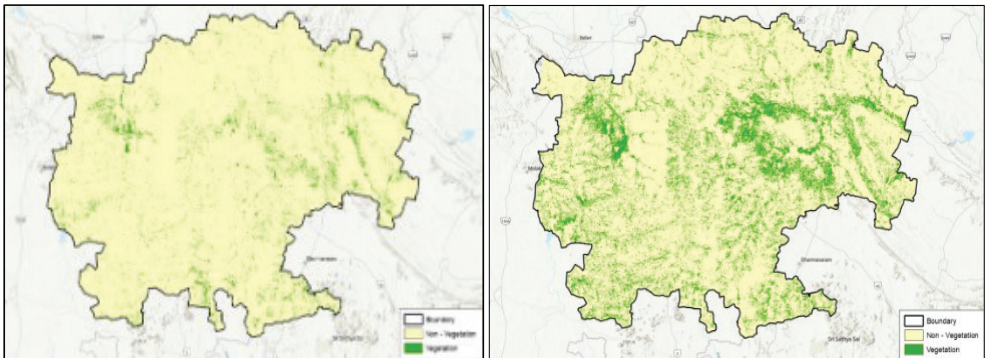
Vegetation map of Anatapur district 2007 and 2022

LIST OF DONORS
2023-24

Individual Donors – National	Individual Donors – International
Mr. G P Ramachandran, Bangalore	Dr. Krishnamurthy Shyam, USA
Ms. Amiya Kesavan, Chennai	Jagdish Latha, USA
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Capt. J.S. Yadav (Retd), Gurgaon	Ms. Winnie Shyam, USA
Mr. Ashok Kumar Yadav, Gurgaon	Dr. Arun Agarwal, USA

Sources of Project Support

Coastal Systems Research

National	International
National Fisheries Development Board, Hyderabad	Qualcomm, USA
Centre for Sustainable Conservation Action and Protection of Ecosystems of the Seas, Gujarat	WorldFish, Malaysia
Indian Council of Agricultural Research (ICAR)– National Bureau of Fish Genetic Resources, Lucknow	Environment Defense Fund, San Francisco, USA
Indian National Centre for Ocean Information Services, Ministry of Earth Sciences, Govt. of India, Hyderabad	
National Bank for Agriculture and Rural	
Development (NABARD), Tamil Nadu	
Department of Science & Technology, Govt. of India, New Delhi	
HCL Foundation, New Delhi	
National Centre for Coastal Research, Ministry of Earth Sciences, Govt. of India, Chennai	
ICAR-Central Institute of Brackish water Aquaculture, Chennai	
United Nations Development Programme	
Reliance Foundation, Mumbai	

Biodiversity

National	International
Department of Agriculture and Farmer's Empowerment, Govt. of Odisha, Bhubaneswar	Food and Agriculture Organization of the United Nations, Italy
NABARD, Kerala and Tamil Nadu	Asia-Pacific Network for Global Change Research, Japan
Kerala Council for Science, Technology and Environment, Govt. of Kerala, Thiruvananthapuram	Asian Farmers Association, Philippines
HDFC PARIVARTAN, Mumbai	US Consulate General, USA
Cochin Shipyard Limited, Kochi	United Nations University, Malaysia
ICAR – Indian Institute of Rice Research, Hyderabad	Keidanren Nature Conservation Fund, Japan
Shashwath Foundation, Ahmedabad, Gujarat	The University of Queensland, Australia
Agro Crops Pvt. Ltd, Chennai	
Indian Council of Agricultural Research, New Delhi	
ICAR – Indian Institute of Millets Research, Hyderabad, Telangana	
North East Slow Food & Agrobiodiversity Society, Meghalaya	
SBI Foundation, Mumbai	
Housing Development Finance Corporation Ltd, Mumbai	
Jamnalal Bajaj Foundation, Mumbai	
DM Education & Research Foundation, Wayanad	
Protection of Plant Varieties and Farmers' Rights Authority, New Delhi	
Kerala State Biodiversity Board (KSBB), Thiruvananthapuram	
Kerala Development and Innovation Strategic Council, Kerala	
SBI Youth for India	
ALPS Remedies Pvt. Ltd, Mumbai	

National	International
LIC Housing Finance Limited, Mumbai	
L & F Machinery, Irinjalakuda, Kerala	
Pilosmith India (P) Limited, Irijalakuda, Kerala	
Directorate of Arecanut & Spice Development, Calicut, Kerala	
State Bank of India, Kalpetta, Wayanad	
Dream India, Kottayam, Kerala	
E-Planet, Kalpetta, Wayanad	
National Biodiversity Authority, Chennai	
Kudumbashree, Kalpetta, Wayanad, Govt. of Kerala	
ATMA Wayanad, Dept of Agriculture, Kerala Govt	
Responsible Tourism Mission, Tourism Dept, Govt. of Kerala, Trivandrum	
Rainmatter Foundation, Bengaluru	
GIZ, New Delhi	
Reliance Foundation, Mumbai	
TATA Consumer Soulfull Pvt. Ltd	
Watershed Support Services and Activities Network	
Kerala Bureau of Industrial Promotion, Kerala	
Odisha Millets Mission, Govt of Odisha, Bhubaneswar	

Biotechnology

National	International
Biotechnology Industrial Research Assistance Council, Govt. of India, New Delhi	Deutsche Gesellschaft fur Internationale Zusammenarbeit (GIZ), Germany
Larsen & Toubro Ltd, Chennai	
Department of Biotechnology, Ministry of Science and Technology, New Delhi	
Indo French Centre for the Promotion of Advanced Research, New Delhi	
Science & Engineering Research Board, New Delhi	
Five Star Business Finance Ltd, Chennai	
Department of Science & Technology, Ministry of Science and Technology, New Delhi	

Ecotechnology

National	International
CABI, New Delhi	
National Bank for Agriculture and Rural Development, Tamil Nadu	
Indian Meteorological Department, Ministry of Earth Sciences, Govt. of India, New Delhi	Global Challenges Research Fund, University of Reading, UK
International Rice Research Institute, India	Commonwealth of Learning, Canada
Vaazhndhu Kaattuvom Project (Tamil Nadu Rural Transformation Project) Govt of Tamil Nadu	Norwegian Institute of Bioeconomy Research, Norway
GIZ, New Delhi	SAARC Development Fund, Bhutan
Department of Biotechnology, Ministry of Science and Technology, Govt of India, New Delhi	Kimora Klug, Hamburg, Germany
The Nature Conservancy, New Delhi	International Institute for Environment and Development, UK
State Planning Commission, Govt of Tamil Nadu	The World Food Prize Foundation
Krishi Vigyan Kendra, Puducherry	
Pushkaram Agriculture College, Pudukkottai	
Japan International Cooperation Agency, New Delhi	

Agriculture, Nutrition and Health

National	International
Agricultural Technology Management Agency, Koraput	Extension for Community Healthcare Outcomes - University of New Mexico
	Bill & Melinda Gates Foundation, India
Department of Agriculture and Farmers Empowerment, Govt. of Odisha under Rashtriya Krishi Vikas Yojana Programme	

Climate Change

National	International
ICAR-Central Research Institute for Dryland Agriculture, Hyderabad	Third World Network, Malaysia
Google India Pvt. Ltd, Bangalore	Climate Trends LLP
The Energy and Resources Institute, New Delhi	
Ministry of Environment, Forest and Climate Change, Govt. of India, New Delhi and United Nations Development Programme	

Others

National
World Resources Institute India Pvt. Ltd, New Delhi
ASPEE Foundation, Mumbai
Malayala Manorama, Kerala

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