



CARBON CREDITS: A SOLUTION TO ENABLE CLIMATE-RESILIENT AGRICULTURE

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Acknowledgements

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Executive Summary

With the impact of climate change mounting, being the third largest emitter of greenhouse gas is no longer a sustainable option for India. While efforts to move to a more green economy have been outlined by India's Nationally Determined Contributions (NDC) to 'reduce emissions intensity of its GDP by 45% by 2030 from 2005 level', this journey is fraught with challenges (India's NDC Submission to UNFCCC August 2022).

A significant change that could accelerate it, would be to address the backbone of the Indian economy, which also contributes significantly to emissions: agriculture. To solve the current challenges and barriers to adopting climate-resilient practices in agriculture, focusing on the challenges faced by smallholder farmers (SHG) will be key. There needs to be a push towards enhancing understanding, sharing technical knowledge, providing remunerative benefits, and reducing high costs in the initial adoption of emission-reducing activities, especially for SHGs.

The commodifying of carbon through the use of carbon credits at the farm level could be a potential solution. With the understanding of carbon credit markets evolving in the last few years, voluntary demand for these credits, generated through carbon sequestration across various sectors, has been rapidly growing globally (Taskforce on Scaling Voluntary Carbon Markets 2021). Even India has recently latched onto carbon markets by passing the Energy Conservation (Amendment) Bill in 2022, setting forth a plan to regulate high emission sectors like energy, manufacturing and cement (Moneycontrol News 2022). Based on the success and efficacy of implementing carbon markets across these sectors, the agriculture sector could benefit from any best practices and learnings that emerge.

Carbon credits have the potential to enable SHGs particularly, by generating a supplemental revenue stream for them, enticing more financing and investments in climate-resilient projects and establishing a carbon trading platform for greater transparency and trust amongst all stakeholders.

However, India still has a long way to go towards establishing carbon as a commodity, as this would require the right mix of stakeholder support. For example, national-level authorities would need to set carbon at a standard price, these credits would then need to be traded on platforms by vendors and accepted by farmers as any other agricultural commodity like sugar or cotton. Some key recommendations that could mutually enhance stakeholder support and bolster the adoption of carbon as a commodity include:

- Involving more carbon project funders and developers in agriculture to influence more capital investments and fund training and awareness campaigns for end-level stakeholders and farmers.
- Introducing agencies that standardise carbon credits through proper verification and evaluation mechanisms.
- Involving policy-makers and government authorities to establish carbon policies to promote trust amongst stakeholders.

Sequestering Carbon: Toward Making Indian Agriculture Climate Smart

Currently, India is the world's third-largest emitter of greenhouse gases (GHG) with over 2.4 billion metric tonnes of carbon dioxide emissions in 2020 (World Population Review Database 2022). To redress this situation, the Government of India has set NDCs in line with the UN's climate targets for the world and committed to 'reduce emission intensity of its GDP by 45% by 2030 from 2005 level'.

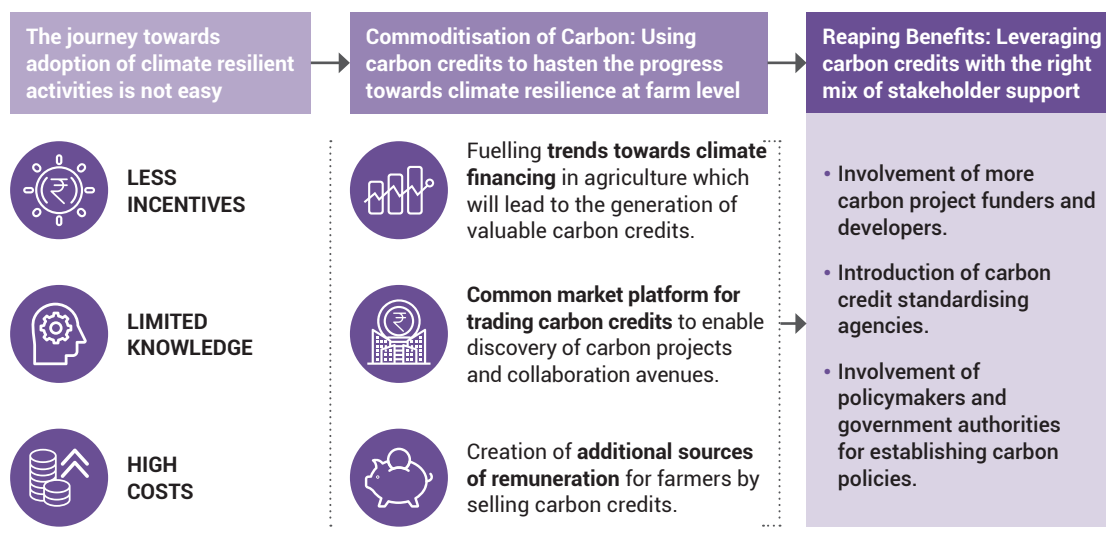
Following the manufacturing and energy sectors, which are the primary contributors to India's emissions, is agriculture. The Agriculture, Forestry and Land Use (AFOLU) sector of India contributes significantly, nearly 18%, to India's GHG emissions. Currently, most agricultural activities like stubble burning, rice cultivation, and livestock production are carbon-intensive. Rice cultivation is estimated to contribute the highest amount of GHG emissions with more than 72 million metric tonnes (MMT) of carbon dioxide in 2018 (Gurprasad et al. 2018). Additionally, the need to solve food insecurity and unresolved hunger problems, with 14% of the population being undernourished, has led the Government to allow for more agricultural activity overall to increase output (The State of Food Security and Nutrition in the World 2020). Unfortunately, these two factors coupled together mean that India's carbon footprint is rising.

There is considerable potential within the agricultural landscape to drive change for India's economy and enable it to achieve set climate targets.

Making Indian agriculture sustainable and encouraging farmers to adopt more climate-resilient and low-carbon solutions at scale, is clearly the way forward for the Indian economy. As India aspires to be a \$5 trillion economy, we must not rely only on foreign and domestic investments that drive growth, but also align our ambitions with the tailwinds of climate choices.

Yields in rice and wheat are likely to decrease by 6-10% by 2030 and 40% by 2080. (Juneja & Gulati 2021) India could bring down farming emissions with improved water management across 20 million hectares of irrigated rice fields, better livestock feed and manure management for 25% of the cattle population, and eliminate rice-crop residue burning. Active and aggressive employment of carbon sequestration in Indian farms can aid these measures. Improved management of agricultural land with known, low-cost practices has the potential to both reduce net GHG emissions and act as direct sinks of carbon dioxide. Research also shows that on-farm soil carbon sequestration can potentially sequester all of the globe's current annual global greenhouse gas emissions of roughly 52 billion metric tonnes of carbon dioxide (Rodale Institute n.d.).

Figure 1: Moving towards climate resilient agriculture using carbon credits at farm level

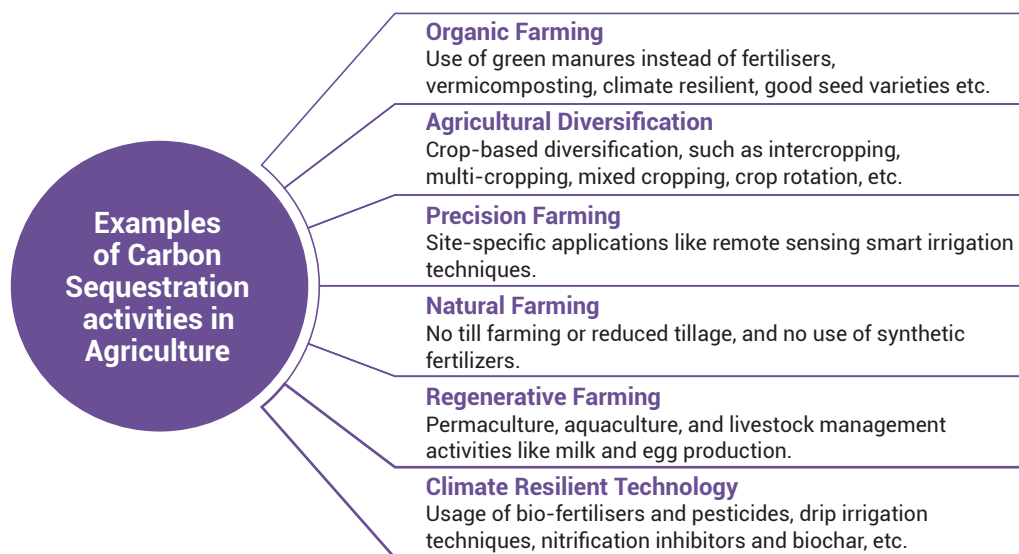


(Sattva 2022)

The Journey Towards Climate Resilient Agriculture Will Be Challenging

The agricultural activities in India that lead to the highest emissions include the use of **nitrogenous fertilisers** on Indian farms and **livestock activities** in allied sectors. To minimise or offset the effects of conventional agricultural practices, several **alternative agricultural practices** have emerged as potential solutions, as shown in *Figure 2*.

Figure 2: Carbon sequestration activities in agriculture



(Sattva 2022)

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To create an enabling environment for the increased adoption of climate-resilient practices in Indian agriculture, steps have been taken by various stakeholders.

- **Government and policy-led promotion of alternative and climate-resilient activities with an increased focus on organic and natural modes of farming.**

At the central level, the National Mission on Sustainable Agriculture (NMSA) focuses primarily on scaling up sustainable, climate-conscious farm activities. NITI Aayog has also led focused interventions to set national goals for allocating lands specifically for natural and organic farming methods. Indian states like Andhra Pradesh are engaged in scaling up natural farming through central and state government interventions and budgetary allocations under the Zero Budget Natural Farming initiative, which has potential for replication in other states (Andhra Pradesh Community Managed Natural Farming 2022). Sikkim which is India's first fully organic state has also received tremendous support from both the central as well as state governments (Ministry of Agriculture and Farmers' Welfare 2016). Governments in states like Odisha, Karnataka, Chhattisgarh, Telangana, and Tamil Nadu are also incentivising the production and promotion of millets, as an alternative to high-emission crops like rice.

- **Privately led anti-emission initiatives, which are increasingly focusing on innovation and resource conservation techniques on farms.**

Across India, there are private institutions that are leading by example. In Tamil Nadu, Auroville practices permaculture and natural farming over six acres, in Haryana, Ananda is converting barren land to a permaculture-based food forest with 4,500 trees, and in Telangana, Aranya has converted the land into a food forest through permaculture, water harvesting and percolation techniques (Villupuram District Administration 2022; Gupta & Gupta 2022; Aranya Agricultural Alternatives 2022).

Apart from this, global food and agribusiness corporations like PepsiCo, Coca-Cola, Unilever, and more, with their huge and ever-expanding supply chains across countries, have increasingly been focusing on making their processes environmentally sustainable. Various measures are being adopted, such as setting supplier requirements to procure through regenerative farm practices, and establishing processes in the value chain for conservation of resources while integrating sustainability across all business functions.

Despite this trend of stakeholders adopting and engaging with climate-friendly agricultural practices, there are limitations to their adoption in India. Many of these activities are yet to be mainstreamed when compared to the ubiquity of conventional modes of farming. Most sustainable agricultural practices in India cover a small fraction of land, with uptake by only around five million of the total of 150 million farmers in India (Gupta et al. 2021). With a lack of proper knowledge or incentives, adoption by farmers is at a low scale, scattered and costly. This is compounded by limited research on sustainable agriculture and assessment of its impact. (Gupta et al. 2021).

The limitations faced when trying to scale **sustainable, climate-resilient and carbon sequestering** activities in the farming ecosystem are as follows:

- **Solving for high costs:** diversified activities bring about less remuneration as compared to conventional ones. The per day household income of SHFs is already low at about \$3.48, which is at par with the minimum wages paid under the Mahatma Gandhi National Rural Employment Guarantee Act 2005. Additionally, there is a high cost associated with sustainable practices. Due to currently low scalability and profits, these activities are less viable in the short-run and are, therefore, adopted only in minor patches across India. The Government of India has set a target to double the income of farmers by 2030 and to hasten this, it is necessary to create alternative modes of remuneration for them (NITI Aayog 2017).
- **Solving for limited knowledge:** most Civil Society Organisations (CSOs) that train farmers in the use of farm inputs and capacity building for sustainable farming activities are active only in Maharashtra, Rajasthan and Madhya Pradesh. The market linkages are currently less efficient and offer limited transparency and information on existing climate-resilient solutions in the ecosystem to all stakeholders, especially farmers. Research on geographical areas is limited to short-term assessments with plot-level focus leading to reduced understanding of the landscape and lower scope for adoption of climate-resilient activities. With the option for the generation of carbon credits from sustainable, emission-reducing agricultural practices, more projects will be reported and standardised and convince farmers to learn from each other more actively.
- **Solving for lack of incentives:** sustainable farm practices have not scaled up effectively due to a lack of ownership, incentives, insurance and risk mitigation measures for farmers at a large scale. Farmers are therefore less inclined to adopt sustainable farm practices. With the emergence of carbon markets and the growing ability to generate credits, which can be traded nationally as well as globally, there is now increased interest in climate-resilient agricultural projects. This is not only peaking amongst farmers, but various stakeholders like project developers, financial institutions and capital investors, whose involvement would drive increased inclination across the ecosystem.

Commodifying Carbon by Using Carbon Credits at the Farm Level

Control over carbon means control over emissions in the atmosphere. Most GHGs, such as carbon dioxide, methane and chlorofluorocarbons, are composed of carbon and its related compounds. Carbon markets refer to a system where carbon is commoditised and the value for carbon is set based on the existing supply and demand of the commodity. This leads to **the emergence of platforms that can essentially trade in carbon to generate revenue and create market-based incentives for the propagation of carbon sequestering at scale.** The

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United Nations had conceptualised such markets, as illustrated in *Figure 3* below, as early as the late 1990s as part of its climate change plans.

Carbon markets, in simplest terms, can be defined as follows:

'Carbon market refers to a market where carbon credits (also called carbon certificates) are bought and sold within defined standards with the aim to prevent or reduce the emission of greenhouse gas emissions.'

(Ulucak et al. 2019)

A carbon credit is a certificate representing the equivalent of one metric tonne of carbon dioxide, that is either prevented from being emitted into the atmosphere, otherwise referred to as emissions avoidance or reduction, or being removed from the atmosphere as a result of a carbon-reduction project or intervention.



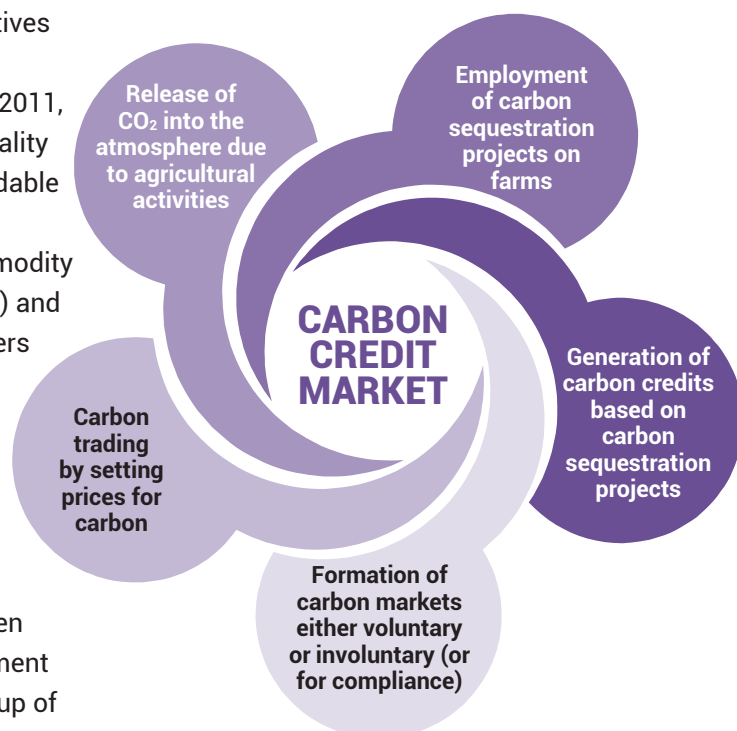
Carbon markets are gaining traction in India.

India has witnessed a rapid influx of private as well as public investments in carbon markets. Currently, most of the demand is driven by voluntary initiatives by corporations, industrial entities, and municipal zones that are interested in meeting certain publicly beneficial or climate-oriented goals.

The Ministry of Environment, Forest and Climate Change has been testing initiatives around the use of emissions trading, in particular carbon trading. Launched in 2011, this programme aims to improve air quality by setting mandates on emissions (tradable on National Commodity & Derivatives Exchange Limited (NCDEX), Multi Commodity Exchange of India Ltd. (MCX) and more) and pollutants, and incentivising stakeholders to reduce pollution. The Central Pollution Control Board and State Pollution Control Boards lent support to this initiative in the pilot states of Gujarat, Tamil Nadu and Maharashtra.

Carbon offset projects in India have been implemented under the Clean Development Mechanism (CDM) which led to the setup of the National Clean Development Mechanism Authority (NCDMA) in 2015. This body gives

Figure 3: Components of a carbon credit market



(Sattva 2022)

approval for CDM projects related to energy efficiency and solid waste management and helps capture their entire life cycle. This experience has enabled India to develop projects that qualify for voluntary carbon credits. Alongside these ongoing compliance projects, projects for carbon offsetting under voluntary standards like Verra and Gold Standard have also emerged rapidly in the last few years.

These steps towards a climate-sensitive future have been promising. The Lok Sabha passed the Energy Conservation (Amendment) Bill in August 2022, to set the course for carbon credit markets at a national level. Currently, the focus is on sectors with the highest emission contributions like power, steel and cement, which can also be followed by the agriculture sector shortly. In anticipation of this, proper strategies can be set in place to secure the feasibility of generating carbon credits at the farm level.



Carbon markets have the potential to enable a sustainability transformation in Indian agriculture.

Customising the carbon market mechanism is valuable to the agriculture sector and promises potential. A variety of stakeholders like farmers, private players, and governments can come together to make this work efficiently. Carbon credits issued to farmers can enable the adoption of many innovative, climate-resilient and sustainable activities to provide scale.

Initiatives centred around the introduction of carbon credits in farms have already broken ground. In 2018, in a pioneering move, the Indian startup agricultural firm nurture.farm sold 20,000 carbon credits in global carbon markets through its dry-seeded cultivation project that conserves water (Ghosal 2022). Recently, a group of stakeholders including The Indian Agricultural Research Institute (IARI), The International Maize and Wheat Improvement Center (CIMMYT), and agriculture firms Mahyco and Indigo Ag worked on building Growindigo.com, a marketplace where Indian farmers can trade agricultural carbon credits (GrowIndigo 2022). Currently active in Punjab and Haryana, these projects will expand to states like Uttar Pradesh, Bihar, Odisha, Chhattisgarh, Andhra Pradesh and Telangana. Another example is the collaborative platform built by Intellecap and Transform Rural India Foundation (TRIF) to bring together SHFs and provide support and training for climate-smart agriculture and agroforestry (Intellecap Advisory Services Pvt. Ltd. 2022).

Building on these nascent initiatives is necessary, and given the stakeholders' interest in deriving value from carbon credits, the following three points effectively summarise the potential of carbon markets for Indian agriculture:

1. There is potential to derive sufficient learnings from other sectors that use the emission trading mechanism.

Most carbon offset projects in India currently focus on energy generation, such as solar, wind, hydro, and biogas. Leveraging insights from these projects, the agriculture sector can understand and anticipate potential challenges in real-life execution. Making the process

more seamless and effective for emerging climate-resilient and carbon sequestering agricultural activities to generate carbon credits.

2. The carbon trading infrastructure at the farm level is undergoing development and growth.

Some platforms have emerged at the farm level to help Indian SHFs leverage climate finance, especially carbon finance, for sustainable agroforestry, climate-smart agriculture and other activities that can result in carbon sequestration and mitigation. Initial infrastructure has been developed in the form of trading exchange platforms, trading platforms, and verification agencies, along with sectoral reporting of energy efficiencies and capacity-building initiatives to raise awareness. Additionally, policy-driven, market-based systems for tradable instruments in the energy sector like Perform Achieve and Trade (PAT) scheme and the Renewable Energy Certificate (REC), are already underway.

3. Both the global and Indian ecosystems can derive increasingly higher value from independent and voluntary trading mechanisms.

The demand for carbon credits could increase by a factor of fifteen or more by 2030 to an estimated total of nearly \$50 billion. Furthermore, it is expected to scale by a factor of up to one hundred by 2050 (Taskforce on Voluntary Carbon Markets 2021). Nature-based credits are in especially high demand with forestry and land use transactions having more than doubled between 2020 and 2021 (State and Trends of Carbon Pricing 2022). Voluntary carbon markets in India can be developed on the existing PAT scheme, and are projected to save about 70 million metric tonnes of carbon dioxide by March 2023 (Bureau of Energy Efficiency 2020). Even from a policy implementation perspective, a carbon tax would be less politically feasible than a carbon market, which can be tailored to accommodate multiple priorities and stakeholder interests. More voluntary carbon markets emerging at the farm level can benefit from this growing trend.



Carbon markets can solve existing challenges within the context of Indian agriculture.

1. Carbon credits can provide additional sources of remuneration and rewards to SHFs.

Carbon markets enable SHFs to generate additional revenue from their non-conventional solutions and generate carbon credits for their efforts. They can sell these credits to organisations that want to offset their carbon emissions and there are a few organisations already doing this. Microsoft intends to purchase these credits and compensate the farmers. The Terraton Initiative by IndigoAg, an agricultural technology company, aims to reduce emissions by using regenerative practices. This initiative has sequestered around 40-60 MMT of carbon dioxide emissions and promised returns of around \$15 per 1 metric tonne of verified carbon dioxide emission offset (Gullickson 2019). Cargill has set up a programme employing carbon sequestration techniques on farms that would lead to around \$30 to \$45 carbon payments per acre (ESG & Climate Research, S&P Global 2022). Similar techniques, if employed across Indian farms, could provide additional income avenues for farmers.

Carbon markets thus facilitate predictable, least-cost emission reductions, and prices which are competitive and decided by market forces, enabling a smooth transition toward a sustainable future for India.

The National Indian Carbon Coalition shares their view on the economic viability of carbon credits: "The value of carbon credits varies according to market conditions, which are driven by supply and demand. This impacts how much money nations can earn from carbon sequestration activities. Assuming an average market value of \$10 per credit, and a 10,000-acre project, projected revenues are quite significant. For example, prairie restoration might generate \$100,000 per year, while planting trees on grazing land could produce \$200,000 per year. These are just rough estimates. The real viability of a project is based on the number of credits produced, not the amount of land involved."

2. Carbon credits can incentivise the financing of climate-resilient and low-carbon projects in agriculture.

The introduction of financial products to fund projects capable of generating carbon credits would lead to a better flow of capital toward climate-smart agriculture. Banks and non-banking financial institutions can generate a stream of financial products with provision for the inclusion of climate-resilient funds with special features for farmers. This will incentivise involvement in such projects due to easier entry into the market and support with associated costs or risks. Currently, most philanthropic funding directed at climate change in India is led by banks, public sector enterprises, and a handful of heavy capital private players.

If the system were to reward climate-resilient activities and if farmers were to see value in generating carbon credits through certain projects, banks and other financial institutions would be motivated to drive efforts toward blended financing, integration of climate-resilient funds into financial products, and availability of more risk mitigation and insurance products for farmers. This would help strengthen farmers to overcome the challenges and risks that long-term commitments and gestational periods that sustainability projects usually involve.

3. Carbon trading platforms can enable the discovery of efficient and collaborative market platforms at the farm level.

Currently, sustainable solutions within the agricultural ecosystem are not sufficiently visible to all market stakeholders. Indian carbon producers are unable to reap benefits due to poor awareness about climate and carbon financing mechanisms, limited technical capacity to design and implement high-quality carbon projects, and the lack of clarity on fair price sharing and legal arrangements, among other aspects.

There is a need for a platform that would enhance the capacity of SHFs to effectively participate in the voluntary carbon market. Farmers do not know where to get revenue for their credits, and investors or buyers of credits are not sure where they can buy carbon credits or how to discover and map them effectively. The creation of standardising agencies to assess the efficacy of projects can also improve their impact. Moreover, carbon trading

platforms at the farm level can increase the supply and demand for carbon credits derived from low carbon solutions in agriculture, increasing visibility and transparency for all stakeholders, including farmers.

Leveraging Carbon Credits Requires Multistakeholder Support

Leveraging carbon credits at the farm level with the right mix of infrastructure and on-ground support to farmers will help maximise the benefits. Carbon markets have potential, but they also face some challenges which need to be solved for them to scale. Some recommendations for the way forward are:



Involving more carbon project funders and developers in agriculture.

For implementing effective carbon farming projects at the minimum level of scale required, more capital and interest needs to be driven toward carbon sequestering projects on Indian farms, to help them generate carbon credits.

Agricultural projects require a certain minimum threshold to be met, for them to be deemed to be at an optimum scale and to make them remunerative and large enough to cover costs. Moreover, they have large gestation periods. For example, in most cases, farmers would be required to commit to farmland for ten to fifteen years. Farmer Producer Organisations (FPOs) and cooperative models, in collaboration with private stakeholders, can strengthen efforts to drive up the scale of such projects, enabling the generation of a good amount of carbon credits.

In general, a particular project would be deemed to have sufficient ability to generate carbon credits and be worth pursuing, as per projects from the energy sector, if they can demonstrate having a quantum of 100,000 Certified Emission Reductions (CER). To bring the required scale and investment toward these projects, the creation of collaborative platforms that bring many farm-level stakeholders in touch with carbon credit buyers will be helpful.



Introducing agencies that standardise carbon credits.

Standardising organisations, which are exclusive to carbon market mechanisms, can help farmers generate credits through proper project evaluations and help in simplifying difficult terminologies and jargon. Farmers need to be made aware of the long-term benefits of investing in carbon projects and the utility of carbon markets. The process can be aided by organising engagement-driven events to foster ongoing communication and dialogue with stakeholders. These could be in the form of workshops or round tables, with industry experts, auditors, registry operators, accreditation agencies, academics, civil society and other relevant government ministries.



Involving policy-makers and government authorities to establish carbon policies.

The primary role of policy-makers will be to establish protocols and certification mechanisms to accurately verify carbon offsetting efforts. The government can enable a national platform so that carbon has a standard price and revenue and is not skewed or scattered. In the long run, compliance mechanisms will help build overall trust in the system. Effective avenues for remuneration should be provided to farmers for minimising input costs through subsidies, and for easier procurement of credits and loans through blended financing and risk mitigation schemes. Including carbon prices in Minimum Support Prices (MSPs) can help farmers realise effective returns.

Conclusion

Carbon credits have the potential to solve issues faced by smallholder farmers in India to adopt climate resilient and emission-reducing activities at scale. They, however, require an optimal mix of suitable infrastructural arrangements and strategic stakeholder support. With increasing involvement of funders and investors in carbon farming projects, the potential to reach the threshold to scale carbon credits becomes more of a reality. This along with proper evaluation of projects through standardisation and verification agencies will help to make the use of carbon credits more normalised. Lastly, the investment of the Government in carbon markets, through national-level pricing and trading policies for carbon, would enable long-term trust in the carbon market ecosystem. Farmers would then be able to actively participate and adopt more low-carbon technologies on farms in the future. Collectively this matrix of stakeholders, who would enable investments, herald standardisation and push for adoption, will help to pave the way for commodifying carbon as a viable solution to make Indian agriculture more climate resilient and sustainable.

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