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20 YEARS LEISA INDIA
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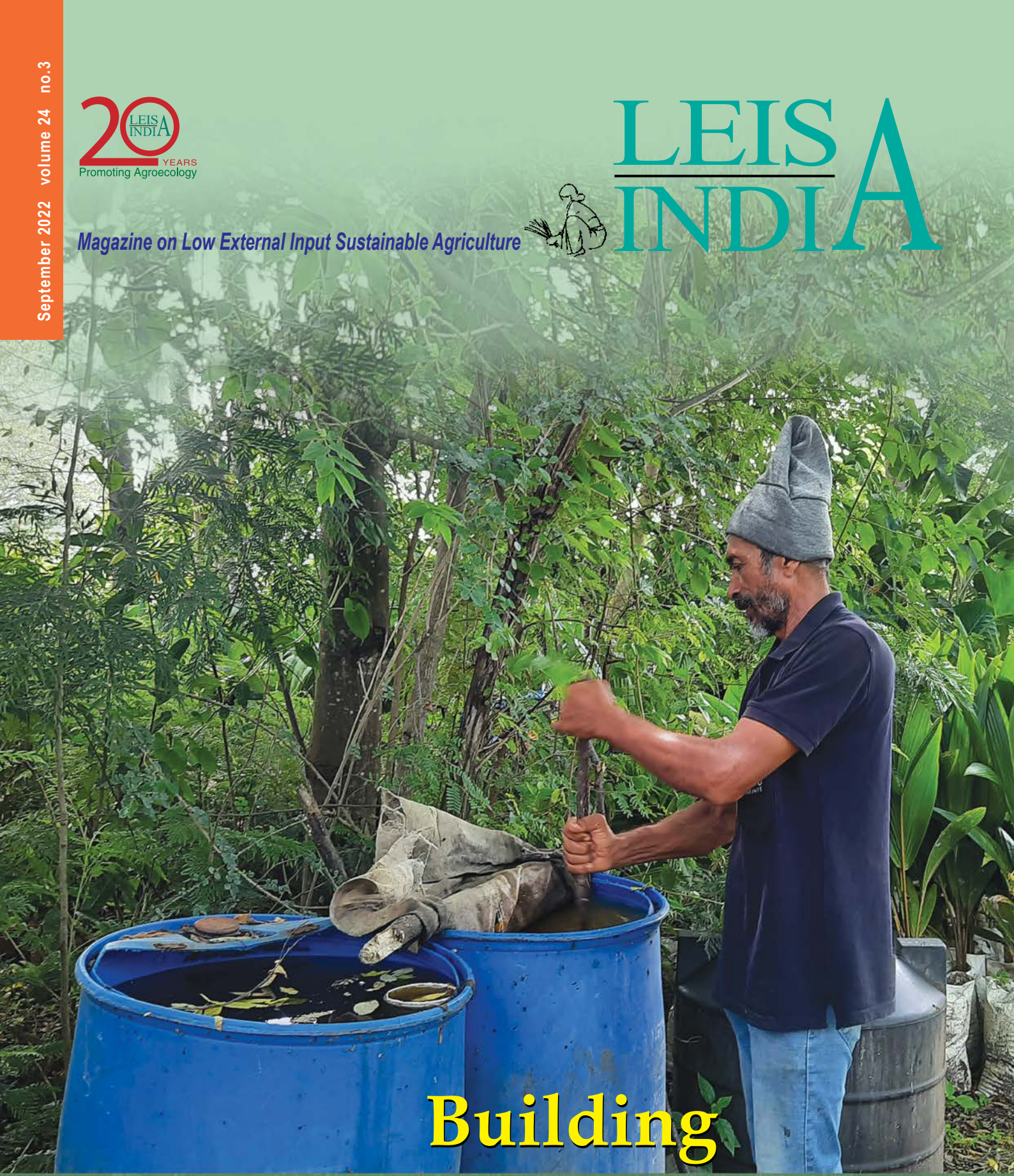
LEISA INDIA

Magazine on Low External Input Sustainable Agriculture



Building farm resilience

LEISA INDIA

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COVER PHOTO

One acre model farm of Thammaiah in Chowdikatte village, Karnataka.
(Photo: B M Sanjana, AMEF)

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Dear Readers

We have come a long way on the path of development, which we can be proud of. But development comes with a huge cost in terms of its effect on environment, climate and communities. Farmers, already a vulnerable lot, become more vulnerable when they have to deal with the aberrations in climate, markets and life in general. It is important to strengthen their adaptive capacities and find ways to deal with such situations and become resilient.

Farm resilience is not just about specific technology, like the drought or flood resistant varieties, or is it about a package like 'climate smart farming'. It is also about building capacities of farmers, building social capital, recognising traditional knowledge and reducing dependency on external inputs and so on. A self reliant farm is also a resilient farm. In this issue, you can find several examples where communities are encouraged to practise farming with low external inputs and include diversity, to build farm resilience. The support of external agencies and policy support, however play a crucial role.

Also, in the changing climate and market scenario, some innovative farmers are exploring ways to deal with vulnerabilities and are leading change rather than feeling as victims of change. They are serving as role models adopting methods of farming which are in sync with nature and motivating others to follow. They are the hope for the present and future of farming and the environment.

Hope you find this issue interesting. While we await your feedback, we also request you to continue to support the programme, as before.

The Editors

LEISA is about Low-External-Input and Sustainable Agriculture. It is about the technical and social options open to farmers who seek to improve productivity and income in an ecologically sound way. LEISA is about the optimal use of local resources and natural processes and, if necessary, the safe and efficient use of external inputs. It is about the empowerment of male and female farmers and the communities who seek to build their future on the bases of their own knowledge, skills, values, culture and institutions. LEISA is also about participatory methodologies to strengthen the capacity of farmers and other actors, to improve agriculture and adapt it to changing needs and conditions. LEISA seeks to combine indigenous and scientific knowledge and to influence policy formulation to create a conducive environment for its further development. LEISA is a concept, an approach and a political message.

MISEREOR founded in 1958 is the German Catholic Bishops' Organisation for Development Cooperation. For over 50 years MISEREOR has been committed to fighting poverty in Africa, Asia and Latin America. MISEREOR's support is available to any human being in need – regardless of their religion, ethnicity or gender. MISEREOR believes in supporting initiatives driven and owned by the poor and the disadvantaged. It prefers to work in partnership with its local partners. Together with the beneficiaries, the partners involved help shape local development processes and implement the projects. This is how MISEREOR, together with its partners, responds to constantly changing challenges. (www.misereor.de; www.misereor.org)

AME Foundation promotes sustainable livelihoods through combining indigenous knowledge and innovative technologies for Low-External-Input natural resource management. Towards this objective, AME Foundation works with small and marginal farmers in the Deccan Plateau region by generating farming alternatives, enriching the knowledge base, training, linking development agencies and sharing experience.

AMEF is working closely with interested groups of farmers in clusters of villages, to enable them to generate and adopt alternative farming practices. These locations with enhanced visibility are utilised as learning situations for practitioners and promoters of eco-farming systems, which includes NGOs and NGO networks. **www.amefound.org**

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Women-led climate resilient farming model

Upmanyu Patil

When women are empowered to decide what to grow, what inputs to use, when and where to sell – key shifts happen in agriculture and livelihoods. By empowering women in Marathwada as change-makers in agriculture, the WCRF model promoted resilient livelihoods for farming households while ensuring farming to become an economically viable venture.

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With a little support and guidance, farmers can transform their lives and become resilient to changes in weather and markets. The case of Pitar Sabar shows how a tribal farmer with the support from WOTR, changed the way he farmed and enhanced the income levels, besides becoming a resource person in his area.

19 Natural farming builds farm resilience

Reflections from the field

M Manjula, V Manikandan and Divya Sharma

Natural farming being recognised as an important pathway for achieving sustainable development goals, a study was undertaken to understand the potential of natural farming as a sustainable agricultural model. The field assessment revealed that natural farming systems contribute highly to the environmental/ ecological dimensions of sustainability of farmers while there is a clear trade-off on the economic dimension. The study recommends a multi-pronged approach that adopts strategic interventions on the institutional, governance and marketing aspects for natural farming to be promoted as a new paradigm for inclusive agricultural growth, at scale.

33 Resilient farming

The one-acre model

B M Sanjana

Farming can be remunerative even from an acre of land holding, when practiced through natural methods, utilizing natural resources to the optimum. Thammaiah, a farmer in Karnataka shows how small farmers can make a decent living adopting the multi cropping system, through his one acre model.

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Building farm resilience

Building farm resilience is all about preparing farmers to cope, absorb and recover from challenges in dealing with their agricultural production and livelihoods. Small and marginal farmers are invariably caught in fragile eco systems with degraded resource base. Further, face climate change induced uncertain and extreme weather events. Perpetually, also deal with uncertain markets threatening their incomes. COVID 19 further complicated the scenario.

In fact, farming communities, traditionally have been always resilient and innovative. When encouraged by empathetic support, at the farm level, three major dimensions offering resilience can be recognised. One, the type of eco farming approaches promoting better conservation, reuse and recycling of natural resources; women led farming activities invariably focusing on meeting food and nutrition needs of the family; diversity as the fundamental way forward for dealing with optimal use of natural resource endowments and eco balances and sustainable food, feed and improved incomes. However, for scale and wider adoption, collaborative activities of community organisations, civil societies and enabling policy environment emerge as the key determinants.

Natural/Organic farming helps

Natural farming is showing the way in terms of offering farm resilience, reducing expensive cultivation risks, and serving as a sustainable agricultural model at the farm level and addressing SDGs at the global level. It addresses both environmental as well as economic challenges. While it minimises the negative impacts on environment, it squarely addresses economic risks in farming by bringing down costs of cultivation. the issue of risk and uncertainties The field assessment studies recognises the benefits it offers. A study conducted by Azim Premji University in Satyasai district in Andhra Pradesh, recommends a multi-pronged approach that adopts strategic interventions on the institutional, governance and marketing aspects for natural farming to be promoted as a new paradigm for inclusive agricultural growth, at scale. (Manjula, M et.al., p. 19). The case of Pitar Sabar shows how a tribal farmer with the support from WOTR, adopted sustainable agriculture practices and organic formulations. By meticulously maintaining clear records, could observe the differences, expand his crop choices including vegetables. Thus, he got gainfully engaged throughout the year resulting in enhanced income levels. (Harshal Khade, p.11).

Women as torch bearers of resilience

Rural women from small and marginal farmer households are predominantly identified as agriculture labour. Despite their immense contribution of time, labor, and knowledge, they are not recognized as farmers. (Upmanyu Patil, p. 6). Given a fair opportunity and a leadership role, having deep understanding of food and nutrition needs of the family as well as the local biodiversity, they naturally build resilience. They prefer nutri-rich local millets, pulses and vegetables. Their choices lead to better food access as well as coping with challenging conditions too. Being traditionally the custodians of livestock management, besides managing their feed requirements they are also aware of the manurial requirements of the crops, undertake preparation of biological inputs for cultivating healthy farm produce. *"If we need 10 varieties of leaves to prepare pesticides, women will not stop till they find the tenth leaf; men may be happy with nine."* says Rupali Vikas Shendage from Tugaon, Osmanabad. Thus, women contribute not only to farm resilience but also to improved soils, lesser resource use when they think and decide what to grow, what inputs to use and what farm allied activities to take up. The Women-led Climate Resilient Farming programme illustrates how women farmers even gained access to land and right to cultivate

land, meeting the food, nutrition and income security of the families. Besides contributing to improved production systems and natural resource management offering healthy produce, they participated in the entire value chain, got involved in marketing, became more financially independent.

Diversity and innovation

Diversity and farmer innovation are the fundamental pillars of resilience. They include, crop choices and their innate natural growth patterns optimising land, water, sunlight. These offer productivity throughout the year based on different harvest times. Creating conservation water bodies on the farm, innovative eco-friendly pest repellent mechanisms and measures all of which bring down the risks in farming, are practical measures. For instance, Thammaiah's multilayer farm (200 varieties of plants including 80 medicinal plants) and one acre farming model amply illustrate diversity and innovation in full measure offering food, income and nutrition security. Thammaiah grows millets for household consumption, sells millet powder as Arogya Spoorthi, gets income from coconut, sapota, banana and black pepper trees and sells Kapha Churna prepared from medicinal plants. (B M Sanjana, p. 33).

Farmers themselves are the best role models of resilience for inspiring and encouraging others. Pitar Sabbar (p.11), Thammaiah (p.33) have been on their own guiding several others by showing practically what is possible.

Enabling policy environment

For fostering resilience, policy focus should not be on a single policy angle and restricted participation of diverse stakeholders. Investments in resilience by governments, development agencies, and civil society organizations must target multiple social domains of resilience. For instance, it could focus on access to resources, freedom to choose strategies, capacity to organise themselves for favourable and responsive community action.

Enabling infrastructure network and improving regional co-operation on water and land management was the primary focus in a World Bank project in The Mekong Delta, Vietnam, which has supported more than one million farmers' transition into more climate-resilient and resource-efficient ways of living. Extreme floods, droughts, saline intrusion, coastal and riverbank erosion are some of the characteristics of agricultural and aquaculture hub of The Mekong Delta, Vietnam. To support farmers sustain these good practices after the end of the project, the World Bank has also focused on creating an enabling infrastructure network and on improving regional co-operation to manage a resource that knows no boundaries, like water. With this project's support, climate resilience has been mainstreamed into top-level policy documents. (p.24).

Resilience is not just with reference to dealing with technical options. It is also about dealing with social situations and challenges. Studying community responses in COVID 19 pandemic, Global Resilience Partnership, identified the following key social domains of resilience. They are (1) the assets (natural, physical, human, financial) that people can draw upon, (2) the flexibility to change strategies (3) the ability for social organization to enable (or inhibit) cooperation, collective action, and knowledge sharing (4) learning to recognize and respond to change (5) behavioural and cognitive factors (e.g., risk attitudes, personal experience, social norms) that enable or constrain resilience, and (6) the agency to determine whether to change or not. (p.14). Lessons learnt reveal trust, social networks and community cohesion, collective action, shared learning, community wide decision making are the forms of social capital, which are important in determining resilience to shocks and challenges.

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De-risking agriculture

Women-led climate resilient farming model

Upmanyu Patil

When women are empowered to decide what to grow, what inputs to use, when and where to sell – key shifts happen in agriculture and livelihoods. By empowering women in Marathwada as change-makers in agriculture, the WCRF model promoted resilient livelihoods for farming households while ensuring farming to become an economically viable venture.

In Maharashtra, the landholding under food crops has shrunk by 12%. However, the landholding for cash crops like sugarcane has almost doubled over the last three decades. But the water-stressed conditions in Marathwada make growing these crops unviable. Yet, several small and marginal farmers in this drought-hit region continue to grow water-intensive cash crops like soybean and sugarcane instead of growing food for themselves. Besides, growing these crops has created a dependence on expensive chemical fertilizers, pesticides and market bought hybrid seeds for the farmers, thereby, steeply increasing their cost of cultivation. With close to 80% of the cultivable land in Marathwada being rainfed, the water-intensive cash crops have a high risk of failure during a bad monsoon. Small and marginal farmers who take loans for purchasing farm inputs and grow only one variety of crops are the most affected. Moreover, women in these households are the most affected as they do not have ownership over land which limits their access to productive resources like finance, market, water and suitable government extension services.

Women in focus

Rural women from small and marginal farmer households have a predominant identity as agriculture labour. Despite their immense contribution of time, labor, and knowledge, they are not recognized as farmers. While the men take decisions on what and how to grow, where

Women as change-makers ensure that farming becomes an economically viable venture

to sell, the women take up low skilled jobs on the farm like weeding and harvesting taking directions from the men. With this basic premise, SSP an NGO working in the area, designed a Women-led Climate Resilient Farming (WCRF) model as an empowerment pathway for women to transform them from labourers to leaders in agriculture in four agriculture cycles.

Women inherently understand the food and nutrition needs of the family, and hence when trained to take decisions, they choose to grow local cereals, millets, pulses and vegetables with natural farm inputs. These are short-duration crops that consume less water and are better suited for the local water-stressed climate – which means improved food availability even during adverse conditions like drought. Traditionally, women have been the livestock managers in the household – from preparing cattle feed and milking them to drying their dung for cooking. SSP's model leverages this acquired wisdom of women in training them to prepare low-cost bio-fertilizers. Additionally, women are concerned about the health of the family members and will go that extra mile to arrange for the organic inputs. *"If we need 10 varieties of leaves to prepare pesticides women will not stop till they find the tenth leaf; men may be happy with nine."* – says Rupali Vikas Shendage from Tugaon, Osmanabad. Today, most farmers we met feel use of bio inputs has improved their soil quality enabling it to retain more moisture, improving their productivity and helping them use lesser water.

Build-Empower-Sustain model

At the core of SSP's WCRF operating philosophy is a three-stage model of Build, Empower and Sustain. First, SSP builds a conducive ecosystem of community-based resources, key partners, farmer adopters and refines them over time. In this stage of the operating model, SSP also creates community assets like demonstration farms in collaboration with adopter farmers and farm ponds and community tanks by accessing Government schemes. In the second stage of the operating model, SSP trains and develops the core ecosystem actors – the adopter farmers and matures them into dynamic collectives. This is done with the help of community-based resources like Krishi Samvad Sahayaks and Trainers who are groomed and mentored by SSP to become local agri experts. In the final stage, the farmer groups are enabled to sustain their operations by linking them to ATMA so that they

Fig. 1: Components of the WCRF Model

Women inherently understand the food and nutrition needs of the family

can access Government schemes extended to registered farmer groups. With the help of these schemes, the farmer groups expand their farm-based enterprises and improve market linkages, which help them continue their operations. Moreover, the community-based resources by design are local women and extend knowledge support even after the programme ends. Additionally, the core ecosystem actors including the farmer groups and the community-based resources, develop themselves into adoption-ready social capital in which Government agencies and Donor organizations can invest.

On the field

The CRF model aims to achieve four key shifts in farm practices – the transition from cash crops to food crops, the transition from chemical to bio inputs, conservation of soil and water and diversified livelihoods through farm-allied businesses. To bring in these changes, women continuously need to use their innate wisdom of being food and nutrition managers of the family, which help them think and decide what to grow, what inputs to use and what farm allied activities to take up.

The Women-led Climate Resilient Farming (WCRF) model attempts to reposition women as farmers, leaders and change agents who adopt food secure practices on their farms. The model focuses on four key dimensions: Market Linkages, Federating Women Farmers, Technology Integration and Water efficient micro irrigation models. It is aimed at improving productivity, increasing income, enhancing health and nutrition of the family and building resilience.

The climate-resilient farming model promotes growing 6-8 food crops per season with natural inputs allocating a small piece of the family's land. This requires concentrated effort, care, commitment and time – which men do not have. Hence, SSP's climate-resilient farming model encourages women to gain cultivation rights from their families on a small piece of land – which usually starts with half or one acre, to grow local vegetables, millets, cereals and pulses for the consumption of the family. The model also promotes training and use of natural seeds, fertilizers and pesticides ensuring savings, improved health and conservation of water and soil.

Women are organized into informal groups of 20 members at the village level. Each group is led by two group members who are responsible for leading the group activities and coordinating with the village level community facilitator.

Trainings are imparted following a participatory approach to learning and later graduate them into producer groups during the final season. In the first two seasons, a new adopter is enabled to gain cultivation rights from her family over a small piece of land and is equipped with knowledge and skills in cultivating seasonal food crops. This includes identifying locally available seeds and preparing low cost and eco-friendly fertilizers and pesticides. To execute this phase, she integrates livestock with her farm for bio-inputs and addresses the food and nutrition needs of the family.

In the third season, the year-old adopter typically expands the land under her control and increases her production enough to have a marketable surplus, after meeting home consumption needs (See Box 2). Simultaneously, she is coached to start and execute farm-based enterprises in bio inputs, poultry, dairy, goat rearing etc., to increase the income for the household. In the fourth and final season, SSP helps the woman farmer in gaining legal land title, which helps her to access Government schemes in her name. Additionally, the informal farmer groups created during the initiation of the program are mentored to register themselves with ATMA to continue accessing schemes. Selected groups are coached to start farmer producer companies to run collective businesses.

Box 1

Asha Hajgude from Osmanabad was in a dilemma. She wanted to access drip irrigation under the Government PMKSY scheme but needed to invest first, a lumpsum INR 30,000 to purchase the drip irrigation system. Government subsidies get credited in the account after the farmer purchases the product or service. This was a big sum for the family.

Things became easy for Asha when she got a quick, easy, and low-interest CRF loan of INR 25,000 to purchase her drip irrigation system. *"I had to invest only INR 5,000 at that time"*, recalls Asha. Started in 2009, CRF is sourced through bank loans and maintained by SHG Federation Sashakt Sakhi Sangstha in Osmanabad and Tuljapur blocks.

Community Resilience Fund

Community Resilience Fund (CRF) is a community-owned, driven and managed low-interest fund which helps farmers access the Government schemes without having to invest a large sum themselves. Community Resilience fund or CRF is a quicker and easier way to provide low-interest funds the network of women groups. CRF has played a leading role for farmers in accessing key Government schemes (See Box 1). CRF is accessed by farmer groups created and disseminated to individual farmers through the group lending norms. Accessing CRF is quicker, attracts lower interest rates than bank loans, and reaches the account before purchasing a product or service. A farmer's bank account gets credited within 8 days of CRF loan application on

Box 2: One-acre farming model propagates a shift from cash crops to diversified organic farming

"We were growing Soyabean and using chemical pesticides on our one acre. We barely saved 30% of our earnings," says Archana Tawade from Gaur village, Latur, Maharashtra. *"After the training, I convinced my husband to give me 10,000 square feet of farmland to apply my learnings".*

Experimenting with a variety of crops – vegetables and cereals and using only organic fertilizer, Archana was amazed to see the yield multiple three-fold. While she netted a profit, her biggest accomplishment was the nutritious food she put on the family table. Encouraged by the success, Archana's husband adopted the one-acre organic farming model. Cultivating 23 varieties of crops – vegetables, pulses, cereals and oil seeds, they save almost 60% of their earnings.

Today Archana is a sought-after speaker and trainer. Her experience serves as a powerful motivator for other women to take the plunge and implement the one-acre model. *"As a woman, a mother and a farmer – the health of my family and my land is critical. The one-acre model helps me meet both my goals. This is the message I share with other women",* says Archana.

which she needs to pay an interest of 8% per annum. CRF also helps farmers access loans for purchasing animal fodder, hydroponics, growing vegetables, etc., which they cannot access otherwise from MFIs or banks.

Impact

The programme had a significant impact on the lives of women farmers. Women gained access to land and right to cultivate land, meeting the food, nutrition and income security of the families (See Box 3). By switching to organic farming methods, they contributed towards better natural resource management. Participation in the entire value chain from farming to food processing, supply and distribution and consumers, made these women more confident and empowered. By getting involved in marketing, women became more financially independent. There is increasing recognition of women as farmers and decision makers in the family and in the community.

Box 3: Land ownership for women farmers

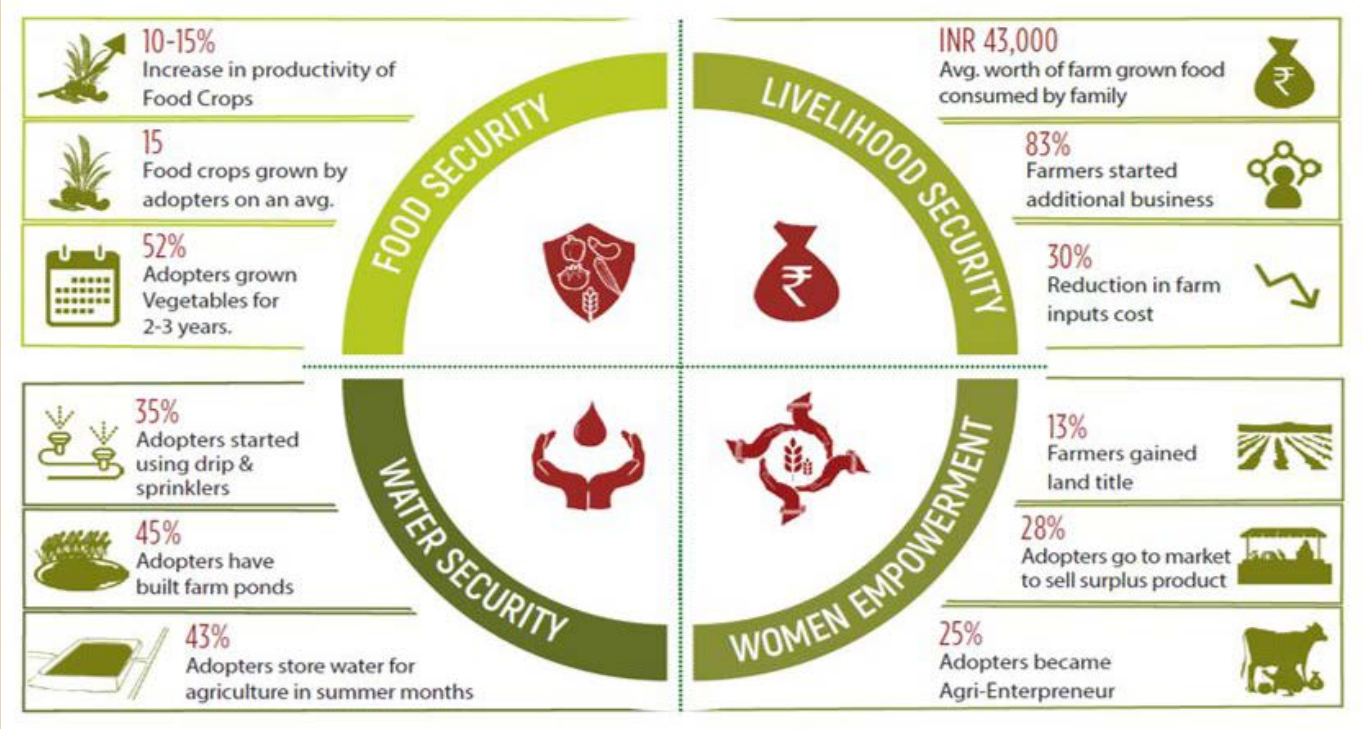
Recurring drought in Marathwada left the farmers in distress with huge losses and increased farmer suicides. The women farmers from Ekurga village in Kallamb, Osmanabad decided to take the matters in their hands and came forward to help their families overcome the situation.

Adding to the distress, the area also saw a rise in alchoholism amongst men. *"My husband started working as a driver and would stay away from home most of the time. His drinking became uncontrollable. My in-laws started fearing that he would sell all our land. To save the situation, I convinced my in-laws to transfer the land in my name."* shares Manisha Yadav. Today Manisha owns one acre land from which she has earned Rs. 2,50,000 by cultivating vegetables.

SSP started training women in Ekurga on climate resilient farming model. During this training, women realized the importance of land rights and ownership to access the government agriculture schemes & resources. They in turn formed a group of 400 women farmers to acquire land rights.

The women started communicating with their families about the benefits and convinced family them to divide land on their name. Savita Tai Bhore was the first woman to convince her husband and completed the legal process without any cost at Block Tahsildar. Savita is an advocate & role model of women land ownership in Ekurga village and has helped more than 50 women get land ownership from family with agreement.

Fig. 2: Impacts delivered under four result areas



Scaling up

SSP first piloted this model in Osmanabad where they introduced cultivation of less water intensive food crops and a shift from chemical to bio farming practices in one acre of land. The WCRF model also popularly known as the one-acre model involved women acquiring one acre or even lesser parcel of land to start the shift in practices and growing food crops.

It needs a collaborative effort to unlock the true potential of a model. SSP collaborated with key ecosystem partners like UMED-Maharashtra State Rural Livelihoods Mission, Government of Maharashtra, MISEREOR Germany, Huairou Commission, Welthungerhilfe-GIZ, Hindustan Unilever Foundation, Kamal Udwadia Foundation, MacArthur Foundation, ASHOKA, HSBC and NABARD in improving the reach, impact and effectiveness of the model. On the other hand, the ecosystem partners have leveraged SSP's collaboration in increasing the uptake of their initiatives with women.

In 2014, SSP teams evolved this approach with an aim to promote participation of leadership of women to ensure food and income security among marginal farmer households. In 2016, the partnership with Government of Maharashtra came as an opportunity to scale up the approach through building a cadre of agriculture leaders as Community Resource Persons to further train and handhold women farmers.

In seven years, 75,000 women farmers and households have begun the shift towards climate resilient farming in over 750 villages across Osmanabad, Latur, Solapur and Nanded districts of Maharashtra. Currently it is being scaled up to Jalna, Ahmednagar and Aurangabad districts and also to Bihar and Kerala states in India. In this process, the program has transformed 65,000 acres of farmland by growing food crops using exclusive bio-inputs. The unique cascading approach in ground deployment of the model makes it scalable, replicable and efficient.

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Building resilience organically

Harshal Khade

With a little support and guidance, farmers can transform their lives and become resilient to changes in weather and markets. The case of Pitar Sabar shows how a tribal farmer with the support from WOTR, changed the way he farmed and enhanced the income levels, besides becoming a resource person in his area.

Collecting biometric data for SRI Paddy

Pitar Sabar is a farmer residing in Targising village of Gunupur in Rayagada district of Odisha. He is a small farmer, dependent on agriculture and allied agricultural activities for his livelihood. He lives with his wife Sanjanita Sabar. He owns 7 acres of land, out of which, one acre is cultivated during Kharif under rainfed conditions. The rest six acres is pasture land where he has planted forest breed cashew, which yields low.

He grows only one crop a year, leaving the land fallow during the winter season. Paddy is cultivated during Kharif and the grain is used for household consumption. Other household expenses are borne by the amount gained by selling cashew and local labour work.

Along with many others in the village, Pitar migrates for about four to six months to States like Arunachal Pradesh, Tamil Nadu and Pune in search of labour work.

The initiative

In August 2018, WOTR started implementing a project in 11 villages in the Gunupur block with the goal of improving and expanding livelihood possibilities for the tribal communities. Building adaptive capacities and resilience to climate change was the major objective of the project, supported by Bread for the World.

Climate Resilient Agriculture is one of the components implemented in the project. This component aims to promote adaptive, sustainable agriculture practices such as System of Crop Intensification (SCI) and improved agriculture practices. Promotion of organic formulations, encouraging farmers to cultivate vegetables, and reduce agricultural input costs were the key activities of this initiative.

Pitar participated in four agricultural trainings organised by WOTR, which covered improved agriculture techniques from seed selection to harvesting the crop. Pitar says, *"in the first training, we were shown how to select seeds, seed treatment and the preparation of seedbeds. In the second training, we were told about SCI and how to transplant using line method to ensure optimum sunlight and other nutrients for the crop*

Onion crop fetched income during the pandemic

for the maximum crop yield. In the third training, a demonstration was given on nutrition management and how to prepare organic formulations such as dashparni ark, jeevamrut, neemastra etc. Fourth training covered topics like harvesting and post-harvest management".

Building resilience

Some of the activities taught in this training are pursued enthusiastically by Pitar, which proved to be beneficial. Wasundhara Sevak and WOTR staff played an important role in organizing these training programmes and hand-holding each farmer throughout the cropping season.

WOTR supported farmers to have a demo plot in which all the recommended methods are applied. This is compared with the control plot on which traditional farming methods are applied. The difference between the two plots is self-evident. WOTR has helped in maintaining detailed records of plant growth, maturation, pinnacle formation etc. and showed how to calculate the yield. Pitar says, *"Keeping a detailed record allows us to learn what goes into every stage of the crop. Analysing* the *data of the demo plot with the control plot helps us realise quantitative benefits of the methods we use over the traditional methods."*

With the guidance received, Pitar grew tomatoes for the first time in 2019. He used the stacking method for his tomato crops in which individual plants are tied to sticks just tight enough to stay up. Staking helps plants grow vertically without a direct contact with soil, reducing loss from fruit rot. He earned Rs. 8,000 by selling tomatoes. These organically grown tomatoes, with the use of *dashparni ark, neemastra and amritpani* are chemical free and taste delicious.

In the year 2020, when the entire district was hit by the pandemic situation of COVID-19, Pitar was busy selling his products such as tomatoes and onions from his field.

Pitar also practiced System of Rice Intensification (SRI) in the Kharif season of 2020-21. In the Rabi season, Pitar was supported with a set of sprinklers as it was observed that the irrigation available is not sufficient. Pitar contributed a sum of Rs. 2000 towards cash contribution for the sprinkler set. He was also trained on how to use it. The end result was quite remarkable as in his control patch, the yield was 1700 kg per acre and in the command or demo patch, the yield was 2000 kg per acre, recording a 18% increase in yield over control plot. He then started cultivating onions and tomatoes and earned a profit of Rs.8530. Thus, a farmer, who has never grown any crop in Rabi is now earning on an average Rs. 8000 in Rabi season.

Pitar is looking forward to growing a second crop such as sunflower, sweet corn and vegetables such as chilli, cauliflower, brinjal, bitter gourd, bottle gourd, onion etc. Pitar says, *"Now, I no longer migrate to other cities in search of livelihood. I grow tomatoes, onions and other vegetables. I work in my paddy field, collect mahua seeds and cashews. I also sell surplus organic formulations to other farmers."*

Pitar believes in sharing what he has learnt. He conducts demonstrations for those willing to learn. He taught the technique of preparing organic formulations to his acquaintances and relatives in nearby villages. Having a great demand in the nearby villages to train others on organic formulations, WOTR has supported in promoting Pitar as a trainer in other tribal villages. It is indeed a great achievement for Pitar to transform from being a migrant to becoming a trainer.

◆

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Resilience of local communities

Lessons from Covid-19

When a crisis hits, community organisations can draw upon six social dimensions of resilience. Here we highlight learnings from how communities in the Global South responded to the COVID-19 pandemic.

The COVID-19 pandemic is one of the most severe global shocks of modern time. The direct health impacts and loss of human lives are devastating, and the unprecedented disruptions to societies and economies will be felt globally for years to come.

Similar to climate change, COVID-19 is having disproportionate impacts on vulnerable and marginalized communities in the Global South. Most of these communities are living in poverty, often at the base of global supply chains, and more vulnerable to shocks and decisions made elsewhere. Dense living conditions, and poor access to water, sanitation, education and health facilities make social distancing and hygiene measures impractical and less effective. Lockdown regulations have a disproportionate impact on the informal sector and migrant workers, dependent on daily wages and with limited social safety nets.

Slowdowns and shutdowns in the production and tourism sectors are also affecting the poorest. Dependence on fresh markets, disruption of agricultural production and urban-rural supply chains, and limited financial means to bulk buy and store foods also exacerbates food insecurity of the most vulnerable. Government assistance is often delayed or limited.

As a response, we are seeing signs of local communities self-organizing and mobilizing sources of resilience in the face of COVID-19. Resilience is the capacity to live and develop with change, and absorb shocks and stresses. Research has identified six key social domains of resilience, and these are:

(1) the assets (natural, physical, human, financial) that people can draw upon,

(2) the flexibility to change strategies,

(3) the ability for social organization to enable (or inhibit) cooperation, collective action, and knowledge sharing,

(4) learning to recognize and respond to change,

(5) behavioural and cognitive factors (*e.g.,* risk attitudes, personal experience, social norms) that enable or constrain resilience, and

(6 the agency to determine whether to change or not.

Despite substantial interest and ongoing investment by local and national governments, non-governmental organizations and development agencies to bolster the resilience of local communities, it is unclear which domains should be prioritized in policies and programmes. A key reason is that most previous studies have focused on a single social domain of resilience, rather than simultaneously examining all six domains.

This brief builds on the Voices from the Frontline (VFL) initiative, which supports communities across

the globe to share their stories on the challenges of and the responses to the pandemic. We provide a first assessment on how many of these communities are building resilience in the face of COVID-19, with a specific focus on the domains of social resilience that they are drawing on. The findings in this brief are targeted at a broad number of actors (e.g., investors, businesses, development agencies, philanthropists, NGOs) working in vulnerable regions, Small Island Developing States (SIDS), and Least Developed Countries (LDCs) with the aim to shine a light on how programmes and policies can help bolster the social resilience of these communities organizations in the future.

Research overview and results

This study analysed a series of semi-structured interviews carried out with 35 community leaders and representatives from 15 communities around the world. The interview framework was collectively produced by the International Center for Climate Change and Adaptation (ICCCAD), the International Institute for Environment and Development (IIED), the Climate Development Knowledge Network (CDKN), Huairou Commission and the Global Resilience Partnership (GRP). The framework was designed to create an evidence base of community-led responses to COVID-19. The research team coded the interview responses based on the six key social domains of resilience assets, flexibility, social organization, learning, behavioural and cognitive factor, and agency. Each was broken down into different indicators. A simple qualitative content analysis was used to identify key patterns emerging from the responses.

Results show that half of the communities drew on all social domains of resilience when responding to the COVID-19 crisis, with all communities mobilizing at least four domains.

Communities used a broad diversity of natural, physical, human, and financial assets when responding to COVID-19. Physical assets, such as information and communication technologies (ICTs) provided quick access to news, helped community leaders raise awareness about COVID-19 and facilitated connections with vulnerable community members in need of food materials and other response actions. Financial assets mainly involved individual and community cash savings, in conjunction with remittances and donations from different sources. The use of existing knowledge, skills and experiences to make materials, for example, detergents and masks, showcases how communities mobilized human assets. Some community members used their communication and other skills to raise awareness of COVID-19 in communities. Natural assets included land suitable for agriculture that was vital to produce food locally.

The 15 communities are located in nine countries highlighted in blue: Gambia, South Africa, Zimbabwe, Kenya, India, Nepal, Bangladesh, Solomon Islands, and Fiji. The number of communities in each country is indicated by the number in parentheses.

Flexibility was mainly exhibited through livelihood diversification, the migration of community members from urban to rural settings, and the adjustment of cultural and social norms. Many communities also reported a quick adjustment to online communication, and working virtually from home.

The ability for social organization and collective action was a critical social domain of resilience in the face of COVID-19. Results show that womens and youth groups, church networks, and good community leadership provided vital platforms for sharing resources, such as food and cash donations, providing homes for the homeless, and adhering to COVID-19 restrictions. These social networks also maintained community bonds and unity.

Learning was mainly mobilized through the creation of group trainings, education and information campaigns. Also, some communities indicated that some individuals used the lockdown to learn new skills, such as making detergents, which were later translated into community businesses.

Some behavioural factors, such as drawing on experiences from previous humanitarian crises to respond to COVID-19, were key sources of resilience in many communities. However, in some cases, certain behaviours such as the stigmatization of individuals and families, and myths and misinformation about COVID-19, proved to be barriers to resilience.

Agency (the ability to have free choice when responding to change) was the most difficult domain to assess in

these circumstances. However, it was clear that the active involvement of women and youth in designing and implementing various response actions provided clear benefits. Womens and youth groups spearheaded effective responses, such as supporting communities to acquire food and financial resources, implementing community awareness and information management to shape community perception and prevention of the infections from outside their communities. They were also involved in building and maintaining social networks within communities.

Key recommendations

Investments in resilience by governments, development agencies, and civil society organizations cannot focus on a single policy angle, but must target multiple social domains of resilience.

Communities use different coping strategies, spanning multiple social domains of resilience, when responding to a crisis. In other words, resilience is not only about communities having access to capital. It is also about people having the flexibility to change strategies, the willingness or agency to influence change, and the capacity to organize themselves collectively in order to mobilize responses. Policy makers must acknowledge which domains are being mobilised by communities ahead of interventions, so that external investments complement existing actions and avoid unintended negative social impacts. For example, collective action and community-based organisations can be crowded out by the provision of certain types of government services (that is, building assets).

Programmes and policies to bolster resilience must support the actions of community-based organizations and treat them as key partners in this endeavour.

Community-based organizations, such as womens and youth groups and grassroots movements, are key elements of locally-led adaptation and resilience. They act as enablers of several of the social domains of resilience. For example, they play a key role in assessing the needs and delivering basic services (assets) to the most vulnerable members of communities. These organizations also function as trusted knowledge brokers and ensure reliable two-way information flows between vulnerable groups and local authorities and other external support systems.

Invest in programs that increase reservoirs of trust and social cohesion.

Trust, social networks and community cohesion are forms of social capital, and important in determining resilience to shocks. These features are critical in providing a social architecture for mobilising collective action and shared learning, and empowering community-wide decision-making processes. Interventions that foster these forms of social capital could include focus groups, social events, and the redesign of community physical space in order to maximize social interactions.

This brief was authored by Albert Norstrom (Stockholm Resilience Centre & Global Resilience Partnership), David Mfitumukiza (Makerere University College of Agricultural and Environmental Sciences), Emilie Beauchamp (International Institute for Environment and Development), Mohammad Feisal Rahman (Durham University).

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Source: This is an edited version of the original published at https://www.globalresiliencepartnership.org/wp-content/uploads/2021/01/brief_resilience-of-local communities.pdf

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Performance of agriculture, allied sectors shows resilience to Covid-19 shock: Economic Survey

Observing that the performance of the agriculture and the allied sector has been "resilient" to the Covid-19 shock, the Economic Survey 2021-22 has highlighted the need for improving productivity of small and marginal farmers through development and implementation of small-holding farm technologies. The survey has also suggested use of "alternative" fertilisers like Nano Urea and organic fertiliser to protect the soil.

The Survey said, "The performance of the agriculture and the allied sector has been resilient to the COVID 19 shock. The sector grew at 3.6 per cent in 2020-21 and improved to 3.9 per cent in 2021-22."

Increasing importance of allied sectors including animal husbandry, dairying and fisheries in growth and income of the farmers indicates that focus needs to shift more towards harnessing the potential of allied activities. There is also a need to improve productivity of small and marginal farmers through development and implementation of small-holding farm technologies," said the Survey, which was tabled by Finance Minister Nirmala Sitharaman.

The recommendations come at a time when the government is in the process of preparing a farmers' database by providing a unique ID to each farmer. Besides, the Ministry of Agriculture and Farmers' Welfare has recently signed MoUs with 10 private companies: CISCO, Ninjacart, Jio Platforms Limited, ITC Limited and NCDEX e-Markets Limited (NeML), Microsoft, Star Agribazaar, Esri India Technologies Private Limited, Patanjali, and Amazon.

The survey also highlighted the need for using alternative fertilisers like nano urea. "There is a need to explore options and promote use of alternative fertilisers such as nano urea and organic fertiliser which protect the soil, are more productive and contribute to higher nutrient use efficiency," the Survey said.

"While the Government has adopted the use of MSP as signal to encourage crop diversification, there is also a need for coordinated action from the State Governments to facilitate the shift to high value and less water consuming crops to enable realization of the objective of doubling farmers' income in a sustainable way," the Survey said. It also said that "research and development" in agriculture and allied sectors can play a major role in realization of sustainable agriculture practice that efficiently meets the objectives of nutritional security and improvement in farm income.

Source: https://indianexpress.com/article/cities/delhi/performance-of-agriculture-allied-sectors-shows-resilience-to-covid-19-shock-economic-survey-7749912/

Natural option: Organic, natural farming not only profitable and sustainable but also productive

It's hard to fathom that just 3.8 million hectares (ha) – 2.7 per cent of the country's net-sown area – is under organic and natural farming despite two decades of government efforts to upscale the practices.

The Union government passed its first policy on organic farming in 2005, and introduced the flagship Paramparagat Krishi Vikas Yojana (PKVY) in 2015-16. Recently in December 2021, highlighting the ill-effects of chemical-based farming, Prime Minister Narendra Modi also appealed to make natural farming a mass movement in the country. Some of the prime reasons that hinder the shift is a lack of conviction among policymakers; limited consensus among the scientific community in favour of organic and natural farming; and the tendency to evaluate the non-chemical agricultural practices only on the basis of yield.

The Centre for Science and Environment (CSE), a Delhi-based non-profit, has recently consolidated long-

term evidence on holistic benefits of organic and natural farming.

The studies highlight the importance of organic and bio-inputs like farmyard manure, vermicompost, poultry manure, green manure, liquid bio-fertilisers, Jeevamrutha, Beejamritha, Ghanajeevamritha, Panchagavya and fish-protein hydrolysate. They can play a crucial role in spreading awareness, building capacity and influencing policymakers. It is also important that the advantages of organic and natural farming should not be evaluated only on the basis of yield.

Benefits of organic farming related to profitability and sustainability strongly outweigh those with inorganic approaches. The existing programmes to support organic and natural farming should therefore be scaled up, expanded and properly funded. Develop a roadmap that sets the long-term agenda for adoption of agro-ecological approaches across different parts of the country in view of its holistic benefits such as nutrition, livelihood of farmers, natural resource conservation, biodiversity, resource efficiency, soil-health, disease resilience and mitigation of climate crisis.

An alternative certification that is simpler for farmers and trustworthy for consumers could be explored for well-connected local markets. They can be instrumental in helping farmers sell organic and natural produce by developing value chains, procuring produce and getting remunerative prices.

Source: https://www.downtoearth.org.in/news/agriculture/natural-option-organic-natural-farming-not-only-profitable-sustainable-but-also-productive-81684

US, India launch new initiative to increase coverage in India

US and India announced a new initiative to increase tree coverage outside of forest lands in India in a bid to support global climate change mitigation and adaptation goals. "The Ministry of Environment, Forest, and Climate Change, the Government of India and the US Agency for International Development (USAID), on September 8, 2022, announced the launch of a new program, "Trees Outside Forests in India," US Embassy in India said. The move will enhance carbon sequestration, support local communities, and strengthen the climate resilience of agriculture.

The new USD 25 million programme will bring together farmers, companies, and private institutions in India to rapidly expand tree coverage outside of traditional forests by 28 lakh hectares. Through agroforestry, or integrating trees into farming systems, the program will improve the resilience of farming systems while increasing the income of farmers.

The program will also use innovative financing models and leverage India's private sector to promote tree-based enterprises, helping to create sustainable markets and improve rural economies and livelihoods, with the potential to benefit more than 13 million people.

Implemented by a consortium led by the Center for International Forestry Research (CIFOR) and World Agroforestry (ICRAF), the program will be implemented in seven states including Andhra Pradesh, Assam, Haryana, Odisha, Rajasthan, Tamil Nadu, and Uttar Pradesh.

USAID's forestry activities in India support important priorities of the US and Indian governments, contributing to the Forestry Pillar of the Climate Action and Finance Mobilization Dialogue in support of the US-India Climate and Clean Energy Agenda 2030 Partnership. This new program builds on the enduring US-India partnership to tackle the climate crisis and bolster resilience in the face of climate threats and extreme weather events, as per the US Embassy here.

In addition to safeguarding India's forests and other critical ecosystems, USAID is working with India to implement its ambitious emissions reduction measures by transitioning to renewable energy and adapting ongoing activities, such as health and disaster risk reduction, to the reality of today's climate crisis.

Source: https://swachhindia.ndtv.com/us-india-launch-new-initiative-to-increase-tree-coverage-in-india-70934/

Natural farming builds farm resilience

Reflections from the field

M Manjula, V Manikandan and Divya Sharma

Natural farming being recognised as an important pathway for achieving sustainable development goals, a study was undertaken to understand the potential of natural farming as a sustainable agricultural model. The field assessment revealed that natural farming systems contribute highly to the environmental/ecological dimensions of sustainability of farmers while there is a clear trade-off on the economic dimension. The study recommends a multi-pronged approach that adopts strategic interventions on the institutional, governance and marketing aspects for natural farming to be promoted as a new paradigm for inclusive agricultural growth, at scale.

The word sustainable agriculture has been defined from diverse vantage points by various stakeholders, and as a result, there are different kinds of systems and practices promoted as sustainable agriculture with claims of building resilience of farming systems (LEISA, Agroecology, Permaculture, Natural farming etc.). Agriculture being human driven, the concept of resilience in agriculture has put the farmer at the center of the discourses on sustainability of production systems. Hence, resilience in agriculture has been investigated in the light of farmers being part of urban, socio-ecological, and agrarian systems.

The natural farming system prevalent in Andhra Pradesh and Karnataka is one such agrarian system, that is gaining popularity, as a model of sustainable agriculture that has principles of resilience built into it. These farming systems are based on ecological principles but are not prescriptive in nature. Moreover, they are centered on the synergistic relationship between people and nature and have a strong social movement emphasis.

Natural farming system aims (i) to end dependence on external synthetic inputs and agricultural credit, (ii) improve soil condition, (iii) source inputs from local resources, (iv) emphasise conservation of functional biodiversity, (v) reduce reliance on irrigation and (vi) conserve soil moisture. Accordingly, at the core, the natural farming practices are (i) seed treatment using a slurry of cow dung and cows' urine (*Bijamrit)*

(ii) application of in-situ culture of water, cow manure and urine from indigenous cattle, unrefined cane sugar, legume flour and uncontaminated/virgin soil, to introduce local soil microbiota (*Jivamrita*) (iii) Acchadana: Live, soil and straw mulching - to conserve soil moisture and (iv) *Whapasa*: Improving soil aeration – to build soil humus. The fields are designed using the 'five-layer multi-crop' model. Unique to this practice is the use of cow dung and urine of indigenous cows, which is the primary ingredient in inputs in natural farming. Thus, the goals and processes of natural farming are aligned with the agroecological principles of equity, synergistic relation between human and nature and decentering of markets.

The natural farming system prevalent in Rachuru has principles of resilience built into it

Natural farming has been recognised as an important pathway for achieving sustainable development goals and is said to have the potential to meet 169 targets of SDGs. The movement has been inclusive of all classes of the peasantry in the states of Karnataka and Andhra Pradesh. Natural farming movement in India is part of the *La Via Campesina*, the agroecology-based global peasant movement. The system attracted policy attention not only from the national government but also from international development agencies. The *Bhartiya Prakritik Krishi Padhati* (BPKP), which was introduced in 2020-21 budget, as a sub-scheme of *Paramparagat Krishi Vikas Yojana* (PKVY) for the promotion of traditional indigenous practices, advocates principles of natural farming and agroecology. Moreover, the practice has found mention in the Union budgets 2019-20 ('*going back to the basics*') and 2020-21. Also, NITI Aayog, the Government of India's think tank enlists natural farming as a means for doubling farmers' income A recent NITI Aayog working paper hails natural farming (Agroecology) as a new paradigm for agricultural growth. The state initiatives on natural farming in Karnataka and Andhra Pradesh have also got financial support from national and international funding agencies. State governments of Andhra Pradesh, Karnataka and Himachal Pradesh have specific allocations for natural farming, while governments of Rajasthan, Gujarat and Meghalaya have set up programmes for the same.

Commissioned studies on natural farming systems have shown substantial savings on paid-out costs, decline in interlocking of markets and long-lasting improvement in farm efficiency. The potential social, economic, and environmental impact of natural farming has been mapped to specific targets under the 17 SDGs using specific case studies. However, natural farming, has attracted criticism for the magnitude of labour that is used in producing the natural inputs. Large part of this being family labour, if imputed in the cost of production is bound to challenge the claims of lowering expenditure. Hence, the ecological gains in natural farming are argued to have been realized at a huge trade-off of economic viability.

With this background, a field study was conducted to measure the performance of the natural farming systems on various parameters of sustainability using a comprehensive assessment framework. The assessment was carried out among 15 farmers in Rachuru village

of Roddam block (mandal) in Sri Sathyasai District (previously part of the undivided Anantapur district).

Background

The geographical position of the Indian peninsula renders Anantapur region (consisting of Sri Sathyasai and Ananthapuramu districts of Andhra Pradesh) as one of the rain-shadow and drought-prone regions in the country. Sri Sathyasai district records an average annual rainfall of 604 mm with only 34.7% of its total geographical area under net sown area. A total of 79% of landholdings are with small and marginal farmers and 22.7% of the district's gross cropped area is irrigated. The high variability in the southwest monsoon is an indication of the risks associated with farming in the district.

Many of the farmers in the Rachuru village are part of the Dharani Farming and Marketing Cooperative promoted by the Timbaktu collective. The Dharani Cooperative is a producer-owned business enterprise of more than 2000 smallholder farmers from eight blocks (mandals) in Anantapur region. Besides supporting the farmers in crop planning and training them in sustainable farming methods, the cooperative undertakes procurement, processing, value addition, packaging, and marketing of members' produce. The major crops cultivated in the village include millets, groundnut, pulses, fruits, and vegetables. Sericulture was also a major enterprise and farmers raised mulberry for this.

Sustainability Assessment Framework

The sustainability assessment framework had specific indicators that covered the major domains of sustainability- economic, environmental, social and governance and perception of climate change (Table 1). The indicators are assigned equal weightage and the dimensions of sustainability are also equally weighted on the framework. The indicators would take ratings of one, three and five, where five represents the highest (best quality) and one represents the lowest (low quality) value of the indicator.

The performance of dimensions of the sustainability framework is the cumulative value of the individual indicators in that dimension. Thus, the individual dimensions will take values in the range of six to 30. The closer the value is to 30, the higher the performance of the dimension on the sustainability framework.

Results

It was observed across the farms, that the environmental dimension performed well on the framework, followed by the social, economic and governance and perception of climate change. The environment dimension scored values in the range of 22 to 24 across the farmers whose fields were measured on the framework. The indicators which performed best on the environment dimension were the ones that captured soil-biodiversity and the use of natural inputs. However, indicators on availability and sustenance of ground and surface water sources were observed to perform very poorly on the assessment framework.

The economic dimensions scores were in the range of 14-20. Access to credit is the only indicator on the economic dimension that showed a high level of performance. Whereas the other set of indicators, that are more reflective of the economic viability of the individual farms and farm households had received lower score on the framework. Access to credit can be closely linked to the indicator on the social capital of the farmers. Through the assessment it was observed that the farmers who got the highest score on the 'access to credit' indicator on the economic dimension, were also the ones who got the highest score on the 'membership in collectives' indicator on the social dimension.

The other indicators on the social dimension, like 'gendered aspects of farm level decision making', 'gendered wage differentials' and 'gendered ownership of land' have scored poorly on the framework, with the indicator on 'decision making' performing the worst. Governance indicators, namely, – 'awareness and access to government schemes and entitlements' and the 'intensity of engagement of the extension worker' show medium performance (score 3). Additionally, the rest of the indicators set on this dimension, which captures farmers perception of climate change and its impact on farming scores the least on the framework.

The field assessment reveals natural farming systems contributing highly to the environmental/ecological dimensions of sustainability of farmers in the Rachuru village. However, a clear trade-off on the economic dimension was also evident from the analysis. Further, the positive outcomes on indicators like access to credit, government schemes, entitlements and extension

Table 1: Sustainability assessment framework				
	Dimensions/Indicators	**Ratings Scales**		
	Environment	**1**	**3**	**5**
1	On-farm external input use	Chemical	Both	Natural
2	Presence of earthworms	No		Yes
3	Presence of honeybees	No		Yes
4	Type of soil	Sandy	Clay	Laterite/Loamy
5	Change in groundwater table – past decade	Deep	Remains same	Closer to Surface
6	Changes in surface water availability	Lesser months than before	Remains same	More months than before
	Economic	**1**	**3**	**5**
1	Average yield of the major crops?	< than potential yield	Same as potential yield	Than potential yield
2	Share of agriculture income in household income	<25%	25-50%	=/>50%
3	Number of crops grown in a year	One or two	three	More than three
4	Source of credit	No Source	Informal	Formal
5	Alternate livelihoods opportunities	None	two in addition to crop-based agriculture	more than two in addition to crop-based agriculture
6	Size of the land holding	less than 2.5 Acre	2.6 to 5 Acre	More than 5 Acre
	Social	**1**	**3**	**5**
1	Ownership of land holding	Lease	Joint ownership with family	Sole/name of husband and wife/ Own
2	In whose name is the land registered		Male	Female
3	Who usually makes decisions related to agriculture?	Only Men	Men leading decision in consultation with women	Joint decisions through consensus
4	Wage difference between male and female labour	Two times	< Two times	No difference
5	Membership in collectives	No		Yes
6	Dominance of caste in access to productive resources	Always	Sometimes	Never
	Governance & Perception of Climate Variability	**1**	**3**	**5**
1	Number of schemes availed for agriculture in the last two farming seasons?	None	One to two	More than two
2	Number of interactions with the extension officer in the last two farming seasons	None	once or twice	More than Twice
3	Distance to the PHC	> 5 Km	Within 5km	In the village
4	Distance to the nearest veterinary dispensary	> 5 Km	1 to 5km	< 1 km
5	Perception of rainfall pattern – compared to parent's time?	Different		Same
6	Perception of the impact of weather on farm-based livelihoods	Negative	None	Positive
Author's work				

services could all be linked to the membership in the collectives. This indicates the strong facilitating role played by Dharani Cooperative in building resilience of smallholder farmers in the region. The performance on the environmental dimensions can also be attributed to the membership in the cooperatives as members receive focused capacity building on preparation of jeevamrita, bijamrit and techniques like whapasa and multi crop models – which are the pillars of natural farming practices. In addition, the village has a decentralized unit for production and supply of natural inputs. The role of Dharani Cooperative in value addition, branding and marketing of the products from natural farming systems is limited to oil seeds, pulses and millets. However, farmers engaged in horticulture face challenge in realizing economic benefits in terms of branding or premium pricing. It is also evident from the analysis that membership in the cooperative has not resulted in any

Photo: Timbaktu Collective

Women working in groundnut fields in Rachuru

gender transformative changes in agrarian relations at the community or the household level.

The study is an attempt to understand the potential of natural farming as a sustainable agricultural model. Despite, the small sample size, the results of the study, have relevance in the current agricultural policy and practice context. Agroecology/Natural Farming has been hailed as a new agricultural paradigm in a recent working paper from the public policy think tank NITI Aayog. Government of India is already making budgetary provisioning for BPKP. However, for natural farming to be promoted as a new paradigm for inclusive agricultural growth, at scale, would need a multi-pronged approach that adopts strategic interventions on the institutional, governance and marketing aspects.

Acknowledgements

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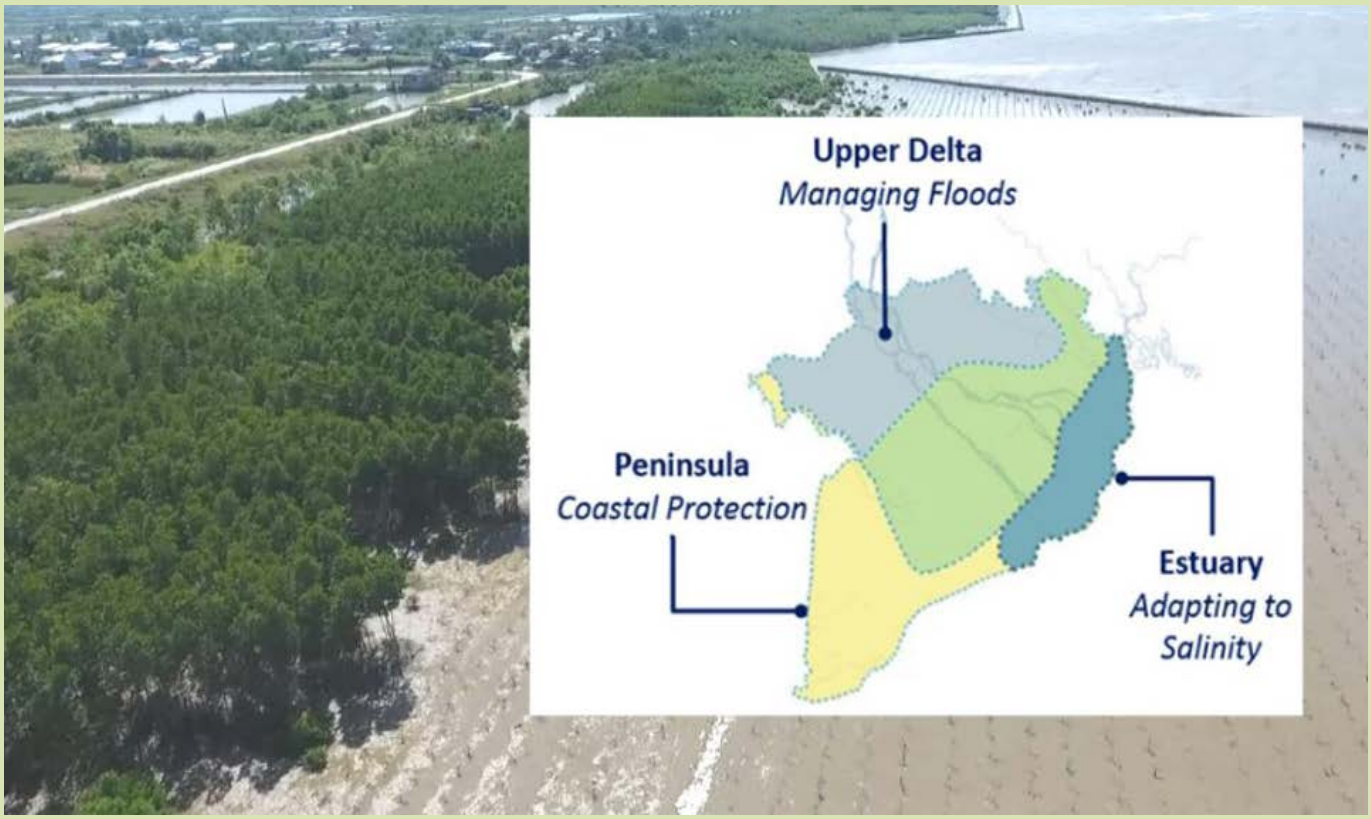
For Mekong Delta farmers, diversification is the key to climate resilience

Vietnamese farmers in the Mekong Delta face worsening impacts of climate change. Environmental deterioration threatens the lives and livelihoods of millions of people here. Since 2016, a World Bank project has supported more than one million farmers transition into more climate-resilient and resource-efficient ways of living. The project has also focused on creating an enabling infrastructure network and improving regional co-operation on water and land management.

Extreme floods. Extreme droughts. Saline intrusion. Coastal and riverbank erosion. Land subsidence.

The Mekong Delta, Vietnam's vital agricultural and aquaculture hub, has it all. While the Delta has been hailed as a biological treasure and is home to one of the most abundant biodiversity systems on Earth, its ecosystems are experiencing dramatic degradation on many fronts. For farmers and communities whose livelihoods depend on the health of these rich natural resources, adaptation will be the key to survival.

The Delta loses about 500 hectares of land per year to erosion, Vietnam's agriculture ministry estimates. In addition, unsustainable land and water management practices are polluting its labyrinths of rivers and canals. Upriver saltwater intrusion has risen to four grams per liter in places, four times higher than tolerance thresholds for major crops, triggering a region-wide freshwater shortage crisis. While climate change and sea level rise are responsible for some of these changes, direct human impacts such as upstream dam development and over-exploitation of sand and groundwater are also stressing the Delta.



This environmental deterioration threatens the lives and livelihoods of millions of people across 13 provinces. If the Delta is going to continue to thrive and be a resource for communities around it for generations to come, farmers and local communities will need to find an approach that allows them to live in greater harmony with nature.

Since 2016, the World Bank, through the Mekong Delta Integrated Climate Resilience and Sustainable Livelihoods Project, has supported the Government of Vietnam in applying broad policies and operating activities in the Mekong Delta enabling more than one million farmers transition to more climate-resilient and resource-efficient ways of living.

The Delta has four hydro-ecological zones that are connected by water flows, and the project promotes strategies specific to each area. In the upper Delta, the objective is to encourage flood retention, which is vital to alleviating droughts and saline intrusion downstream. In the river's estuary, the goal is to adapt to increasing salinity. Along the Ca Mau Peninsula, protecting the extremely exposed coastline and addressing water shortage is the priority.

Upstream – Adding ducks and fish

The project leverages an extensive network of scientists working hand-in-hand with farmers to find new production models that best fit the agroecological and socioeconomic challenges, and scale them up.

For example, farmers in Dong Thap Province were accustomed to growing three crops of rice a year and relied on high dikes to divert floodwaters elsewhere. This practice has proven neither economically optimal nor ecologically sound. Decades of multiple-crop farming systems have depleted soils and disrupted hydrological balances, resulting in lower agricultural activity, shrunken floodplains, and heightened flood risk and pollution.

To transition away from this practice, the project helped farmers to grow other crops or raise other livestock, both reducing their reliance on rice farming and generating higher incomes.

For farmer Nguyen Van Vuong from Tam Nong District, raising ducks and fish was challenging and a financial risk. However, the project helped him by providing 70%

of the capital needed to switch to this new model. Vuong also got regular training and on-site support by technical officers.

"*I was worried because this plan was costly and it was something I had never done before,"* Vuong said. *"But it sounded promising and there was a lot of help. So I gave this a try. I never thought it would pay off this handsomely*."

It is estimated that growing two crops of rice generate an annual profit in the range of 25 to 30 million VND per hectare. With the crop-fish-duck model, this could go up to as much as 81 million VND. Besides providing additional income, these practices help farmers like Vuong retain floodwater, which eases saline intrusion downstream during the dry season.

Downstream – Healthier shrimp, protected forests

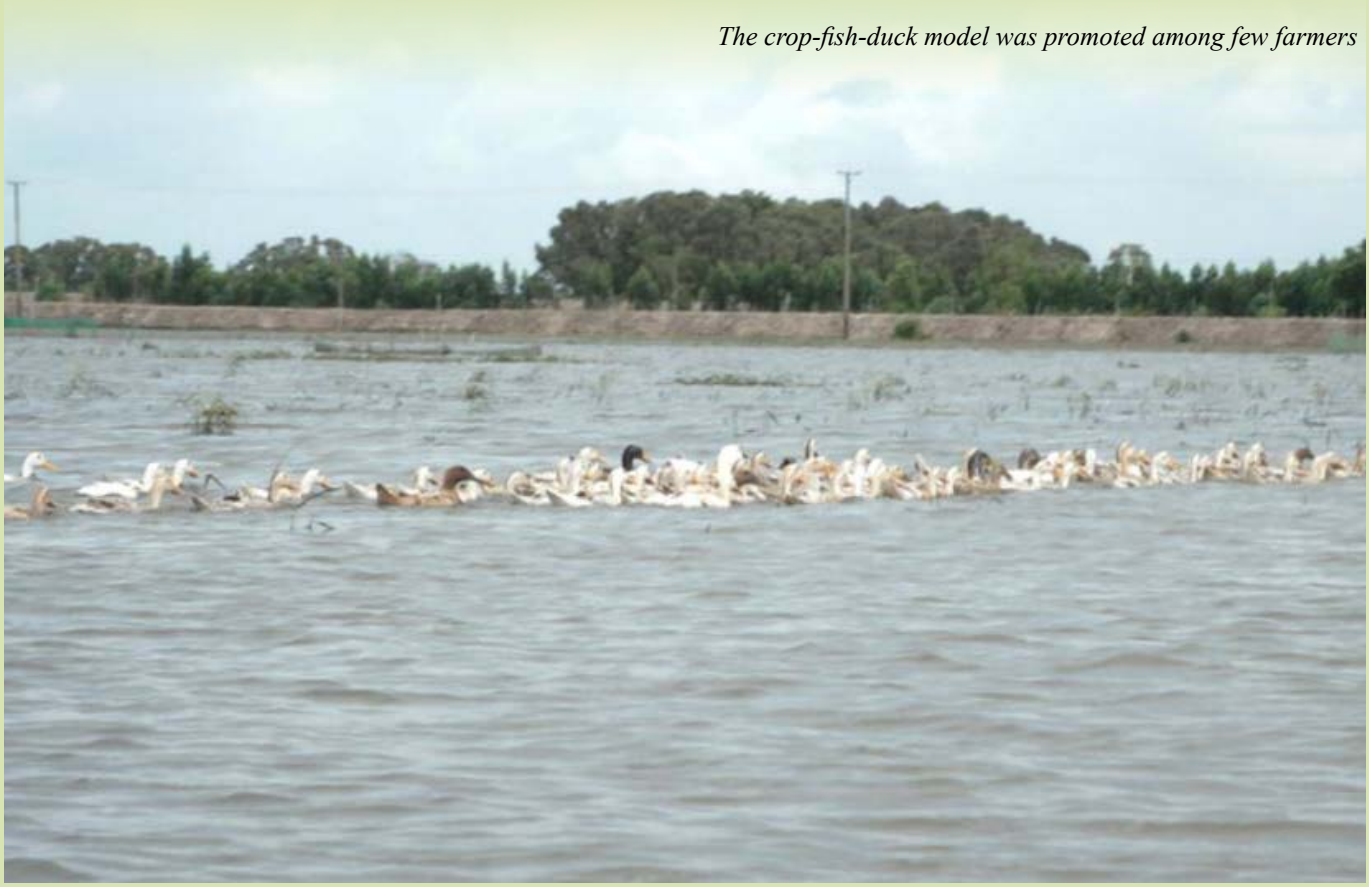
Farther downstream in the Ca Mau Peninsula, farmers are encouraged to consider trying nature-based models to offset any tradeoff between sustaining livelihoods and protecting the environment. The peninsula has been suffering from serious coastal erosion and land subsidence as farmers cleared mangrove forests, and as the operation of shrimp ponds over-extracted groundwater and polluted surface water.

Farmers have been shown how to take advantage of mangrove forests as ideal breeding grounds for cultivating shrimp, clams or snails. The rich mangrove ecosystem nurtures this livestock with its food webs and protects them from disease. Shrimps raised this way are often sold at higher prices in European Union markets since they meet organic standards.

Elsewhere, farmers have also been taught to grow shrimp in other cleaner and more resource-efficient ways. For example, in Bac Lieu Province, shrimp growers have adopted a polyculture system by adding tilapia to their shrimp ponds. The farmers have found that this practice brings higher returns and improves water quality.

"*Clean water is so important to grow healthy shrimp,"* said Le Van Thanh, a farmer in Dong Hai District. *"I used to use chemicals to clean my ponds but in turn, it killed a lot of shrimp. Tilapias are so great -- they clean the water and bring extra income.*"

The crop-fish-duck model was promoted among few farmers



Scaling up with dikes, dams, and sluice gates

To support farmers sustain these good practices after the end of the project, the World Bank has also focused on creating an enabling infrastructure network and on improving regional co-operation to manage a resource that knows no boundaries, like water.

The majority of the project's investment of US$387 million has gone into building new infrastructure and upgrading outdated facilities. In the upper floodplains, 61 kms of dikes have been rehabilitated and 15 associated sluice gates erected to better manage floodwaters, in particular, to capture flood benefits.

Along the 27km coastline of the peninsula, a combination of sea dikes, wave breakers, and mangrove belts have been developed to cope with the ever-shifting coastal dynamics. Sluice gates and other water works have also been constructed and canal systems dredged to better manage saltwater circulation and control high tides that come more frequently. In the estuary areas, four major riverbank and coastal sluice gates have been built to regulate salinity.

The large-scale Nam Mang Thit irrigation system spanning Vinh Long and Tra Vinh provinces is one of the project's major highlights. Upgrade work was completed just before the historic drought of 2020 hit the region. At the height of the drought in March, the fully functional system helped save crops on thousands of hectares of land.

"*It is the no-regret approach which takes into account the uncertainties of climate change that makes the infrastructural measures deployed under this project different from other conventional interventions*," said Nguyen Hoang Ai Phuong, an environmental specialist and the World Bank's Task Team Leader for the project. "*In addition, these infrastructure investments are guided by the growing body of climate science and also by new information from the integrated data and information system that this project is building."*

As part of this effort, the project is supporting the establishment of a Mekong Delta Center, which will serve as a one-stop-shop for information about the Delta's water, land, resources, and other environmental and climatic indicators. Across the Delta, the project has established 50 monitoring stations that provide real-time updates on water resources and developed a suite of decision-supporting tools to inform the operation of its complex water network.

> *"I do not want to leave home, I want to grow my family here, like my grandfather and my father did. That means I have to be prepared for whatever Mother Nature throws at me."*
>
> **Nguyen Van Vuong**
> A farmer living in the upstream area of the Mekong Delta

Importantly, with this project's support, climate resilience has been mainstreamed into top-level policy documents.

Pending approval by the Prime Minister, for the first time, the Mekong Delta will have a regional master plan that places climate adaptation at the forefront. The new master plan recognizes the interdependence of soil, water, and climate, while promoting an integrated Delta-wide approach to development.

"*Collaboration and coordination are key to securing a prosperous and climate-resilient future for the Mekong Delta,"* said Phuong. *"Everyone at every level-- from farm to boardroom, local to central, one province to a sub-region, or the whole Delta -- has to go beyond their immediate interest and think about the Delta in broader terms and perspective."*

For farmers in the Delta, like Vuong, adapting is key to his survival.

"I do not want to leave home, I want to grow my family here, like my grandfather and my father did," he said*." That means I have to be prepared for whatever Mother Nature throws at me."*

Source: This article has been first published at https://www.worldbank.org/en/news/feature /2021/10/21/ for-mekong-delta-farmers-diversification-is-the-key-to-climate-resilience

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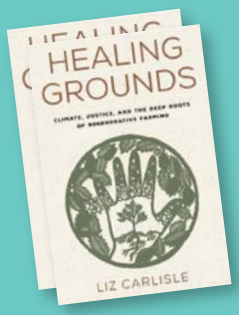
NEW BOOKS



Healing Grounds: Climate, Justice and the Deep Roots of Regenerative Farming

Liz Carlisle, *2022, Island Press,* 200 Pages, ISBN 9781642832211

A powerful movement is happening in farming today—farmers are reconnecting with their roots to fight climate change. For one woman, that meant learning her tribe's history to help bring back the buffalo. For another, it meant preserving forest purchased by her great-great-uncle, among the first wave of African Americans to buy land. Others are rejecting monoculture to grow corn, beans, and squash the way farmers in Mexico have done for centuries. Still others are rotating crops for the native cuisines of those who fled the"American wars" in Southeast Asia. In Healing Grounds, Liz Carlisle tells the stories of Indigenous, Black, Latinx, and Asian American farmers who are reviving their ancestors' methods of growing food—techniques long suppressed by the industrial food system. These farmers are restoring native prairies, nurturing beneficial fungi, and enriching soil health. While feeding their communities and revitalizing cultural ties to land, they are steadily stitching ecosystems back together and repairing the natural carbon cycle. This, Carlisle shows, is the true regenerative agriculture – not merely a set of technical tricks for storing CO_2 in the ground, but a holistic approach that values diversity in both plants and people.

Permaculture for Beginners : The Ultimate Guide to Natural Farming and Sustainable Living

Nicole Faires, *2022, Skyhorse,* ISBN 9781510767706

Permaculture is an important but often misunderstood method of growing food and building homes in a manner that works with nature, rather than against it, to create beautiful, healthy, and useful gardens. Blending ecology, organic agriculture, green home design, appropriate technology, and biology can be confusing and overwhelming, but Permaculture for Beginners simplifies this vast field for practical application. This is a hands-on guide, taking the beginner through each step of the design process, so that anyone can apply permaculture principles to their own life. While the principles are simple, the in-depth topics cover every aspect of permaculture, including: Building green homes and passive solar design Growing edible plant communities and forest gardens using no-till and natural farming methods, Creating microclimates for extended growing seasons, Raising livestock with ecological foraging techniques, Transforming urban backyards into food-abundant oases. This is a commonsense approach to sustainable living that creates a self-sufficient and low-effort home for the people that live there, whether in the city or the country. Permaculture for Beginners isn't a philosophy book, or a dissertation on theory. It is a step-by-step, complete guide to every aspect of permaculture.

Handbook of Research on Green Technologies for Sustainable Management of Agricultural Resources

Bhadauria, H., Rakesh S. Sengar, Reshu Chaudhary, *2022, IGI Global,* 637 Pages, ISBN 9781799884354

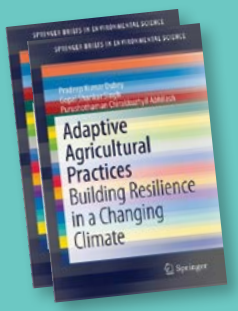
Green technology is focused on devising environmentally-friendly (eco-friendly) agricultural practices. It plays a crucial role in dealing with food security issues and reducing the carbon footprint. Green technologies and environmental sustainability are focused on the goals of green technologies, which are becoming increasingly important for ensuring sustainability. The Handbook of Research on Green Technologies for Sustainable Management of Agricultural Resources covers the applications of green technology as well as different eco-friendly technologies for the sustainable management of natural resources. It also explores the timely topic of enhancing crop productivity. It is ideal for agriculturists, farmers, botanists, technologists, policymakers, scientists, academicians, researchers, and students as it covers a variety of concepts such as organic farming and the role of green technologies.

SOURCES

Building Agricultural Resilience to Natural Hazard-induced Disasters Insights from Country Case Studies

OECD, 2021, *OECD Publishing,* 174 Pages , Ebook, ISBN 9789264752788

Natural hazard-induced disasters (NHID), such as floods, droughts, severe storms, and animal pests and diseases have significant, widespread and long-lasting impacts on agricultural sectors around the world. With climate change set to amplify many of these impacts, a "business-as-usual" approach to disaster risk management in agriculture cannot continue if we are to meet the challenges of agricultural productivity and sustainability growth, and sustainable development. Drawing from seven case studies – Chile, Italy, Japan, Namibia, New Zealand, Turkey and the United States – this joint OECD-FAO report argues for a new approach to building resilience to NHID in agriculture. It explores the policy measures, governance arrangements, on-farm strategies and other initiatives that countries are using to increase agricultural resilience to NHID, highlighting emerging good practices. It offers concrete recommendations on what more needs to be done to shift from coping with the impacts of disasters, to an ex ante approach that focuses on preventing and mitigating the impacts of disasters, helping the sector be better prepared to respond to disasters, and to adapt and transform in order to be better positioned for future disasters.



Adaptive Agricultural Practices Building Resilience in a Changing Climate

Pradeep Kumar Dubey, Gopal Shankar Singh, Purushothaman Chirakkuzhyil Abhilash, 2019, *Springer International Publishing,* 132 Pages, EBook, ISBN 9783030155193.

This brief explores several adaptive agricultural practices from around the world to fulfill current and future agricultural demands for food security due to the challenges posed by climate change and growing global population. Readers will discover how farmers adapt to environmental changes by adopting various agronomic practices at crop, farm and landscape levels. Particular attention is given to systemic and transformational adaptation strategies employed by farmers such as mulching, organic farming and crop diversification. This is a highly informative and carefully presented book that provides insights on how crops can build up resilience against periods of drought, high salinity, disasters such as floods, and diseases. The policy implications and future prospects of these adaptation strategies are also addressed. Environmental and plant scientists, agronomists and researchers in climate sciences will find this book interesting.

Food Security and Climate-Smart Food Systems Building Resilience for the Global South

Abdlmalek A. Alsheikh, Ali Wafa A. Abu Risheh, Mirza Barjees Baig, Mohamed Behnassi, Mohamed Taher Sraïri, 2022, *Springer International Publishing,* 398 Pages, ISBN 9783030927370.

The resilience of food systems and security to emerging challenges and threats, especially in the context of environmental and climate risks and global pandemics such as the Covid-19 crisis, is currently gaining growing importance in research, policy, and practice. Based on this, the core focus of this book, as a part of a series of CERES publications, consists of identifying and exploring the best ways to overcome such challenges and shocks and to build resilience in the Global South. More precisely, the book analyzes current dynamics and trends related to the climate resilience of food security and assess the relevance of emerging approaches such as climate-smart agriculture, new roles of agriculture extension, smart farming, and climate adaptation of farming systems.The book includes both conceptual and empirical research reporting lessons learned from many geographical, environmental, social, and policy settings while focusing on Africa, Middle East, and Asia. It also provides research and policy-oriented inputs and recommendations to guide change processes at multiple scales.

Enhancing resilience of flood affected communities

Archana Srivastava and Bijay Prakash

Farming becomes a challenge when flooded and left silted, making farmers vulnerable to weather and livelihoods. Technical support along with digital weather forecast and e-learning training has enhanced the resilience of farms and changed the fate of farmers like Nisha.

Several villages in Bagha 1, Bagha 2, Madhubani, Bhittah, Piprasi blocks in West Champaran district of Bihar, and in Nichlaul and Khadda blocks of Maharajganj and Kushinagar districts in Uttar Pradesh are located along the banks of Gandhak River, close to the Gandhak barrage. With no embankment between them and the river, every year they face the problem of floods and waterlogging. Heavy rains and the water inflows from nearby mountainous region, ruin the Kharif crops as well as the seasonal vegetable crops. Also, being close to Balmiki Wildlife Sanctuary, animals are also found in abundance in this area.

A good water melon harvest was possible adopting sustainable agriculture practices

Agriculture is the primary source of income for many residents in the village. While only 15-20% of the area is cultivated during Kharif, crops like wheat, mustard, lentils and vegetables are cultivated in the Rabi season. As waterlogging lasts for approximately six months, cultivation of paddy is difficult. The main crop of the region is sugarcane. Farmers are forced to sell their sugarcane to the local two sugar mills or to the vendors, with less returns. Farmers also sell their sugarcane to jaggery makers of Kushi nagar district in Uttar Pradesh, which does not fetch well.

In 2018, Gorakhpur Environmental Action Group (GEAG), an NGO started working in Rajwatia village of West Champaran. Several initiatives to build community resilience were taken up under the LWR supported "Congregational Transboundary Flood Resilience Project, Gandak River Basin". This includes organising village level institutions such as Village Disaster Management Committee, Farmer Field School, Self-Help groups, etc. Following is the account of Ms. Nisha Devi, a farmer who benefitted from this project.

Nisha Devi, a role model

Nisha devi, belongs to Rajwatiya village of West Champaran district in Bihar. Nisha owns 1.5 acre of cultivable land out of which 0.4 acres of land is located in the flood and water-logged area near the Gandak River. As the fields are submerged for 6 months a year, there is no hope of producing enough food for the family. Her husband, therefore migrates to metropolitan cities such as Delhi, Bangalore etc. to earn and support the family.

In 2020, during the COVID-19 pandemic, Nisha faced the toughest times. In the month of June, flood hit her field and destroyed the standing crops. Added to this, her husband had to return owing to the Pandemic conditions and this made them very vulnerable.

Nisha Devi met the GEAG team members during an FGD meeting where in she got to know about simple, yet substantial resilience practices that enhance farming in flood prone areas. These included features such as jute bag farming, use of bamboo structures, mounding, bund farming, raised bed farming and raised nursery. She participated in Farmer Field Schools and got to know about the its impact and long-term health, environmental benefits of Matka fertilisers and pesticides. She also learnt the process of preparing *Matka* fertilizer and *Matka*

Soil health was improved using Matka fertilisers

pesticides. She executed various farm techniques in her field, learnt through GEAG team, during FFS sessions. She used the information received from weather forecast and agro advisory through WhatsApp messages, SMS messages and through display board established at community places, to plan her farming activity.

In September 2020, she came to know about oyster mushroom cultivation from the GEAG project team and prepared 18 bags of substrate with costs around Rs. 1250 for cultivation. After 40 days, she cultivated 7 kg. of mushroom, costing around Rs. 840. Gradually, mushrooms started coming out every three to four days and till December, a total of 45 kg of mushrooms were produced. Her family consumed 15 kg of mushrooms, adding to the family nutrition. By selling the remaining 30 kg of mushroom at the rate of Rs 150.00 per kg, she got Rs 4500.00 as an incremental income. Thus in 3 months time, Nisha was able to earn some income.

Nisha also started vegetable cultivation using agro advisory and new farm techniques learnt in FFS sessions. She sowed fenugreek seed in her 0.30 acres of land in Rabi season between two rows of garlic and cultivated radish on the field bunds. She obtained 7.5 quintals of garlic, 3.8 quintals of fenugreek and 60 kg. of radish. As a result, she earned more than rupees ten thousand from the three crops. The input cost was also low at Rs. 1980 as she had used Matka Khad and pesticides.

Nisha Devi earned additional income through intercropping

She has also generated extra income by following intercropping method. She intercropped garlic crop with ladies finger, sponge gourd and maize crops. By this, an additional amount of Rs.12600 was realised. Further, she also harvested 1.1 quintals of Sponge Gourd and 1.5 quintals of lady's finger and earned Rs 7800 by selling it in the market.

Nisha says, "Seeing this success, my husband started supporting me in my farming activities. This encouraged me to initiate farming in 1 acre of silted land in December. We adopted various farm-based techniques to bring back the soil fertility. These include self-prepared compost, line sowing methodology, retaining soil moisture using leaves of local plants".

She dug one-inch-deep pit with a diameter over 12 inches and put homemade compost into it. Further, Sponge Gourd and Bottle Gourd was intercropped with Watermelon considering line sowing method (maintaining a 2-meter distance on one side of land). To retain the moisture, she cut the branches of Watermelon and spread 1/2-inch-thick layer all over the field. This reduced the cost of irrigation. She also saved on the labour for weeding, as weeds did not accumulate in the field due to mulching. The practice helped crops grow without making contact with soil and sand and thus reduced the chances of crop rot.

By using the weather related information, she reduced her irrigation cost and the damage caused by rain. As a result, during lockdown, she earned an amount of Rs. 28500.00 by selling Watermelon, Bottle Gourd and Sponge Gourd produced in their silted land.

Today, Nisha Devi has become a master trainer of Rajwatiya village. Inspired by the easy method of mushroom production, she cheerfully and proudly promotes mushroom farming as an alternative source of income. She says, *"mushroom cultivation has the potential to improve the socio-economic condition of farmers and can help solve employment problems in both literate and illiterate rural areas. She adds that for women, this can well be a boon. It is a women friendly profession where women can utilize their time without sacrificing their household responsibilities"*.

Early weather forecast information and agro advisory helped her a lot in decision making and planning for their seasonal crops. Nisha Devi has succeeded in cultivating her silted land by adopting the resilient practices, using digital technology and natural resources and serves as a role model for other farmers.

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Resilient farming

The one-acre model

B M Sanjana

Farming can be remunerative even from an acre of land holding, when practiced through natural methods, utilizing natural resources to the optimum. Thammaiah, a farmer in Karnataka shows how small farmers can make a decent living adopting the multi cropping system, through his one acre model.

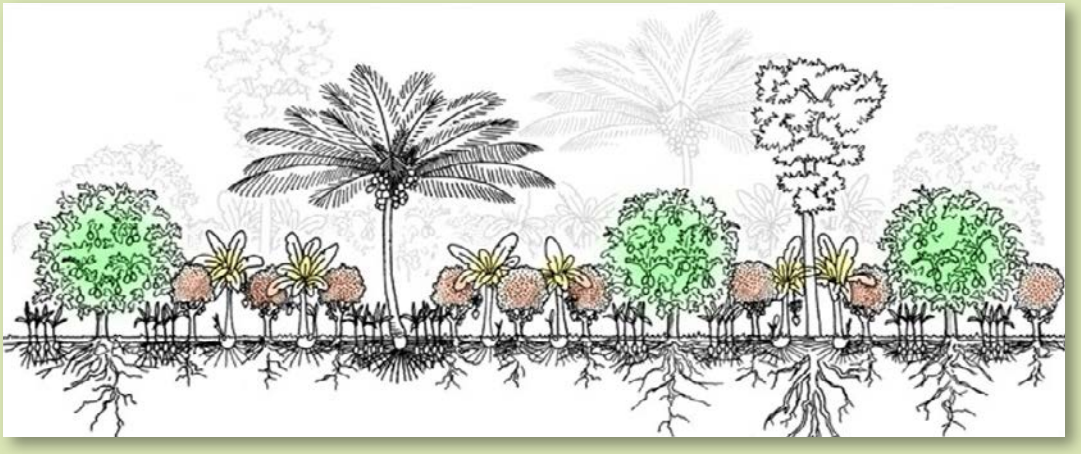
Mr. Thammaiah of Chowdikatte village, Hunsur taluk, Mysore district, is an innovative farmer, practicing natural farming since four decades. He inherited his farm from his father who practiced chemical farming. But Thammaiah, being a graduate and aware of the ills of chemical farming, moved towards natural farming approach.

Thammaiah owns 24 acres of land. About 16 acres are under orchards - a mix of mainly 800 coconut trees, intercropped with sapota, banana, mango, ginger, turmeric and seasonal field crops. Crops are cultivated organically in traditional rotation. About one acre is exclusively kept for raising nurseries of plantation crops, forest crops, fruit crops and timber crops. The saplings raised in the nursery are in great demand and serve as an income generation activity for the farmer.

There are 6 farm ponds, extending over an area of 6 acres. On the bunds, bamboo, cluster fig trees and fodder

Water in farm ponds helps in recharging ground water

Fig 1: One side view of one acre model plot



crops are grown. His farm receives an average annual rainfall of 770 mm, around 53 rainy days, mostly during the Southwest monsoon. Water in the ponds is used for irrigating land, when necessary. When left unused, pond water helps in recharging ground water. Though he is against pumping out water, during summer he uses 5HP motor to lift water for irrigation.

Fishes are reared in one of the 6 ponds, which is additional source of income for the farmer. Also, Thammaiah rears livestock, which he considers important to practice organic farming, besides being a source of income. Around 11 cows (8 Malnad gida and 3 Hallikar), 4 calves, 3 sheep, 12 goats, 2 turkey hens and 4 local hens are reared on his farm. Turkey hens act as predators to snakes.

One acre model plot

With growing population and declining farm holdings, Thammaiah realized that it was becoming increasingly difficult for small farmers to make a decent living out of farming. This was especially true with monocropping using conventional methods of cultivation. In 2019, he visited Shri Siddhagiri Math, Kaneri, Kolhapur, where he learnt about one acre model plot. He felt that if he could show how one could be self sufficient with an acre of plot, it could help farmers with limited resources to make a living from agriculture. This was the beginning of the development of one acre model on his farm.

In 2019, Thammaiah learnt multilayered farming technique. In this method, plants of different heights are grown on the same field at the same time to optimize the use of natural resources like land, water, sunlight etc. It is a self-sustaining technique as by the time the first crop is harvested, the second crop is already getting ready to be cut. Since the plants are growing in close proximity with each other, the amount of water required for one crop is sufficient to cover two or more crops, thus saving water.

Thammaiah's experiment began with coconut trees. He first planted coconut trees (tall) on the east and west side of the field at a distance of 30 feet. In between two coconut trees, he planted a sapota tree (medium tall with more canopy). In the space between the coconut and sapota, he planted a banana tree (medium height) (2nd layer). Below the coconut trees, he has planted black pepper and betel vine. In between these trees, he planted spices ginger & turmeric. In the third layer north and south side of the field, he planted trees like mango, guava, papaya, jamun, jackfruit. Under these trees are planted noni plant, passion fruit, ramphal, lakshman phal, lemon tree, and minor fruit trees as next layer (Fig 1).

He has also planted green leafy vegetables, seasonal vegetables and millets. They prevent the growth of weeds by covering the soil. Below the ground, ginger, turmeric, yam, cassava and sweet potatoes are planted. Sweet potatoes are grown mainly to attract rats and save other crops. The system involves symbiosis, each plant helping the other to grow. Turmeric controls the bacteria growth due to its antimicrobial properties, vegetables prevent weed growth and spices are in between as they require less sunlight.

Glyricidia, drumstick, sesbania, Milliea dubia are planted as fence crops. All plants have various qualities. While glyricidia fixes nitrogen in soil, leaves and seeds of drumstick and sesbania are used for culinary and

Group method of banana cultivation, an innovative method

medicinal purpose. Also the leaves serve as organic manure to the soil. Whenever, Thammaiah visits the one acre plot, he harvests the leaves and leaves it on the ground, which serve as green leaf manure and a mulch. Around one kg of glyricidia leaves spread on the soil holds around 120 litres of rain water, thus helping in water conservation.

The other plants include 80 medicinal plants, coffee and other minor fruits. With abundant flora on the plot, to enhance pollination, Thammaiah also set up beehive units in the one acre model farm. Jeevamruta, an organic preparation (See Box 1) is stored in drums and placed in the model farm. Crop debris for compost preparation is also stored in the model farm. Weeding, ploughing and intercultivation are not practiced in one acre model farm.

Thammaiah has also demonstrated biological pest management in the model farm. For instance, oil of *Terminalia chebula* seed is filled in 2 litre bottle and tied to coconut tree to control Rhinoceros beetle. Similarly, to control monkey menace, Thammaiah places a 2 lit water bottle filled with fish sambar with fish pieces, on the coconut tree. Monkeys get repelled owing to fish smell.

Box 1: Jeevamruta preparation

Put 200 liters of water in a barrel then add 10 Kg fresh local cow dung and 10 liters cow urine. Add 2 Kg of Jaggery, 2 Kg of pulse flour and a handful of soil from the bund of the farm.

Stir the solution well and let it ferment for 48 hours in the shade. Now jeevamruta is ready for application. 200 liters of jeevamruta is sufficient for one acre of land.

Thammaiah being an innovative farmer has tried out a number of innovative ideas on his farm, like the selection of coconut saplings, group method of banana cultivation etc., (Box 2), which he shares with the farmers who visit his model farm.

Benefits and returns

Through multi-layer farming, around 200 varieties of plants including 80 medicinal plants, Coconut, Sapota, Banana, Guava, Jackfruit, millets, Leafy vegetables, Mango, tuberous and root crops to fodder crops are grown on just one acre. Multitier cropping systems result in dynamic interactive practices aimed at better use of the production components such as soil, water, air space, solar radiation and all other inputs on sustainable way.

One acre farming requires less usage of water, thus can be implemented very effectively in drought prone areas. To begin with, water usage goes down significantly as shrubs, vines and vegetables retain the water and the shade by large trees further prevents evaporation. *"If in one acre, a conventional farmer uses more than 20,000*

Box 2: Innovations in plantation and fruit crops

Selection and raising of coconut saplings: Trees which are 40 years old and where it looks like spherical crown (like full moon shape), should be selected as mother tree. Fallen coconut seed nuts from mother trees should be collected and kept for 3 months in small pond. Then half floated, half dipped nuts should be selected for seedling raising. Nuts should be soaked in Jeevamruta (Box 1) and then pretreated nuts are placed in nursery bags for saplings.

Group method of Banana cultivation: Thammaiah has maintained 10 varieties of banana *i.e.,* Robust, Nendran, Ellakki Bale, Rasabale, Sambar bale, Kadbale, Marabale, Kempu / Raja bale, and G9. After harvesting the bunches, the pseudo stem is left in the field. The potash present in the pseudo stem is absorbed by the newly emerging suckers and there would be no need to apply potash or fertilizer to the plants.

Dried leaves are left on the ground to serve as mulch

liters of water per rotation, I need less than 6,000 liters," says Thammaiah.

Another benefit of this model is getting yield round the year since he grows crops that have different harvest periods. The model results in food, nutrition and income security. For example, Thammaiah uses millets for household consumption, which provides both food and nutrition security to the family. Value addition is made for some portion of the millet harvest. He produces around 20-25 kgs of millet powder, using traditional stone grinder, ensuring the nutrients remain intact. This, he sells under the brand name, Arogya Spoorthi and gets income to the tune of Rs.50000 per year. From horticulture trees like coconut, sapota, banana and black pepper, he earns roughly Rs.10 lakhs annually, from the one acre model. Additionally, he earns by selling "Kapha Churna" prepared from medicinal plants and selling dried bananas, which are prepared from unsold bananas.

He also maintains good will by sharing produce like vegetables, mangoes and jackfruits from his farm with friends and visitors to his farm.

His farm produce is chemical free and healthy, which is the overriding benefit of growing organically. Thammaiah has proved that it is possible to make farming profitable even from one acre land, if it is grown managing natural resources properly, using less external inputs and adding value to the produce, where possible.

Beyond cultivation

Thammaiah has not only created a sustainable model, but has also been inspiring farmers who visit his farm to practice it. Around 20-30 people visit his farm every week. Recently, students from Agriculture and Horticulture university and Vidyavardhana college in Mysore, visited his farm.

Thammaiah also educates what he practices. He organizes training once a month to those interested. Generally 50-100 farmers get trained on his farm. He also guides and provides training on farm management to the youth residing around Hunsur area. While providing free accommodation and food, he also pays Rs.500 per day for training these youth.

He has also guided 70 farmers in setting up one acre model. This includes farmers from Kanakapura taluk, Nanajagud taluk, Mysore and Channapatna taluk.

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