Framework for Voluntary Carbon Market In Agriculture Sector

सत्यमेव जयते

Department of Agriculture and Farmers Welfare
Ministry of Agriculture and Farmers Welfare

Framework for Voluntary Carbon Market In Agriculture Sector

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Ministry of Agriculture and Farmers Welfare
Government of India
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अर्जुन मुंडा
Arjun Munda

D.O. No. 1144 /AM

सत्यमेव जयते

मंत्री
जनजातीय कार्य मंत्रालय एवं
कृषि एवं किसान कल्याण मंत्रालय
भारत सरकार
Minister
Ministry of Tribal Affairs and
Ministry of Agriculture &
Farmers Welfare
Government Of India

MESSAGE

It gives me immense pleasure to know that the Ministry of Agriculture and Farmers Welfare is releasing the "The Framework for Voluntary Carbon Markets in Agriculture Sector". The Government has taken several initiatives to revitalize agriculture sector and unlock its potential to benefit the farming community in India. In recent years, Indian agriculture has embarked on a transformation journey, building on technology to be ready for the future. The emphasis on promoting organic cultivation and regenerative farming seeks to make agriculture sustainable and remunerative for farmers. While the sector secures food for the nation and provides employment to a large section of the people, unsuitable land management practices in agriculture is also contributing to the country's carbon emissions.

India has announced its climate goals in the Nationally Determined Contribution (NDC) and seeks to reduce Emission Intensity and achieve Net Zero by 2070. The evolving carbon markets globally provides an opportunity for agriculture sector to tap the benefits of such financing as well as contribute to the national goals for emission reduction through positive action.

This framework document presents a compelling vision of how we can transform this challenge of emissions from the agriculture sector into an opportunity — a remarkable chance to embrace climate-resilient and agroecological farming practices that will not only mitigate climate change but also enhance the well-being of our farmers, improve soil health, and secure our nation's food security. Through this comprehensive framework, it is endeavoured to unlock the vast potential of a voluntary carbon market (VCM) within our agricultural sector. This forward-looking initiative not only contributes to achieving our NDC targets, to UNFCCC, but also represents a dynamic ecosystem that actively promotes and rewards sustainable agricultural practices across our diverse landscape.

Beyond economic dividends, this initiative embodies shared environmental responsibility, inviting all stakeholders to participate in a transformative movement that leaves a lasting impact on the environment and uplifts local communities. It underscores our unwavering commitment to sustainable development goals, rural livelihoods, and climate resilience, charting a course towards a brighter and more sustainable future for our agriculture and our nation.

(Arjun Munda)

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MANOJ AHUJA
SECRETARY

सत्यमेव जयते

आज़ादी का अमृत महोत्सव

भारत सरकार
कृषि एवं किसान कल्याण मंत्रालय
कृषि एवं किसान कल्याण विभाग
Government of India
Ministry of Agriculture & Farmers Welfare
Department of Agriculture & Farmers Welfare

MESSAGE

I am delighted to present the "Framework for Voluntary Carbon Markets in Agricultural Sector". This document outlines a trans-formative pathway that combines our nation's agricultural prowess with our commitment to environmental stewardship and climate action. India's agricultural landscape is vast, diverse, and rich, and it has been a cornerstone of our nation's growth and sustenance for centuries. It provides livelihoods to a significant portion of our population and is vital for ensuring food security. However, it is incumbent upon us to address the environmental challenges associated with the sector arising out of degradation of agricultural land, loss of productivity and greenhouse gas (GHG) emissions.

It is imperative that we transform this challenge into an opportunity, and this framework offers a roadmap to achieve just that. The proposed voluntary carbon market (VCM) for agriculture is a key initiative, that has the potential to provide a unique platform for our farming community and landowners to not only adopt sustainable agricultural practices but also earn revenue by selling carbon credits to those individuals and companies seeking to offset their carbon emissions, thereby potentially creating a self-sustaining cycle of environmental protection and economic growth. Agroforestry also has vast potential to generate substantial carbon credits, unlocking economic opportunities worth billions of dollars in the coming decades.

The Framework aims to make VCM more accessible to farmers with coordinated and synergistic actions from all the stakeholders. The Ministry will also facilitate dissemination of information to farmers about the benefits of accessing VCM with the support of various stakeholders.

I endorse this framework for its potential to bring about a paradigm shift in our agricultural practices and carbon mitigation efforts and urge all stakeholders to actively engage in its implementation. Together, we can make a significant difference in our battle against climate change, while also benefit farmers from the potential of the carbon markets.

I extend my gratitude to all those who have contributed to the development of this framework and to all those who will join hands in its realization. Let us work collaboratively towards a sustainable, resilient, and prosperous future for agriculture sector.

(Manoj Ahuja)

October 06th, 2023

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Faiz Ahmed Kidwai, I.A.S.
Additional Secretary
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आज़ादी का अमृत महोत्सव

INTERNATIONAL YEAR OF MILLETS 2023

G20 भारत 2023 INDIA वसुधैव कुटुम्बकम् ONE EARTH • ONE FAMILY • ONE FUTURE

MESSAGE

I proudly present this document detailing the country's first step towards, how an ever-evolving voluntary carbon market (VCM) could be brought closer to the farmers of India. In an era where the need for environmental stewardship resonates more profoundly than ever, this framework exemplifies India's commitment to proactive climate action without compromising on the immediate needs of food security and nutrition. Emissions from agriculture practices would be greatly influenced by the changes in dietary, purchasing power and pattern of demand of the people driven by economic development and progress of the country. At the same time, India's agriculture sector holds the potential to become a significant repository of carbon.

Creating a voluntary market for carbon sequestration or emission reduction in agriculture would help in adoption of climate friendly practices, so far not considered economically viable. Additionally, the framework would throw rural market open to funds flowing in, based on the emissions mitigated. Institutional initiatives like JAM has made farmers ready to take advantage of the Direct Benefit Transfer for accessing carbon finance. This would incentivise the farmers to adopt beneficial agriculture practices, aligning the sector to our climate goals and welcome organizations to invest in the agriculture sector, benefitting the nation's backbone.

This document provides a framework for developing a VCM for the agricultural sector in India keeping in view the present circumstances, potential and future opportunities of the sector. The framework also explores creation of a sector specific registry, using available methodologies, learnings and experiences, and addresses barriers that create risks for penetration of VCM in the sector.

I hope this document will serve as a useful guide for policymakers, practitioners, researchers, and stakeholders who are interested in developing and implementing VCMs for the agricultural sector in India. I also hope that it will encourage more farmers and landowners to join the VCMs and contribute to our national and global climate goals.

(Faiz Ahmed Kidwai)

Acknowledgement

Indian Agriculture is highly vulnerable to climate change with about 50% of cultivated areas under rainfed conditions. Often, the country is experiencing frequent extreme weather events which has the potential to cause sizeable loss of yield and income to the farmers at micro scale and to the nation's economy at macroeconomic level. Inter-Governmental Panel on Climate Change's (IPCC) report on global temperature increase could be the major challenges for sustainable agriculture in the coming years. Therefore, Government of India has accorded high priority on climate action in agriculture sector which is manifested through National Mission on Sustainable Agriculture (NMSA).

Voluntary carbon market is emerging and has demonstrated to have immense market potential already. The Kyoto Protocol adopted in 1997 followed by Paris Agreement, which was adopted in 2015, aim to strengthen international cooperation on climate action. Article 6 of Paris agreement provides for creating global carbon market.

For India, Voluntary Carbon Market has a huge potential in agriculture sector with 60% of the country's geographical area under cultivation. The programs under NMSA promotes sustainable agriculture practices and farming methods with the potential for carbon sequestration and reducing emission. The framework for the voluntary carbon markets in the agriculture sector would support development of a market-based mechanism to incentivize sustainable agricultural practices. Farmers can embrace regenerative farming, promote agro-ecology and get benefits from carbon credits.

In order to develop the framework for carbon market, a separate Cell was created in Natural Resource Management (NRM) Division in the Ministry. Wide consultation was done across stakeholders while working on the framework. A core committee was then constituted to come out with the draft framework. The contribution of all stakeholders, senior officers of the Ministry, members of the carbon cell and the core committee deserve appreciation without which developing the framework would not have been possible.

The framework brings out the farming methods practiced in the country and the potential of carbon sequestration and the market-based mechanism which can be easily understood. It also highlights the importance of the role of farming communities including FPOs, SHGs, WUAs, farmers cooperatives etc. in the VCM ecosystem and how best their services can be leverage for carbon market.

I sincerely thanked Secretary (DA&FW) and Additional Secretary (NRM) who continuously enlightened the team with ideas and experiences on the subject throughout the exercise. I also thanked specially members of the carbon cell, especially the core committee and all the people who contributed to developing the framework. I believe that the framework will provide meaningful guide to farmers, farmers groups, carbon credit promoters and buyers in their road to progress.

Joint Secretary(NRM)
Ministry of Agriculture & Farmers Welfare

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List of Acronyms

1. CBOs - Community-Based Organizations
2. CCBA - Climate, Community and Biodiversity Alliance
3. ER - Emissions Reductions
4. FPIC - Free, Prior and Informed Consent
5. FPO - Farmer Producer Organization
6. GDP - Gross Domestic Product
7. GS - Gold Standard
8. MoA & FW - Ministry of Agriculture and Farmers' Welfare
9. NGO - Non-Governmental Organization
10. NTFP – Non-Timber Forest Produce
11. SHG - Self-Help Group
12. SOC - Soil Organic Carbon
13. VCM - Voluntary Carbon Market
14. VCS - Verified Carbon Standard

Introduction

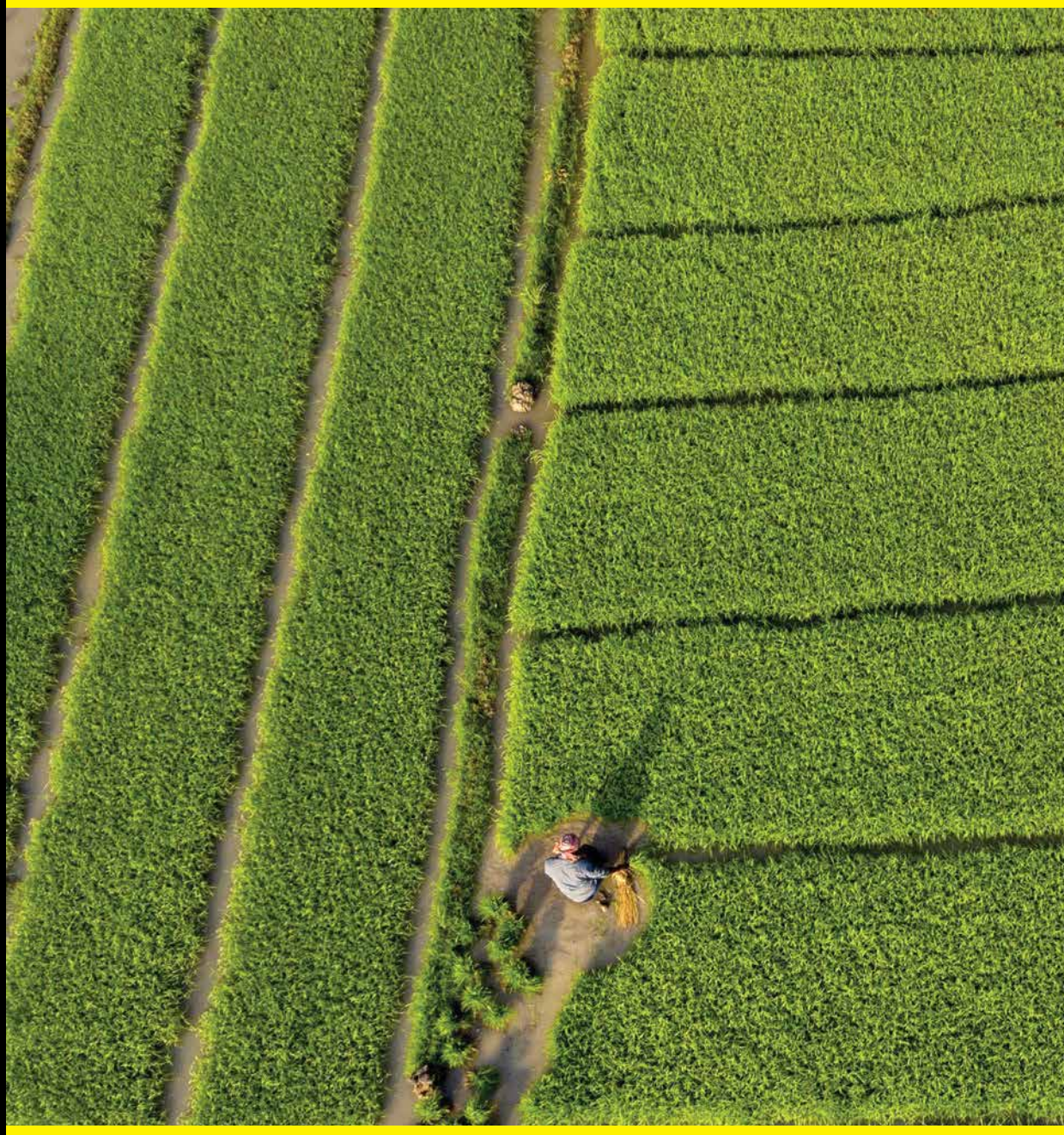
India is home to one of the largest agricultural sectors in the world contributing significantly to the country's economy and livelihoods to millions of people. The country's economy is highly dependent on agriculture with 54.6 % of the total workforce engaged in agriculture and allied sector activities. The sector accounts for 18.6 % of India's GVA. At present, forests cover 23% of the total land available, while agricultural land accounts for 59%, and the remaining 18% is used for non-agricultural purposes, grazing land, and unproductive land[1]. As per the Land Use Statistics 2018-19, the total geographical area of the country is 328.7 million hectares, of which 139.3 million hectares is the reported net sown area. Given the importance of the agriculture sector, Government of India has taken several steps for development of the sector in a sustainable manner. However, agriculture in the country is also faced with situation of excess use of chemical fertilizers and pesticides and non-sustainable use of natural resources in some areas. There is a growing need and interest in achieving food production through sustainable agriculture practices.

Natural resources form the capital base for agricultural production with agriculture and allied sectors utilizing the dominant share of natural resources (land, water, biodiversity). In India, 59% of the total geographical area under cultivation utilizes 80-90% of the country's available water resources. Given the considerable impact of the agriculture sector on the livelihoods and the natural resource base, the challenge for Indian agriculture is raising agricultural productivity per unit of land, reducing rural poverty through enhancing on/off farm employment and ensuring sustained agricultural growth to meet the food security and nutrition needs of the country, while ensuring long term food security in the face of population growth and climate change. Enhancing natural capital holds the key for ensuring a balance between agricultural growth, environmental preservation, social equity, and human health.

The Government of India has taken up significant interventions to scale sustainable agriculture practices from the realization that there is a need to balance the economic benefits provided by the agriculture sector while conserving the natural resource base that provides significant ecological benefits. Future agricultural growth can be sustained only by promoting conservation and sustainable use of the dwindling natural resources through appropriate location specific measures. Sustainable farming practices provide unique pathways to maintaining production through conservational measures and sustainable use of the ecological resources and the natural capital, that focus on increasing soil microbial health and organic carbon, water resource availability, biodiversity, etc. Achieving these goals requires moving beyond the thinking of merely increasing "yield per hectare" and instead adopt sustainable practices that not only increase farmer incomes but also promote social equity and environmental management.

Encouraging farmers to adopt sustainable agriculture practices is essential. For sustainable farming, steps such as promoting Voluntary Carbon Market (VCM), Green

[1] https://unfccc.int/sites/default/files/resource/INDIA_BUR-3_20.02.2021_High.pdf



Credit Program (GCP), Payment of Ecosystem Services(PES)etc. provides promising scope of convincing farmers to cover more areas. Such steps have the potential to bring sizeable farmland under sustainable practices.

Sustainable farming supports Mission LiFE (Lifestyle for Environment) actions which makes environmental protection and conservation a participative process. For instance, Agroforestry promotes agroecology and is one of the potential areas for Carbon Credits as well as GCP. Introducing carbon markets to farmers can accelerate the acceptance of eco-friendly agriculture practices while enhancing their financial stability and income. Farmers can adopt sustainable agriculture practices and get additional income from carbon credits/green credits as well as other agro-ecological benefits in terms of improved natural capital such as soil, water, biodiversity etc.

Carbon trading by tapping global VCM markets has started gaining momentum in India. Multiple local initiatives are already running to generate value by selling carbon credits. Accelerated action could generate carbon credits worth a total of $480 billion (₹3,94,405 lakh crores) from 2030-2070, making it a net-positive opportunity if integrated well into domestic carbon markets[2]. For promoting VCM, India could consider creating domestic demand for VCMs, building a robust supply pipeline, and designing a VCM open to international participation. Allowing international trade of carbon credits could improve the financial prospects of VCM projects. It would also be beneficial for the global economy by creating a new source of revenue and incentivizing the adoption of sustainable practices in the agricultural sector.

This document provides a framework for promoting a VCM in India for the agricultural sector bringing out the potential of sustainable agriculture practices for VCM, available methodologies, precedence in other counties and other challenges in VCM. Green Credits can be the additionality for VCM projects. VCM emphasises the benefits of climate resilient and agroecological farming practices as a way to support the incomes of farmers, improve soil health, water and build resilience in the food production systems.

The Framework for the VCM in the agriculture sector in India would support in development of a market-based mechanism to incentivize and finance sustainable agricultural practices. By participating in voluntary carbon markets, farmers and landowners can earn revenue from the sale of carbon credits generated in their farm through adoption of sustainable agriculture practices. This revenue can be used to invest in the scaling up of sustainable practices, leading to a virtuous cycle of increasing carbon sequestration and promoting sustainable agriculture. Voluntary carbon markets also provide an opportunity for companies and individuals to take responsibility and invest in projects that have positive impact on the environment and local communities. In the long run this would contribute to sustainable development goals, support rural livelihoods, and promote resilience in agriculture. VCM can be an important step for driving the sustainability agenda in agriculture for farmers' welfare.

[2] https://www.mckinsey.com/~/media/mckinsey/business functions/sustainability/our insights/decarbonizing india charting a pathway for sustainable growth/decarbonising-india-charting-a-pathway-for-sustainable-growth-full-f.pdf

1. National Mission on Sustainable Agriculture(NMSA)

Agriculture, which contributes to 18% of India's GDP and employs more than 50% of its population[3], forms the bedrock of the Indian economy. However, it is a sector that is both extremely vulnerable to and one of the contributors to climate change. Nearly 50% of agricultural land is highly dependent on rainfall, which over the last decades has become increasingly erratic. Due to extreme climatic conditions, and major crops are expected to see their yield decrease by 10-20%[4], if sufficient adaptation and mitigation measures are not taken. Annual emissions from agriculture come up to 400 million tCO_2e[5]. Various sustainable agriculture practices have been popular in India since the advent of farming.

National Mission on Sustainable Agriculture(NMSA) is one of the nine Missions outlined under National Action Plan on Climate Change (NAPCC). The strategies and program of actions (POA) outlined in the Mission Document, that was accorded 'in principle' approval by Prime Minister's Council on Climate Change (PMCCC) on 23.09.2010. NMSA aims at promoting sustainable agriculture through a series of adaptation measures focusing on eleven key dimensions encompassing Indian agriculture namely;

- Climate ready crops, varieties & resilient practice
- livestock and fish cultures
- Water Use Efficiency
- Pest surveillance and forewarning.
- Agri waste management
- Insurance & Risk management
- IFS, Agroforestry, Bamboo
- Strengthening value chain
- Energy management & Farm Mechanization
- Organic farming
- Soil Health & Nutrient management

During XII Five Year Plan, these adaptation measures were mainstreamed onto ongoing Missions/Programs/Schemes of Dept. of Agriculture & Cooperation (DAC) through a process of restructuring and convergence. Accordingly, NMSA Strategy (2018-30) was formulated in 2018 to encourage all programs of the Ministry to adopt the above adaptation measures. The Vision of NMSA is given as below;

- Bring resilience in agricultural production against climate variability and change
- Conserve natural resources like soil, water, pollinators & biodiversity to achieve sustainable crop and livestock production
- Increase green cover & carbon stocks

[3] https://unfccc.int/sites/default/files/resource/INDIA_BUR-3_20.02.2021_High.pdf
[4] https://krishi.icar.gov.in/jspui/bitstream/123456789/32431/1/GreenhouseGasEmissionfromIndianAgricultureHPathaketal%281%29.pdf
[5] https://unfccc.int/sites/default/files/resource/INDIA_BUR-3_20.02.2021_High.pdf

- Ensure food security and economic stability

The objectives of NMSA includes promoting location specific integrated farming systems & rainfed technologies, conserve natural resources through appropriate resource conservation technologies, adopt comprehensive soil health management practices based on soil fertility status and develop capacity of farmers & stakeholders in the domain of climate change. The objective is to invest more in natural capital(land, water, biodiversity) to achieve sustainable production system.

The Mission also identifies measurable indicators on sustainable agriculture from the activities taken up which includes - Area under organic farming; Production of Bio-fertilizers; Precision Irrigation; SRI/Direct Seeded Rice from Transplant; Crop diversification; Additional Area under plantation in Arable land; Climate Resilient Varieties(CRV) Identified/Released; Identification of genotypes of crops with enhanced CO2 fixation potential and less water consumption & Nutrients; Climate Resilient genotypes with greater adaptation to drought, flood, salinity and high temperature etc.

Carbon credit is the co-benefits of sustainable agricultural practices. A voluntary carbon market will provide farmers adopting sustainable agriculture to participate in carbon projects and earn additional income. VCM, therefore, can be an important stimulant to encourage farmers to adopt sustainable agricultural practices.

I. Regenerative Agriculture

There is a great potential to leverage methods of regenerative agriculture to improve soil organic carbon content and enhance biodiversity. These will, in turn, lead to increased productivity and resilience in agricultural systems. Healthy soil will also provide better water retention, aeration and favours higher microbial activity. Regenerative farming focuses on the use of natural inputs. Examples include mulching, intercropping, multi-cropping and the sowing of diverse and native crop varieties[6]. Natural inputs help improve soil structure and sowing of water-efficient varieties reduces the need for frequent irrigation. Some examples of regenerative agricultural methods are explained below.

a. Good Agricultural Practices (GAP) in Rice

India is the second-largest rice producer in the world after China and more than 80 percent of its paddy fields are continuously flooded with water. Continuous flooding releases large amounts of methane into the atmosphere while also leading to waterlogging, soil degradation and nutrient loss. In addition, the majority of Indian farmers use nitrogen-based fertilisers indiscriminately. Farmers need to be encouraged to take up practices that will mitigate methane emissions from rice fields. Good Agriculture Practices in rice and the environmental benefits is given as below:

[6] https://www.downtoearth.org.in/news/agriculture/restore-by-use-regenerative-agriculture-can-help-save-water-here-is-how-86065

Practice	Method	Benefits
Alternate wetting and drying (AWD)/Mid-season drainage	Paddy fields are intermittently flooded and drained, or drained in the middle of the season	• Reduction in irrigated water usage by 25% • Reduction in labour and energy usage by 10-15% • Reduction in methane emissions by 30-35%
Nitrification inhibitor/ urea super-granules/ Neem Coated Urea	Chemical compounds that reduce nitrous oxide emissions by suppressing the action of microbes (nitrifiers) which convert nitrogen into nitrate	• Reduced nitrous oxide emissions. • Reduced nitrate leaching
Direct seeding of rice	Seeds are directly drilled into the seedbed at a depth of 2-3 cm	• Reduction in irrigated water usage by 25-30% • Reduction in labour and energy usage by 10-15% • Reduction in methane emissions by 70-75% • Increased stress tolerance of crop
Crop diversification (e.g., rice to other arable field crops)[7]	Shifting to or addition of new crops or cropping systems	• Reduction in irrigated water usage by 50-60% • Reduced fertiliser usage. • Reduction in labour and energy usage by 20-25% • Reduction in methane emissions by 90%[8]

Crop diversification with Millets: The United Nations has declared 2023 as the International Year of Millets (IYM) recognizing that millets are climate resilient with drought-resistant, pest-tolerant, and water-saving traits. In addition, they also help enhance the nutritional baskets of farmers and their families.

b. Micro-irrigation

The National Mission for Sustainable Agriculture (NMSA) supports farmers through micro-irrigation, a key component of the Per Drop More Crop (PDMC) initiative under Rashtriya Krishi Vikas Yojana (RKVY). Micro-irrigation, including drip and sprinkler technologies, is promoted to enhance water use efficiency and optimize available water resources at the farm level. By adopting precision irrigation and better on-farm water management practices, farmers can reduce water wastage and improve crop yield. Micro-irrigation also plays a crucial role in climate change adaptation by minimizing the impact of drought and extreme weather events on agriculture.

ICAR reported that reduction in emission achieved from the total area of 13.78 million ha. area achieved under micro-irrigation is 10.90 million tonnes of CO_2e.

c. Farm Mechanisation

[7] https://icar.org.in/sites/default/files/Crop%20diversification.pdf
[8] https://krishi.icar.gov.in/jspui/bitstream/123456789/32431/1/GreenhouseGasEmissionfromIndianAgricultureHPathaketal%20%281%29.pdf

Farm mechanisation refers to the use of agricultural machinery and equipment to streamline and automate farming operations. It optimizes the use of inputs such as fuel, water, and fertilizers, resulting in reduced carbon footprint and improved environmental sustainability. Additionally, the use of advanced technologies and precision farming techniques allows for better resource management, minimizing wastage and maximizing productivity..

d. Agroforestry/Horticulture

Agroforestry/Horticulture with perennial tree systems of fruit and plantation crops is a sustainable land use system that aims to enhance income, conserve resources, and provide additional livelihood opportunities. In the context of climate change, agroforestry offers benefits such as microclimate moderation, improved soil moisture retention, and carbon sequestration. Both agroforestry and dryland horticulture-based farming systems in rainfed ecosystems aid in not only greening of parched landscapes which occupy 50% of net cultivated land in the country but also provide livelihood and ecological security in the long run. These practices help to mitigate the impacts of erratic rainfall patterns, increase resilience in agricultural systems, and contribute to greenhouse gas emissions reduction. The National Mission for Sustainable Agriculture (NMSA) promotes agroforestry through the Sub-Mission on Agroforestry (SMAF), which focuses on expanding tree coverage on farmland, improving livelihoods, and enhancing carbon sequestration, among other objectives[9]. The Government of India launched the National Agroforestry Policy in February 2014 during the World Congress on Agroforestry, held in Delhi to improve agricultural livelihoods by maximizing agricultural productivity for mitigating climate change. Further under Mission on Integrated Development of Horticulture, Government is striving to expand horticulture across all the agro ecologies.

ICAR reported that quantification of Carbon Sequestration Potential (CSP) in agroforestry system has been completed in 17-States covering 60 districts. Carbon sequestration potential of Agroforestry system existing on farmer's field is 0.35 t C/ha/yr and total carbon sequestration potential of 17 states is 8.13 million tonnes (NICRA, 2019). The total soil organic carbon (SOC) in agroforestry system existing on farmer's field varied from 46.59 to 100.13 t C/ha in 0-90 cm soil depth under different states.

e. Integrated Farming Systems (IFS)

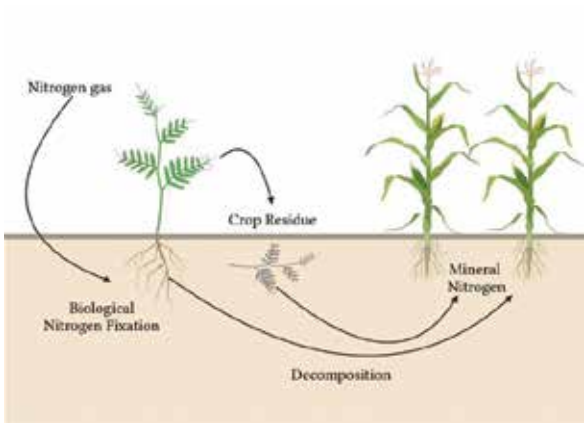
Integrated Farming Systems (IFS) involve the combination of crops, livestock, fishery, and other agricultural activities such as horticulture, agro-forestry, and apiculture. It is a comprehensive approach that aims to enhance livelihood opportunities, ensure food security, and minimize risks associated with crop failure. IFS promotes practices such as multi-cropping, rotational cropping, intercropping, and mixed cropping, along with allied activities. From a climate change perspective, IFS offers several benefits, including increased resilience to extreme weather events like droughts and floods. The diversified farming system helps farmers maximize their returns, sustain their livelihoods, and mitigate the impacts of climate variability. Additionally, IFS contributes

[9] https://nmsa.dac.gov.in/pdfdoc/Agroforestory_Guidelines_English.pdf

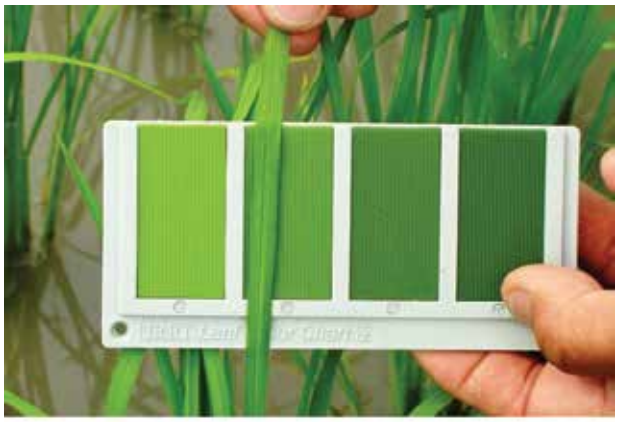
to the conservation and promotion of Non-Timber Forest Products (NTFPs) and provides supplementary and residual production systems, reducing dependence on single-crop farming and enhancing overall sustainability. Out of 71 IFS models developed in India, 45 are found to be carbon neutral and their promotion/ upscaling contributes for large scale mitigation co-benefits, and they form best candidates for carbon credits in agriculture.

f. Management of Nitrogenous Fertilizers Usage

Nitrogen management practices significantly influence the emissions of nitrous oxide in agriculture. These practices are fertilizer type, timing, placement, and rate of fertilizer application, as well as coordinating the time of application with irrigation and rainfall events. Methods to enhance nitrogen use efficiency include using cyanobacteria, leaf colour chart, deep embedded super granular urea, and inter-cropping with legumes. LCC-Based Nitrogen Application-Leaf Color Chart, being easy to handle, is a favourable and non-destructive tool for the determination of the need-based nitrogen demand of rice. LCC comprised six colour strips (from yellowish green to dark green) fabricated with veins matching the leaves of maize crops.



Legumes fix atmospheric nitrogen in the soil, reducing the need for external fertilizer application.



A leaf colour chart (LCC) is used to determine the N fertilizer needs of paddy. The greenness of the leaf indicates its N content.

g. Increasing Soil Organic Carbon Content

Increasing the soil organic content (SOC) of agricultural soils is beneficial to offset the GHG emissions through sequestration. One of the ways of increasing SOC is by adding organic matter regularly as Farmyard Manure (FYM) or compost. SOC can also be increased through crop residue management, green manuring and adoption of cereal-legume rotations. These materials can increase the amount of carbon and nitrogen in the soil, which can promote the growth of microorganisms and improve soil

structure. The addition of organic matter is both beneficial for the environment and the crop[10].

Organic Farming

Organic farming in India offers multiple benefits, including increased soil organic content for GHG emissions trapping and reduced chemical pollution. It provides cost savings for farmers by minimizing external inputs and promotes biodiversity, leading to improved pest control. Additionally, organic produce commands higher prices, offering farmers increased income. Govt. of India has launched Paramparagat Krishi Vikas Yojana (PKVY) and Mission on Organic Value Chain Development for Northeastern Region (MOVCDNER) for large scale promotion in niche areas. Large area certification is also facilitated through Participatory Guarantee System. (PGS)

h. Crop Husbandry Practices

Green Manuring

Green manuring involves growing of specific plant species that are later incorporated into the soil to enhance fertility and structure. It sequesters carbon dioxide, improves soil moisture retention, reduces erosion, and promotes nutrient cycling. It is a natural and cost-effective way to improve soil health, increase crop yields, and reduce reliance on synthetic inputs.

Cover Crops

Cover cropping is a practice in which crops are planted to cover the soil, rather than to be harvested. It protects the soil from eroding and maintains SOC levels. Cover crops may be grown with plantation crops or rotated seasonally. It is a popular method in conservation agriculture as it reduces tillage of land. Some of the commonly grown cover crops are legumes, lentils, wheat, barley and maize.

Mulching

Mulching is a practice in which the soil is covered with organic materials such as crop residue, straw, leaves, peat etc., which conserves soil moisture, decreases runoff and increases soil productivity. It is mostly practised among horticultural plantations (fruit orchards, flowers, vegetables, nurseries) where the crops require less frequent cultivation.

[10] https://www.ceew.in/sites/default/files/cover-crops-mulching.pdf

i. Natural Farming:

Natural farming is a self-sustaining, indigenous farming system that aims to improve soil health, reduce water usage, and thereby increasing soil organic content. Natural Farming ensures better soil biology, improved agrobiodiversity and a more judicious usage of water with much smaller carbon and nitrogen footprints. As Natural Farming does not use any synthetic chemicals, health risks and hazards are eliminated. The food has higher nutrition density and therefore offers better health benefits. Natural Farming farmers are encouraged to follow 365-days cover cropping, multi-cropping etc. while minimizing soil disturbance. Community-led preparation of farm-based fertilizers, seed treatment and insecticides using cow dung, pulses powder, jaggery, cow urine and botanical extracts is an important part of indigenous affordable natural farming. Costs of inputs are lower in natural farming, along with improvement in soil health due to higher microbial content. Govt. of India is launching National Mission on Natural Farming to promote its adoption.

j. Climate Resilient Agriculture:

ICAR through NICRA program demonstrated location specific Climate Resilient Technologies (CRTs) for coping with climate variability in vulnerable districts to generate awareness and build capacity of farmers. The interventions broadly cover natural resource management, crop production, livestock and fisheries. Farm implements, seed and fodder production systems establishment of commodity groups, water sharing groups, community nursery and initiating collective marketing by tapping value chains etc. are some of the innovative institutional interventions established in the NICRA villages. Location-specific climate resilient technologies are being demonstrated in 151 climatically vulnerable districts across the country. Climate Resilient Agriculture focuses on natural resource management and its sustainable use and therefore provide huge scope for VCM.

Case study: Afforestation (contd.)

Case Study: Afforestation

Methodology: Afforestation/Reforestation GHG Emissions Reduction & Sequestration Methodology
Standard: Gold Standard for the Global Goals
Status: Certified **Project Scale:** Small scale
Project Duration: 10 Years **Crediting Period:** May 06, 2013 — May 06, 2023
Credits Issued: 91,092 **Credits Retired:** 43,430
SDGs: 12, 13, 15

In the face of climate change and its impact on agriculture in arid regions, efforts were made to mitigate the challenges faced by Coolie families in Bagepalli, Karnataka. The project involves the planting of fruit and fodder trees on degraded lands with low soil productivity.

- Mango, Cashew, Silver Oak, Tamarind, Jamun and other saplings of the farmers' choice were planted on fallow lands.
- While initial survival rates were very low due to erratic weather conditions, farmers switched to more climate-resilient techniques and brought the survival rate up by nearly 40%
- 96% of the ₹6.18 crore received as carbon revenue for these credits were distributed to participating farmer families in 2019.
- An additional ₹ 4.4 crore was distributed to 1,024 participating farmer families as carbon revenue in December 2021
- Sustainable agroforestry and land use has not only revived the degraded landscape but also provided livelihood opportunities for peasant families.

II. Benefits of Sustainable Agriculture

a. Economic benefits

Regenerative farming, sustainable agriculture, agro-ecology, and climate-resilient agriculture can bring various economic benefits, such as reducing input costs, increasing yields, improving soil health, and creating new income streams. By reducing reliance on expensive inputs such as synthetic fertilizers and pesticides, farmers can save money and increase their profits. These practices lead increase in soil carbon which result in increased yields, as healthier soils produce healthier crops. For example, a study by NICRA found that switching to direct-seeded rice not only conserved resources but also increased farmer profits by 15.36%[11].

Adopting these practices can help to diversify farm income streams by promoting crop rotation, intercropping, and agroforestry, which can provide additional sources of income such as timber, fruits, and vegetables. Additionally, sustainable agricultural practices can help to reduce post-harvest losses, which can be a significant economic

[11] https://atarikanpur.icar.gov.in/img/Impact of NICRA Activities.pdf.

burden on farmers. There is a growing demand for sustainably produced food, which can create new markets and value-added opportunities for farmers. By adopting these practices, farmers can tap into these markets and capture higher prices for their produce[12].

These methods promote biodiversity and ecosystem services, which help to maintain soil health, water quality, and pest control, all of which can improve public health. Sustainable agriculture practices can also help to preserve cultural practices and knowledge related to agriculture, including traditional farming methods and local food systems. For example, studies have shown that reviving traditional agricultural methods as well as planting indigenous seeds have built ecological and community resilience to climactic shocks . In addition, these agricultural practices often promote social equity, such as improving access to land, water, and other resources for marginalized groups like women, smallholder farmers, and tribal communities. They can also provide new income streams and employment opportunities for rural communities, which can help to reduce poverty and inequality[13].

b. Food security benefits

These practices focus on increasing the yield and diversity of crops, and improving soil health, which can result in increased food production. In addition, these practices often prioritize the use of locally adapted and traditional crop varieties, which are better suited to the local environment and can provide greater resilience in the face of climate change. They also promote crop diversification, which can help to ensure a stable food supply and reduce the risk of crop failures due to disease or pests.

There are various initiatives by the Government of India that promote food security by the adaption of climate-resilient crop varieties. The National Food Security Mission aims to enhance food production and ensure food security by focusing on increasing the production and productivity of rice, wheat, pulses, and coarse cereals . In addition, the Government of India has been steadfastly supporting the International Year of Millets(IYM) which aims to promote the cultivation and consumption of millets, not only for their nutritional value but also for their role in achieving food security, enhancing resilience to climate change, and supporting sustainable agriculture[14].

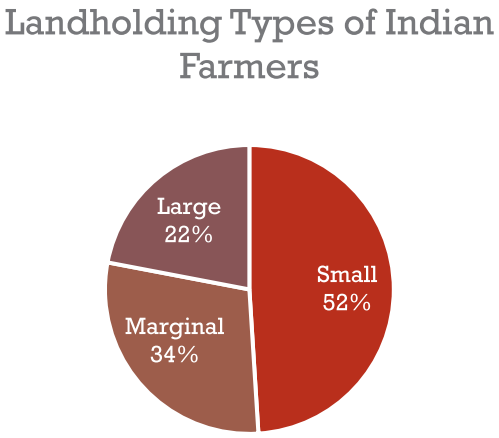
III. Stakeholders in the Agricultural Sector

At the simplest level, the agricultural sector consists of two major stakeholders – producers, i.e., farmers, and consumers. However, a granular look at the Indian agricultural sector reveals multiple categories on the producer end, each with varied interests and challenges. All these stakeholders must actively participate to ensure the

[12] https://www.downtoearth.org.in/news/agriculture/restore-by-use-regenerative-agriculture-can-help-save-water-here-is-how-86065

[13] https://www.ceew.in/publications/sustainable-agriculture-india#:~:text=Sustainable%20agriculture%20is%20far%20from%20mainstream%20in%20India%2C%20with%20only,cent)%20of%20all%20Indian%20farmers.

[14] file:///C:/Users/kannep_sar/AppData/Local/Microsoft/Windows/INetCache/Content.Outlook/SI7TX1LF/Millets - Millets India - International Year of millets_Millets India https:/www.millets-india.com



success of a voluntary carbon market in the agriculture sector. All these stakeholders must actively participate to ensure the success of a voluntary carbon market in the agriculture sector. To bring them together, aggregating bodies such as farmer producer organisations (FPOs), community-based organisations (CBOs), SHGs (self-help groups), Water User Associations (WUAs) and non-governmental organisations (NGOs) play an important role. Small and marginal farmers with less than 2 hectares of land, make up about 86% of all farmers in India . Challenges faced by small and marginal scale farmers in India include limited access to resources, such as land, water, and credit, as well as the high cost of inputs, low productivity, and climate change. These challenges can lead to a cycle of debt, poverty, and food insecurity, making it difficult for farmers to invest in sustainable practices and improve their livelihoods[15].

Women farmers face additional challenges because they own less than 13% of India's land, despite accounting for almost 75% of full-time farm workers. Climate shocks disproportionately affect women farmers because they have greater reliance on natural resources impacted by climate change, such as water, forests, and land, and often lack access to resources and information like credit, insurance, and climate-resilient technologies. Traditional gender roles can also limit women's mobility and decision-making power, further exacerbating the challenges they face.

Landless agricultural labourers are another category of farmers who have an important role in the agricultural sector. Between 2001 and 2011, the number of such labourers has increased by 35% - from 106.7 million to 144.3 million[16]. Labourers provide the necessary workforce to implement all agricultural activities. Their manual labour and expertise are essential for carrying out activities like tree planting, soil conservation, and maintaining carbon-rich ecosystems. Engaging landless agricultural laborers in carbon projects creates additional income and livelihood opportunities for them. These projects often provide employment during the implementation and maintenance phases, enabling them to earn a sustainable income and improve their socio-economic conditions.

IV. Tenurial Aspects

India has a very unique social demography for farming. While we have a smaller percentage of farmers with more than 5 Ha landholding (i.e., large landholders), most

[15] https://timesofindia.indiatimes.com/blogs/voices/necessity-of-holistic-development-of-small-marginal-farmer-communities-in-india/
[16] https://agricoop.nic.in/sites/default/files/air2010-11complete.pdf

farmers are fragmented and hold less than 1 Ha of land. Carbon projects can include both small as well as large landholding farmers. However, an important distinction to make is between farmers who own their land versus those who lease it from others. In India, more than 30% of farming is practised on leased land[17]. This adds another layer of complexity to the carbon cycle. Consent must be obtained from the landowner as well as the contract farmer for availing of carbon credits before being transacted. This is important to avoid conflict in the future as well as the avoidance of double counting.

Double Counting: The same carbon credits are claimed by multiple parties for meeting their emission reduction targets, resulting in an overestimation of the actual reduction.

[17] https://agcensus.nic.in/document/agcen1516/ac_1516_report_final-220221.pdf

2. National Voluntary Carbon Market

I. Present status

The Kyoto Protocol, which was adopted in 1997, was the first international agreement that set legally binding emission reduction targets for developed countries. It also established the Clean Development Mechanism (CDM), which allowed these countries to meet their targets by investing in emissions reduction projects in developing countries[18].

However, the CDM faced criticism for its lack of transparency and additionality requirements . In response, some countries and organizations have developed their own domestic voluntary carbon markets (VCMs) that aim to address these shortcomings and provide a more effective way to mitigate greenhouse gas emissions[19].

The Paris Agreement, which was adopted in 2015, builds on the Kyoto Protocol and aims to strengthen international cooperation on climate action. It includes provisions for carbon markets under Article 6, which allows countries to cooperate in implementing their climate pledges and establish market-based mechanisms to reduce emissions. Article 6.2 and 6.4 establish mechanism for the functioning of this market (See box)[20].

Present most of the VCM projects in the country are registered in global registry such as verra, Gold Standard etc. which are well known among stakeholders. India has recently come up with the Energy Conservation (Amendment) Bill which paves the way for a compliance carbon market for the country. The Bill notes that the ambit of such a market could include agriculture as it produces significant emissions. Thus, it is envisaged that carbon credits from agriculture will \\also be part of this compliance market, specifically with respect to energy use in the agriculture sector. It remains to be seen which methodology will allow for that, as the current article 6.4 methodologies are still being drafted. This will provide an opportunity for the agriculture sector in India to be supported by domestic markets.

Article 6.2: It allows countries to trade emission reductions and removals with one another through bilateral or multilateral agreements. These traded credits are called Internationally Transferred Mitigation Outcomes (ITMOs).

Article 6.4: It will create a global carbon market overseen by a United Nations entity. Projects will have to be registered under this entity. A project must be approved by both the country where it is implemented and the supervisory body, before it can start issuing UN-recognized credits, known as A6.4ERs.

[18] https://unfccc.int/kyoto_protocol
[19] https://cepr.org/voxeu/columns/collapse-clean-development-mechanism-scheme-under-kyoto-protocol-and-its-spillover
[20] https://unfccc.int/process-and-meetings/the-paris-agreement

However, the international VCM market has a strong demand for carbon trading from the agricultural sector. So, there is benefit in exploring both the domestic and international voluntary carbon markets.

II. Carbon Credit Trading Scheme (CCTS)

The Government is taking steps to create and regulate carbon credit market and to incentivize people adopting sustainable lifestyles. For the compliance market, the Government on 28th June 2023 notified Carbon Credit Trading Scheme (CCTS) as part of its process to establish a carbon credit market in India. The Energy Conservation (Amendment) Bill, 2022, which was passed by the Indian Parliament, empowers the Central Government to specify a Carbon Trading Scheme in consultation with the Bureau of Energy Efficiency (BEE). The scheme outlines that an 'Accredited Carbon Verifier' is an agency accredited by the BEE to carry out validation or verification activities in relation to the CCTS. Carbon credit trading aims to reduce carbon emissions and address climate change. Under the scheme the Carbon Credit Certificate is issued to the registered entity by the central government, or any authorized agency, in the CCTS. Each certificate issued represents the reduction or removal of one tonne of CO2 equivalent (tCO2e). Further, the Indian Carbon Market Governing Board (ICMGB) has been created to oversee the Indian Carbon Market (ICM), comprising members from various relevant central ministries and agencies. CCTS will cater to the country's carbon market for the compliance side though the notification mentions VCM will also be on boarded on CCTS platform.

III. Green Credit Programs(GCP)

Green Credit Programme(GCP) was launched at national level to leverage a competitive market-based approach for green credit for incentivising environmental actions of various stakeholders. The Scheme was notified by the Government on 12th October 2023. GCP has been introduced to promote Mission 'LiFE'-'Lifestyle for Environment', which is a grass-root, mass movement, for protection and conservation of environment and for other environmental and climate gains, by enhancing environmental actions that propagate a healthy and sustainable way of living based on traditions and values of conservation and moderation, and for sustainable and environment-friendly development.

GCP is an innovative market-based mechanism to incentivise environment positive actions will help promote the LiFE movement, which aims at encouraging sustainable lifestyles by driving consumer and community towards behavioural changes that promote environment friendly actions. Green Credit is independent of the carbon credit. An activity generating green credit under Green Credit programme may also get carbon credit from the same activity. The Indian Council of Forestry Research and Education an autonomous body of Ministry of Environment and Forests, is the designated Administrator/Registry for GCP.

Activities under Green Credit Program includes tree plantation, water management, sustainable agriculture, waste management, air pollution reduction, mangrove conservation and restoration, Eco mark label development and sustainable building and infrastructure.

IV. Payment of Eco-System Services(PES)

Eco-System services are the environmental benefits provide by nature. Payment of Eco-System Services (PES) is the economic benefit given to farmers/landowners in return to conservation or sustainable practices adopted by them in management of their land. Some PES programs involve contracts between consumers of ecosystem services and the suppliers of these services. PES programs can be funded by Governments. The party supplying the environmental services normally holds the property rights over an environmental good that provides a flow of benefits to the demanding party in return for compensation. In India, the concept of PES is relatively new. However, with increasing need of conservation and sustainability, PES is expected to take shape sooner or later. With the increasing degradation of natural resources and rising demand for ecosystem services in India, its high time to adopt market-best approaches like PES to protect and conserve the ecosystems. With the rich natural resources, the country has enormous potential to adopt schemes like PES for ecosystem conservation and livelihood promotion.

Salt Lake City, Utah, United States community watershed management since the 1850s through multi-jurisdictional regulatory mechanisms such as specifying allowable uses, purchasing land or conservation measures is an example of PES. This mechanism proves to be an effective strategy to preserves ecosystem services, while allowing other uses of the landscape including skiing, snowboarding, hiking, mountain biking, and fishing[21].

[21] Blanchard, Libby; Vira, Bhaskar; Briefer, Laura (2015-10-24). "The Lost Narrative: Ecosystem service narratives and the missing Wasatch watershed conservation story". Ecosystem Services. 16: 105–111. doi:10.1016/j.ecoser.2015.10.019

3. VCM in Agriculture

I. Policy of Government of India

The National Mission on Sustainable Agriculture (NMSA) significantly enhanced the potential of VCM in agriculture sector in the country. Several factors make the development of a Voluntary Carbon Market (VCM) in the Indian agricultural sector favourable.

i. Incentivise the Restoration of Soil Organic Carbon

Soil organic carbon (SOC) is a crucial component of healthy soils and sustainable agriculture. It refers to the amount of carbon stored in soil in the form of organic matter, such as decomposed plant and animal materials. SOC plays a vital role in soil fertility, water retention, and erosion prevention, as well as in mitigating climate change. Carbon sequestration through SOC restoration can have significant environmental and economic benefits[22]. A voluntary carbon market in India can incentivize SOC restoration by providing a financial mechanism for farmers to adopt sustainable practices such as conservation tillage, agroforestry, cover cropping, and nutrient management, which promote SOC accumulation. By creating a demand for carbon credits generated from SOC sequestration, the voluntary carbon market can provide financial incentives for farmers to adopt climate-resilient agricultural practices that improve soil health and mitigate climate change.

ii. Encourage Corporate and Individual Responsibility

Voluntary carbon markets also provide an opportunity for companies and individuals to take responsibility for their carbon emissions and invest in projects that have a positive impact on the environment and local communities. By purchasing carbon credits from agriculture projects in India, buyers can contribute to sustainable development goals, support rural livelihoods, and promote climate resilience. Overall, the voluntary carbon markets in the agriculture sector in India provide a market-based mechanism to incentivize and finance sustainable agricultural practices that can contribute to mitigating climate change and building climate resilience.

iii. National and International Climate Commitments

India's voluntary commitment under the Paris Agreement includes a target to sequester 2.5 to 3 billion tonnes of CO2 equivalent through additional forest and tree cover by 2030[23].

[22] https://www.agric.wa.gov.au/measuring-and-assessing-soils/what-soil-organic-carbon#:~:text=Soil%20organic%20carbon%20is%20a,biological%20function%20of%20agricultural%20soils

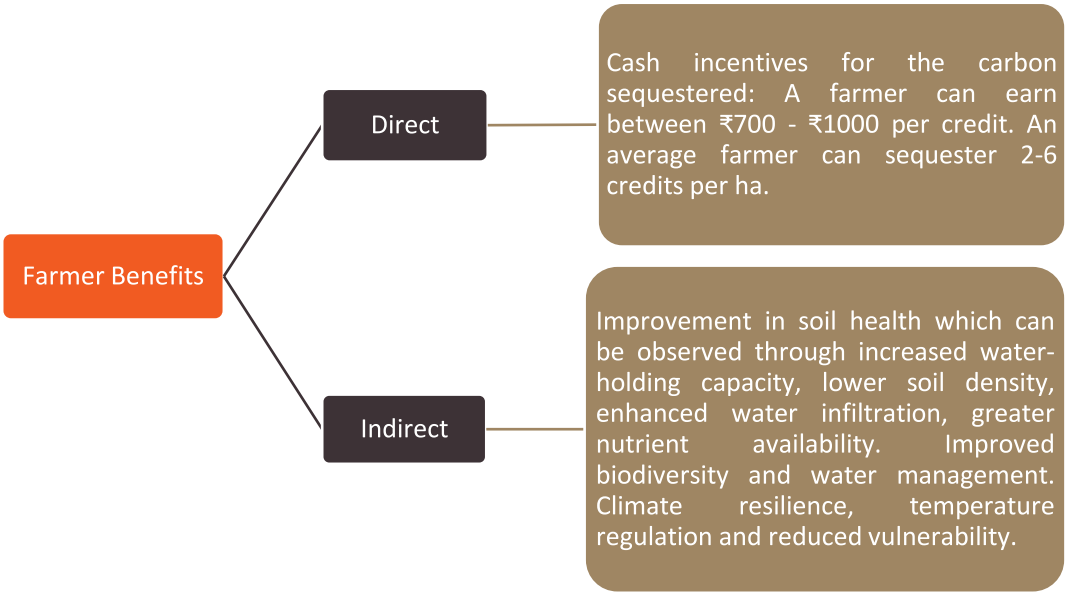
[23] https://unfccc.int/sites/default/files/NDC/2022-08/India Updated First Nationally Determined Contrib.pdf

Voluntary carbon market for the agriculture sector can support this target by incentivizing the adoption of agroforestry and other sustainable practices that increase tree cover and sequester carbon.

iv. Direct and indirect benefits for farmers

Farmers can reap both direct and indirect benefits by participating in carbon markets through sequestering carbon in their lands.

Pilot programs in selected crops/agro-climatic regions to test the feasibility of carbon trading in agriculture may be encouraged. Steps should be taken to scale up successful pilot programs. ICAR has been undertaking research programs on carbon farming. Carbon neutral village under NICRA program is a successful model.



v. Demand for carbon credits

Numerous large corporations have set net zero targets and many more are expected to do so over the course of this decade. As per the 2022 report of the Ecosystem Marketplace, about 500 million carbon credits, valued at $1.98 billion (₹ 16,266.8 crores), were traded globally in the voluntary carbon market in 2021[24]. However, for certain industries in a developing country like India, reducing emissions may not be immediately feasible. As such, offsets will be a crucial means to meet climate targets. It is predicted that India's emissions will peak between 2040 and 2045[25]. Thus, the demand for high quality carbon credits in India is anticipated to increase significantly. As almost 60% of India's land is under cultivation[26], the agriculture sector has huge potential to supply these credits.

[24] https://www.ecosystemmarketplace.com/articles/the-art-of-integrity-state-of-the-voluntary-carbon-markets-q3-2022/
[25] https://www.bloomberg.com/news/articles/2021-11-03/india-sees-carbon-emissions-peaking-in-2040-45
[26] https://data.worldbank.org/indicator/AG.LND.AGRI.ZS?locations=IN

II. Feasibility of VCM

In a vastly diverse country like India, certain unique factors demand specific attention to ensure that a voluntary carbon markets in the agriculture sector can be successfully implemented.

i. Scale – While the farmers who are part of a carbon project may be small scale, the total hectarage of the project should be a minimum of 1000 ha (no upper limit). This is because, at a smaller scale, transaction costs at the beginning are prohibitively high. In addition, it is extremely challenging to map plots, tag them to the farmer and the farmers' land documents. The Indian agricultural landscape poses the additional challenge of dispersed plots – a farmer may have small plots of land in two different locations. On balance, these challenges are ironed out at scale. Credits from all the plots that fall within the project area, even if they are not contiguous, will be counted.

ii. Monitoring – The farmers' inputs, output, package of practices (PoP) needs to be monitored during every planting season for the entire duration of the project.

iii. Capacity building – Farmers and field staff must be provided with technical training to carry out the project activities. This training needs to be continuous and intensive.

iv. Baseline – Project developers must ensure that any carbon project fulfils the principle of "additionality", i.e., the project must prove that without the carbon finance, this project would not have happened. In other words, they must show whether the project is bringing about additional emissions reductions that go beyond what would have happened under business-as-usual or existing practices. For this reason, farmers who have already transitioned to sustainable agricultural practices cannot be included in a carbon project; only farmers transitioning in the future can be. However, to ensure that farmers who have already been practising sustainable methods are not denied of the opportunity, farmer federations can be adopted. Farmer federations allow all types of farmers to come together (those practising sustainable practices and those who are not) and collectively take part in the project. Climate finance will be provided to the federation and carbon funds generated from the project will also be given to the federation. In this way, all the farmers can reap the benefits.

v. Digital Infrastructure: Agri Stack is a digital foundation being set up by the Government to make it easier to bring various stakeholders together to improve agriculture in India and enable better outcomes and results for the farmers by using data and digital services. Agri Stack architecture has foundational layers such as Farmers Database: Farmers ID linked with land records, Geo-referencing of plots, Crop Survey, Crop planning and Soil Mapping, Soil Fertility, Unified Farmers Service Interface for state, Private Players, Data Exchange etc. Such digital foundation in agriculture sector can facilitates implementation of VCM ensuring quality and transparency.

CASE STUDY: SOCIO-ARGOFORESTRY IN MAHARASHTRA

Methodology: Agricultural Land Management
Standard: Verra
Expected ERs/Credits: 234,000
Crediting Period: 20 years
Project Scale: Large scale
SDGs: 2, 12, 13, 15

Background: Nandurbar, a mostly tribal-dominated district in Maharashtra, is one of the districts most vulnerable to extreme climate including droughts, floods and cyclones in the state. The weather is hot and dry, and rainfall erratic. These climactic conditions, combined with poor socioeconomic indicators, necessitate a socio-agroforestry project that can benefit the community and the environment.
Intervention: The project comprises the planting of trees and cover crops over 90,000 Ha of land across the district.
Monitoring: Considering the size of this project, monitoring is both crucial and challenging. To address this, the use of drone technology was piloted. Drones were used in establishing the baseline, i.e., to assess the existing conditions of the land before the start of the project. 2000 Ha of land were monitored in this way. In addition, flow meters that use IoT (Internet of Things) sensors were installed to ensure efficient use of water.

III. VCM Registry for the Agriculture Sector

i. **Existing registries**: Existing registries for VCM such as Verra (VCS) and Gold Standard (GS) are well-equipped to issue carbon credits and are recognised by buyers. They are already trusted by buyers and the credits are guaranteed to be credible. They provide access to a wider international market and have low administrative costs. On the other hand, the Govt. would have limited control over the process and there would be dependence on external agencies. The costs of registration and certification are high. In addition, developing new methodologies is a tenuous process and requires additional technical support.

ii. **Carbon Credit Trading Scheme(CCTS):** The Govt. of India has notified Carbon Credit Trading Scheme(CCTS) which is for carbon market under compliance mechanism. Bureau of Energy Efficiency(BEE) is the designated. registry/administrator for CCTS which will also registers projects under voluntary mechanism.

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iii. **Green Credit Program(GCP):** Ministry of Environment, Forest & Climate Change notified Green Credit Programme (GCP) Implementation Rules, 2023 creating a market-based mechanism for providing incentives in the form of Green Credits. The Indian Council of Forestry Research and Education is the Administrator/Registry of the Programme. An activity generating Green Credits under Green Credit Programme may also get Carbon Credits from the same activity under carbon market.

iv. **New registry:** Establishing a new registry for VCM in agriculture sector would provide better oversight of the entire carbon project cycle from registration to certification for agriculture. The new registry could set registration fees that are in accordance with what is feasible to Indian project developers, instead of the high fees paid to international standards. In addition, a new registry would allow local expertise and knowledge to be leveraged in the creation of geography-climate-demography specific methodologies. However, it must also be noted that a new registry will have difficulty in achieving international recognition given the existence of well-established international standards. It will require capacity-building as issuance and registration are tedious processes that require technical know-how. High initial setup costs and limited access to international markets also need to be factored in.

v. **National inventory**: Having a national inventory can be useful to track credits generated under VCM. Ministry may use an existing registry along with an inventory of all ongoing carbon projects including status, expected ERs, and expected credits. The inventory will allow the Ministry to have oversight over all VCM projects in the country without the tedium of managing the registration and issuance process. The inventory will also avoid any duplication in projects..

Inventory Framework

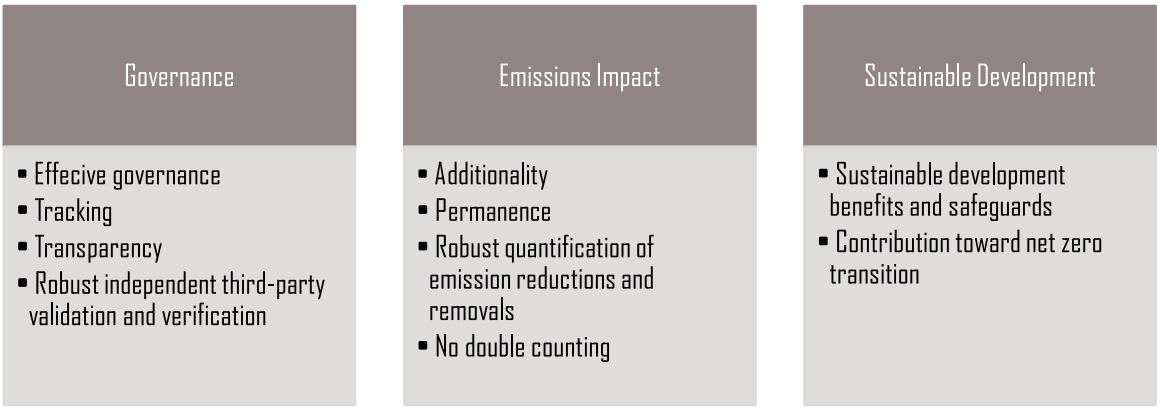
Project Name:
Region (State/District/Block):
Standard Used:
Methodology:
Crediting period:
Number of ERs per annum:
Number of issued credits till date (vintage-based):

4. Global scenario of VCM

While countries like Australia, Canada and the United States have their own VCM frameworks, there are currently no frameworks in the world specifically for the agricultural sector. Given this scenario, the preferred route would be to have a national framework under which Land Use becomes one of the project types. Apart from government frameworks, there are various international ones which are relevant to the VCM, as listed below.

a. **Supply side:** The Integrity Council for the Voluntary Carbon Market (ICVCM) has developed a set of best practices as a benchmark for high-integrity carbon credits. These practices are centred around the Carbon Core Principles, which are guidelines for ensuring that carbon credits are of high quality, transparent, and verifiable. The Carbon Core Principles include additionally, permanence, measurability, and verification, among others. The ICVCM provides guidance for project developers, investors, and buyers of carbon credits to ensure that they are meeting the Carbon Core Principles and contributing to real, additional, and verifiable emissions reductions[27].

10 Carbon Core Principles



b. **Claims and Buyer Side:** The Voluntary carbon markets can be very helpful to enhance effort of emitting entities in achieving transition to net-zero, and support the achievement of countries' Nationally Determined Contributions. VCM can also support the foundation for well-designed climate policies. However, this requires achieving high integrity in VCM landscape. This means that carbon credits must be generated meeting the highest standards and the expectations of the buyers. Without high-integrity practices, voluntary carbon markets will continue to be viewed by companies with certain level of doubts, and their potential will not be realized. Voluntary Carbon Markets Initiative (VCMI) is a multi-stakeholder initiative that aims to develop robust standards and guidelines for voluntary carbon markets. Its Claim Code of Practice is a

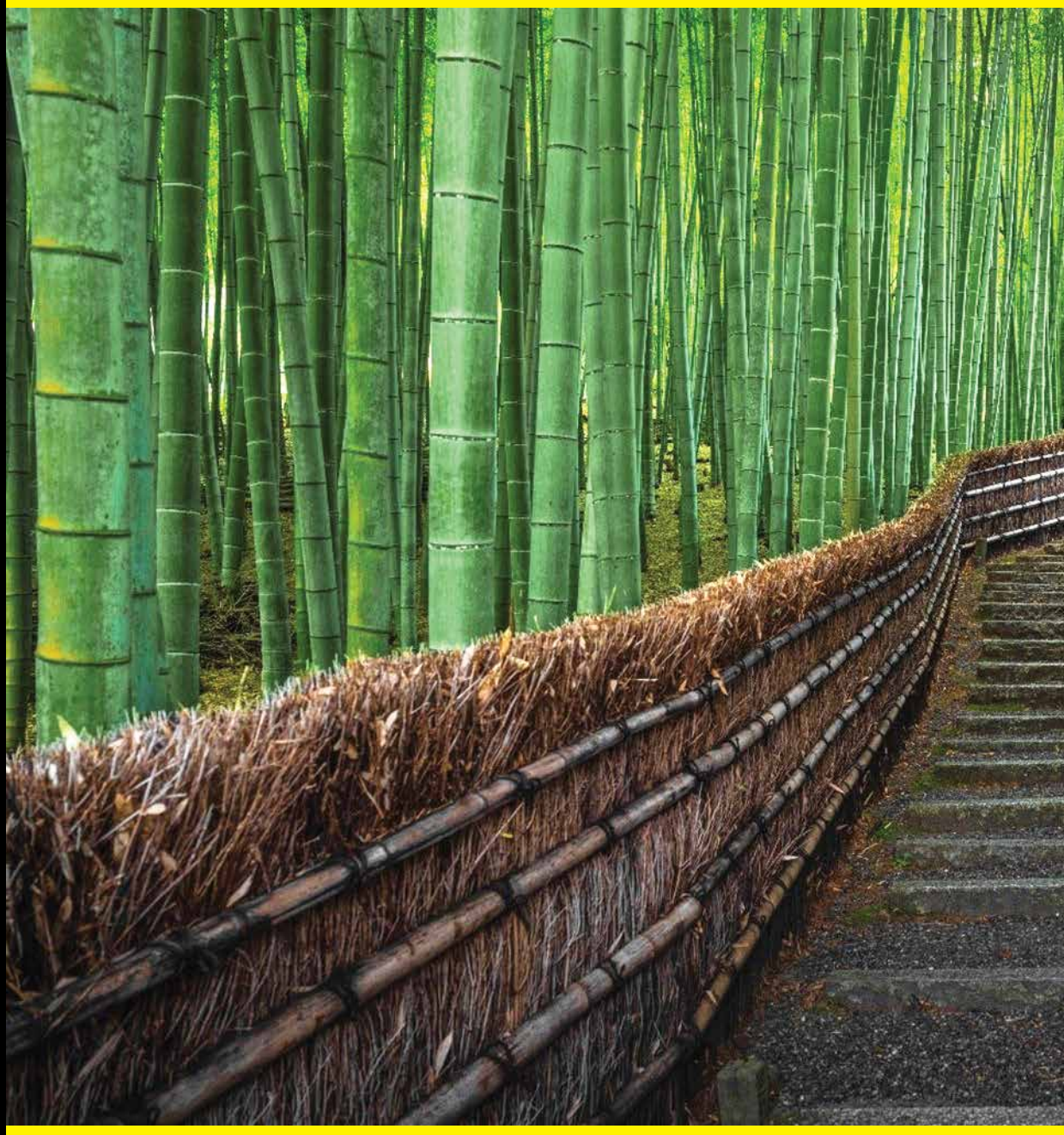
[27] https://icvcm.org/the-core-carbon-principles/

document that defines which claims can be made by companies relying on carbon offsets, how they can make voluntary use of carbon credits as part of their climate commitments and on how they communicate their use of those credits.

c. **Service Provider Side:** The International Carbon Reduction and Offset Alliance (ICROA) is to represent the interests of service providers in promoting emissions reductions and offsetting practices that align with the highest standards of environmental integrity and support the Paris Agreement. To achieve this, ICROA provides an Accreditation Programme and supports organizations through advocacy and action-oriented initiatives aimed at advancing best practices in the Voluntary Carbon Market (VCM). The ICROA also facilitates carbon finance to assist countries in reaching their Paris Agreement commitments.

In addition to these bodies, there are ancillary frameworks such as SBTi (Science Based Targets initiative) which enables companies to set scientifically informed targets for emissions reductions[28], and CORSIA (Carbon Offsetting and Reduction Scheme for International Aviation), a global carbon offsetting scheme established by the International Civil Aviation Organization (ICAO) to address greenhouse gas emissions from international aviation[29].

[28] https://sciencebasedtargets.org/about-us
[29] https://www.icao.int/environmental-protection/CORSIA/Pages/default.aspx



5. VCM & Stakeholder Landscape

I. Planning

Stakeholders: Local government, federal government, academic and financial institutions, project developer, implementation partner, community stakeholders.

Additionality is a key concept in carbon project development and refers to the idea that carbon credits should only be issued for emissions reductions or removals that go beyond what would have happened anyway, or what is required by law or regulation. In other words, a project is additional if it generates a reduction in emissions that would not have happened in the absence of the project.

The planning stage involves identifying a project idea that has the potential to generate carbon credits. In the case of agriculture, this would involve identifying which activities in current agricultural practices can lead to emissions reductions. The selection of a voluntary carbon market standard and approved methodology is also crucial at this stage (See **Annexure B** for a list of methodologies approved for agriculture sector). Choosing a methodology is based on multiple factors such as size of the project, feasibility of implementing the methodology, and documentation required. Additionality must also be ensured at this stage. In addition, the planning stage includes a detailed assessment of the social dynamics of the project location – demography, socioeconomic indicators, unique needs of the community. A deep understanding of agricultural practices must also be studied including the crops grown, crops that are native to the area, where and for how much they are sold, challenges in the cropping or harvesting stages, etc.

Eligibility criteria such as size of landholding, land type etc., should be checked before proceeding. All stakeholders should be involved in the planning process, including State Governments, farmers, farmer producer organizations (FPOs), NGOs, community-based organizations (CBOs), and project developers. Free, prior and informed consent (FPIC) must be obtained from the farmers before the project is finalised. In some cases, state governments may be involved in the process and may act as an implementation partner. In such a case, the state machinery could be used to aggregate farmers as well as to implement the project activities.

There may be opportunities to develop new methodologies for which the procedure set by the standard must be followed. Different standards have different procedures for submitting methodologies, but it largely involves the following steps[30]:

i. Submit a methodology concept note.
ii. Standard reviews the methodology to determine priority and appropriateness.
iii. Methodology developer submits methodology concept note.
iv. Standard reviews methodology concept note.

[30] https://d.docs.live.net/a559ac6f0aba7e33/Documents/Methodologies, Verra.

v. Submission of draft methodology
vi. Review of draft methodology
vii. Conduction of public consultations
viii. Methodology developer contracts independent verification body
ix. Independent verifier assesses the new or revised methodology.
x. Standard reviews updated methodology and determined if it can be approved.

However, developing a new methodology is time consuming, expensive and requires a large amount of expert input. It is only recommended when a project has enough potential and meets all the criteria for the standard but does not have a suitable methodology.

The Government may, if required involve ICAR or constitute Technical Committee consisting of subject experts to look into all technical matters required for the implementation of VCM.

Free, Prior and Informed Consent (FPIC)

FPIC is a principle that requires the rights of Indigenous people and local communities be respected when carbon projects are being implemented on their lands or territories. FPIC means that communities must be consulted and have given their free, prior, and informed consent to a project before it can be implemented. This involves awareness raising through community meetings, wall paintings, and awareness vans which ensure that communities are aware of the project activities and also have a say in them. FPIC is an important principle for ensuring that carbon projects are socially and environmentally sustainable and can contribute to positive development outcomes.

II. Designing

Stakeholders: Project developer, implementation partner, community stakeholders.

The project design stage involves developing a project based on the chosen VCM standard and methodology. The same stakeholders involved in the planning stage should be consulted in the design stage as well.

The project design should be based on a clear understanding of the baseline scenario and the expected emissions reductions. The baseline scenario is the emissions level that would occur without the project intervention. This is compared to the emissions level after the implementation of the project, to determine the emissions reductions that can be claimed as carbon credits.

During the designing phase, opportunities and challenges related to the project can also be identified. For example, the project design may identify opportunities for enhancing local livelihoods through the adoption of sustainable agriculture practices. Challenges related to the technical feasibility and financial viability of the project may also be identified.

New technologies could be employed to accurately measure and verify carbon sequestration in agricultural landscapes. Ensuring the credibility and transparency hold the key to the progress of carbon market related to agriculture. Use of geo spatial technology/satellite imageries/drones can supplement actual measurement at site achieving better accuracy.

Baseline: The baseline of a project shows the pre-intervention conditions of a project. Depending on the project type, different indicators are calculated for example – existing number of trees on a plot of land, amount of chemical fertiliser being used, quantity of water being used for paddy cultivation, etc. These same indicators are then checked at the end of the project to demonstrate how the project activities have led to a change in practices.

III. Validation

Stakeholders: Project developer, implementation partner, validation and verification body (VVB), VCM standard, community stakeholders.

After the project design is finalized, it needs to be validated by third-party independent validators or auditors to ensure that the project is designed in accordance with the VCM standard, and methodology selected. The validation process involves reviewing the project design, verifying the data used for the baseline scenario and estimating the emissions reductions, and ensuring that the monitoring plan is adequate and appropriate for the project.

The validators are independent experts who are accredited by the VCM standard to carry out the validation process. They may also include technical experts who have knowledge and experience in the agriculture sector. The validation process ensures that the project meets the eligibility criteria set by the VCM standard and that the project is expected to deliver the expected level of emissions reductions. On-site visits to farms are conducted to ensure that the project design is feasible and that the proposed practices are consistent with the methodology. The process also involves the assessment of the project's impact on local communities and the environment. This process can take several months to complete and can involve multiple iterations to address any concerns raised by the validators. A positive validation reinforces the integrity and quality of the project and leads to a successful registration. A negative validation will result in the project not being registered and thereby unable to generate carbon credits..

IV. Registration

Stakeholders: Project developer, implementation partner, VCM standard, community stakeholders.

During the registration stage, the project is formally accepted by the VCM standard. The project developers submit the necessary documents and the VCM standard

registers the project on its registry. This step involves the payment of registration fees to the VCM standard by the project developer. The cost of registering a project depends on the standard, the type of project and its size. Standards charge a registration fee based on the expected emissions reductions or removals generated by the project, as well as an annual maintenance fee. For example, as of May 2023, the minimum fee for registering a project under Verra's Verified Carbon Standard (VCS) Program is $2,500 (₹2 lakhs) for a project expected to generate up to 5,000 metric tons of carbon dioxide equivalent (CO2e) per year[31]. Larger projects that are expected to generate more emissions reductions or removals will have higher registration fees. The registration stage is critical as it formally recognizes the project and makes it eligible for carbon credit issuance. Additionally, during the registration stage, the VCM standard will assign a unique identification number to the project, which is necessary for tracking and accounting purposes.

V. Monitoring

Stakeholders: Implementation partner, community stakeholders.

The monitoring process includes regular site visits to verify the implementation of the project, as well as the measurement and recording of relevant data such as inputs, outputs, and the use of energy and resources as per the parameters to be monitored as mentioned in the project design. This information is then used to calculate the actual greenhouse gas emissions reduction achieved by the project. All the indicators and documentation collected during the monitoring period must be submitted to the standard in the form of a monitoring report. Regular monitoring can occur during the year and must always be accompanied by the report.

VI. Verification

Stakeholders: Project developer, implementation partner, validation and verification body (VVB), VCM standard, community stakeholders.

The monitoring reports are verified by third-party independent verifiers/auditors and the VCM standard to ensure compliance. The verifier also checks the project documentation and verifies that the project has been implemented as per the approved project design and methodology. The verification process can take several weeks or months depending on the complexity of the project. Once verification is complete, the verifier submits a report to the VCM standard for review. The VCM standard reviews the verification report and either approves or rejects the issuance of carbon credits based on the verification report. Once approved, credits can be issued to the project developer. Verification must be done every time that credits are requested.

VII. Issuance

Stakeholders: Project developer, VCM standard.

After the verification process is completed and the VCM standard approves the carbon credits issuance, the project developers will receive carbon credits in their account,

[31] https://verra.org/verra-publishes-updated-fee-schedules/

which is managed by the registry. The number of credits issued is determined based on the verified emission reductions achieved by the project, as per the VCM standard methodology. These credits can be traded or sold to buyers who require them to offset their emissions. The certification process provides credibility and assurance to the buyers, and it is essential for the market to function effectively.

VIII. Trade of carbon credits

Stakeholders: Central Government, Project developer, VCM standard, buyer.

Once the carbon credits have been issued, they can be traded on the voluntary carbon market. The project developer pays participatory farmers only after the issuance of credits. The price of carbon credits can vary depending on factors such as the certification standard, vintage, quality, and risk associated with the carbon credits. Carbon credit buyers can be corporates, governments, or individuals who want to offset their carbon emissions or invest in sustainable projects. The buyers may have their own sustainability goals, such as achieving carbon neutrality or reducing their carbon footprint.

The Central Government may, if required facilitates trading of carbon credits by coming up with guidelines for setting up a trading platform for the exchange/sale of carbon credits or may appointed institution to set up a trading platform based on approved guidelines.

IX. Rights to traded carbon credits.

Carbon rights can be assigned based on control of an asset or control of a mitigation activity. In agriculture, carbon rights can be assigned to farmers who own the land on which the mitigation activity has taken place, or to project developers/aggregators who carry out the mitigation activity. Prior benefit-sharing arrangements and agreements can also play a role in assigning carbon rights. By ensuring complete transparency in the entire process from project implementation to transfer of credits, the farmers' rights are protected. It must be made clear to farmers that when they waive carbon rights to the project developer, they are not waiving the rights to their land. The land is and will always belong to the farmer.

Mapping of Stakeholders in the VCM in the Indian Agriculture Sector

Sl. No.	Actor/Stakeholder Type	Role
1	Farmers and landowners	Farmers and landowners play a crucial role in the voluntary carbon markets in the agriculture sector in India by implementing carbon sequestration practices such as agroforestry, conservation agriculture, and soil carbon sequestration on their land.
2	Carbon credit buyers	Companies and individuals who are looking to offset their carbon emissions purchase carbon credits from farmers and landowners who have implemented carbon sequestration practices
3	Validation, Verification Bodies	VVBs play a critical role in the voluntary carbon markets by verifying that the carbon credits being sold meet the standards set by the voluntary carbon markets.
4	Standards and Certification bodies	Standards and Certification bodies certify that the carbon credits being sold meet the standards set by the voluntary carbon markets.
5	NGOs and development organizations	NGOs and development organizations provide technical assistance and capacity building to farmers and landowners to help them implement carbon sequestration practices. Often they are the organisations involved in carrying out the on-ground activities of carbon projects.
6	Government agencies (in this case MoA&FW, MoEFCC)	Government agencies provide policy support and regulatory oversight to the voluntary carbon markets in the agriculture sector in India.
7	NABARD	As an Agri-finance institution can play a major role of anchoring the framework for faster adoption of VCM for Agriculture sector in India.
8	Project developer	Is an entity that submits a project for certification, registration and observes overall responsibility of the project delivery, implementation and generation of carbon credits.
9	Implementation partner	Implementation partner could be a private entity/NGO/CBO/FPO etc. that helps in coordinating project activities including capacity development, enrolment of farmers/landowners, data collection, monitoring amongst other requirements to help successful implementation of a carbon project.
10	Community stakeholders	Community stakeholders are NGOs/local leaders or organisations that provide inputs during stakeholder

		consultations and emphasize on sustainable development aspects of the project.
11	FPOs	Farmer Producer Organisations can act as project developers or help in aggregation of farmers/landowners.
12	CBOs	Community Based Organisations can act as project developers or help in aggregation of farmers/landowners.
13	Research Institutions (Agriculture Universities, ICAR, ICRISAT, etc)	Can provide technical inputs, contribute to methodological issues and capacity building initiatives

6. Enablers for implementation

I. FPOs, CBOs and NGOs

Organisations that aggregate farmers, whether in the form of farmer producer organisations (FPOs), community-based organisations (CBOs) or non-governmental organisations (NGOs), Private Entrepreneurs can address some of the challenges faced by smallholder farmers. They empower them to take collective decisions and exercise their bargaining power. Through aggregation, these farmers can enjoy the benefits of economies of scale. In addition to providing small and marginal farmers with a platform for collective action, these organisations also offer various services such as training, access to credit and market linkages, which can be particularly beneficial for women farmers[32].

Such organisations are also imperative to take any kind of collective climate action to enhance the adaptive capacity of farmer communities. By working together, small and marginal farmers can have greater access to information, technologies, and resources necessary to adapt to climate change and mitigate its impacts. Aggregating farmers is an important pre-requisite for entering the carbon markets as benefits are only salient at scale. These organisations can help farmers navigate the complexities of the market, facilitate the verification of their carbon sequestration efforts, and negotiate fair prices for their carbon credits..

Role of Corporate Social Responsibility

1. Funding and Investment: Companies engaged in CSR activities can allocate funds and investments towards initiatives that promote carbon sequestration and emission reduction in the agricultural sector.
2. Collaboration and Partnerships: CSR initiatives can foster partnerships between private companies, NGOs, and agricultural communities to implement sustainable practices.
3. Capacity Building: CSR programs can focus on building the capacity and skills of farmers can include providing training, education, and technical support.

[32] https://www.nabard.org/demo/auth/writereaddata/File/FARMER PRODUCER ORGANISATIONS.pdf

II. Capacity Building

a. Community stakeholders

Potential Stakeholders

1. Research Institutes: These institutes can provide detailed studies and surveys that will help ascertain baseline scenario before a project begins. They can also provide historical data, estimates for projections, and innovative technologies for carbon projects.
2. Capacity building organisations: Technical support for surveys, monitoring, reporting, as well as the employment of agri-tech methods.
3. NGOs: Provide human resources to carry out project activities, and community know-how.
4. Bi- and Multi-lateral agencies: Connect ground implementation partners with investors.
5. Ministries: MoP, MoEFCC, MNRE, MoRD, MoJS, State Departments.

One of the most important aspects of implementing a carbon project is empowering community stakeholders with all the required information. This allows them to make an informed decision on joining the project, providing their consent, carrying out the activities, and sustaining them for the duration of the project. Firstly, community stakeholders and field staff must understand the basics of carbon sequestration and how it ameliorates climate change. It must be made clear how the objectives of the upcoming project align towards this goal. Secondly, community stakeholders and field staff must be provided with training to implement and monitor all activities. Different methodologies will require different kinds of training – for example, for an alternate wetting and drying (AWD) project, farmers must be taught how the monitoring pipes should be installed and maintained..

b. Field staff

Field staff, who are responsible for monitoring the activities of farmers or other stakeholders, must be trained to use apps and other technology tools that may be utilised to track various indicators. They should be aware of all technical aspects of the project activities so they are able to course correct when required and make suggestions for problems that may arise. Most importantly, the field staff must maintain a relationship of trust with the community stakeholders to enable open communication between the two. Capacity building is a continuous and dynamic process as project developers must respond to the needs of community stakeholders and provide support as and when required. This ensures that the project, once registered and certified, can sustain over a long period of time.

c. Project developers

For a project developer in the voluntary carbon market, having a technically sound team is crucial. They should be well-informed about the standards, methodologies,

eligibility criteria, and the process for registration and certification. It is also essential to have strong operational and implementation experience, with the ability to supervise implementation and carry the project from designing to registration and issuance stages. Maintaining on-ground presence is equally important to communicate with community stakeholders, take feedback, and monitor activities. A robust field presence can be achieved by creating connections with communities and implementing feedback mechanisms. Additionally, the project developer should be able to support field personnel with technical know-how, training, and standard operating procedures. Access to the market and potential investors is crucial, as building relationships and credibility in the investment market can help ensure the project's success. The project developer should be aware of the carbon market scenario, keep up to date with the latest developments, and have an understanding of the international carbon market.

Enhancing awareness and understanding of carbon markets among agricultural stakeholders is important to promote carbon market. Specific training programs or knowledge-sharing platforms can facilitate this process. There are various extension programs under the Ministries/Departments such as Capacity Building program of ICAR, MANAGE, ATMA programs like Farm School, Farmers' Training, Demonstration, Kisan Melas etc. Also, many on-going schemes/programs of the Ministries/Departments also have their own awareness components. States/UTs can provide awareness and capacity building platforms through their schemes/programs.

III. Pilot projects through KVK's

Interventions under National Mission on Sustainable Agriculture (NMSA) such as agroforestry, micro irrigation, crop diversification, National Bamboo Mission, Horticulture, Natural / organic farming, Integrated Farming Systems, etc. have potential to sequester carbon in soil/reduce emission of GHGs. It is important to establish model farms in KVKs, SAUs, Seed farms of NSC and other ICAR institutes for the purpose of demonstration for farming community. Further KVKs should take up VCM projects involving maximum farmers from their respective jurisdiction. Such projects can be the focal point for demonstration and dissemination of information/technology on carbon credits. The KVKs, SAUs and ICAR Institutes should also be actively involved in creating awareness among farming community so that more farmers can be covered under carbon projects. ICAR Institutes can serve as the centre for extending all technical support for carbon credits.

ICAR institutions particularly KVKs and SAUs through their ongoing research programs should developed standards for carbon sequestration/emission reduction potential for various regenerative agriculture practices across different agro climatic zones. Such standards can be the point of reference for designing VCM projects and for developing project modalities which will be useful by project developers. Programs under NMSA should also make provisions for supporting ICAR institutions, SAUs, KVKs etc. to develop the standards for VCM projects in Agriculture.

IV. Supply Creation and Challenges

As described in the feasibility section, there are various challenges for VCM projects at the farm level in terms of adoption and monitoring. Farm plots can and should be

aggregated but the calculation of carbon credits is done at the individual plot level. Operationally, this requires coordination at both the individual and aggregate levels. Furthermore, each farm's carbon accrual is based on its own baselines, meaning that different farms will have different carbon trajectories. Because this carbon credit count is based on each farmer's performance on the package of practices, it becomes imperative to mobilise more innovative methods of training and capacity building.

a. Quality of credits: Agriculture provides vast and diversified activities for VCM projects. Project designing and methodologies have to be feasible and scientifically sound in order to achieve quality and integrity of carbon credits. Land holding in the country is small and regional socio economic and cultural variations may add to the challenges for having implementable VCM projects. The process which is cumbersome and time taking may discourage farmers/communities.

b. Adoption: Requires a great degree of farmer engagement and they have to understand the transition as well as know how to carry it out. Farmers must be continuously engaged for this, and feedback must also be obtained. Additional requirements, linkages and support may also emerge from this engagement.

c. Financing the Adoption: This is a crucial aspect as financing will be required for tertiary technologies, for example: purchasing of solar pumps, vermicomposting units, decentralised biochar units.

The farmer aggregates will also require financing. For example, farmer producer organisations (FPOs) can utilise revolving funds where money is borrowed, repaid into the fund, and lent out again for other projects. The repayments and interest charges help to replenish the fund, making it a self-sustaining source of financing. This can be a beneficial form of financing that farmers can use to purchase farm equipment. Farmer aggregates can be eligible for credit at subsidised rates based on ESG (Environmental, Social, and Governance) points. The better the ESG performance, the more favourable the terms of the loan, such as lower interest rates or longer repayment periods. The purpose of this program is to encourage sustainable business practices and to reward entities that prioritize ESG factors in their operations.

d. Monitoring: There is a great potential to scale up existing digital technologies such as drones to monitor project activities, plots, and emissions reductions over the project period. Once again farmer aggregation eases many monitoring issues.

e. Continual Adoption: Financing is necessary to ensure that the project activities are continually implemented. This guarantees the permanence of the project, i.e., that the carbon stored or sequestered through the project does not get released back into the atmosphere. Any reversal could lead to the loss of the associated carbon credits.

Incentives or support mechanisms would encourage farmers to participate in carbon markets. The Schemes under NMSA provide support for farmers to adopt sustainable agriculture practices. More Programs of the Government should be aligned with carbon market so that farmers are encouraged to change over towards regenerative agricultural practices. Robust monitoring mechanism for quality and integrity of carbon credits should be an integral part of VCM promotion..

CASE STUDY: MAIZE FARMING IN KARNATAKA

Project Location: Belgaum, Karnataka, India

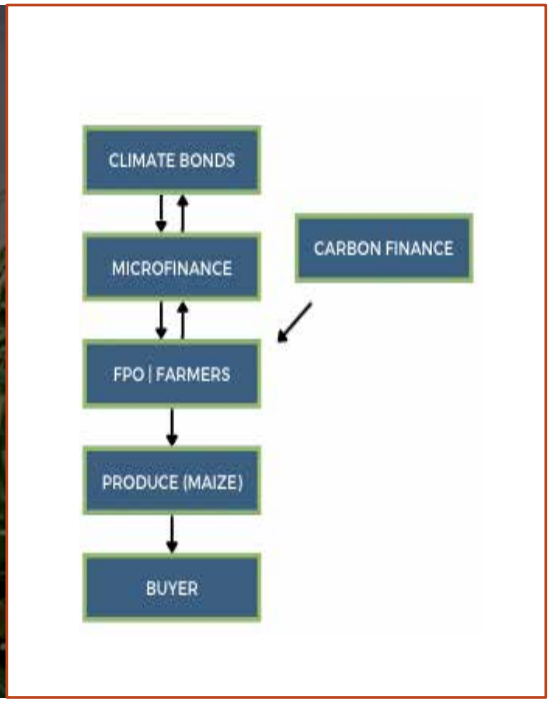
Number of Maize Farmers: 10,000

Project Duration: 10 years

This project involves Maize Farmers in Belgaum, Karnataka, India who are employed through Farmer-Producer Organizations to gradually transition to a more sustainable form of agriculture and crop production.

An agricultural program that accesses Blended Finance from Green Bonds, Microfinance, and Carbon Finance. Carbon credits are generated by FPOs through increased carbon sequestration on the land.

A structured incentive plan is in place to encourage active participation of farmers and communities and help support their transition costs.



IV. Demand for Credits

The international VCM as has been demonstrated to have immense market potential already. If the domestic market is set up in India, huge demand will be generated from corporations aiming to offset their emissions through carbon projects. Many of them have already declared net-zero targets under the science-based targets initiative (SBTi). Regulators such as SEBI and MCA can set clear ESG targets that will further incentivise investments in the carbon markets. India is already known to be one of the largest suppliers of carbon offsets in voluntary carbon market globally.

a. Enhancing Demand for Credits

If a domestic voluntary carbon market is envisaged, internationally recognised co-benefits need to be promoted along with good ESG practices. These co-benefits include Climate, Community and Biodiversity Alliance (CCBA), Sustainable Development Verified Impact Standard (SD VISta), and Gold Standard for the Global Goals (GS4GG). These labels are internationally valued and generate a premium for the associated credits. Comprehensive set of indicators could be included in the inventory to demonstrate the co-benefits of the project.

Moreover, guidance documents from regulators should emphasise co-benefits as an essential part of procuring carbon credits. This could increase the demand for credits from the agricultural domain as the projects will have a host of co-benefits that are farmer-driven.

CCBA encourages the implementation of best practices aimed at generating substantial benefits for local communities through activities like livelihood generation and biodiversity rejuvenation, alongside providing carbon offsets.

SD VISta, developed by Gold Standard, is a framework for measuring and verifying the sustainable development benefits of climate and development projects, such as poverty reduction, food security, and gender equality.

GS4GG is a certification standard for projects that demonstrate measurable contributions to the United Nations Sustainable Development Goals (SDGs), in addition to providing high-quality carbon credits.

Another push could be in the form of guidance around Scope 3 emissions of corporates or emission offsets within their value chain. Scope 3 emissions refer to those that are not generated directly by the company or assets owned by it, but from other activities in its value chain[33]. Many multinational corporations in India depend heavily on the agri-sector for their business supply chain (FMCGs, Agri commodity players), which could be mobilised for greater action.

b. Developing an Online Marketplace

An online marketplace/platform could be built into the inventory for clear communication about the projects, co-benefits, and other documentation, so that buyers have a readily available database to choose projects from. This supply side of the database could also be invited to have bi-yearly exchange sessions with regulators and buyers. The trading system should be transparent. Also, we still do not have standard pricing for carbon credit which makes it difficult to convince farmers on the returns of VCM projects. Setting floor price for VCM may work well.

[33] https://www.epa.gov/climateleadership/scope-3-inventory-guidance#:~:text=Scope%203%20Resources-,Description%20of%20Scope%203%20Emissions,scope%201%20and%202%20boundary.

7. Regulatory/Administrative/Legal Framework

India is one of the countries that have huge potential to unlock Voluntary Carbon Market that remains largely untapped. Private entities and industries are pushing VCM, and the country is expected to see a steep rise in its growth. India is already one of the big suppliers of carbon offsets on the global voluntary market. However, there are challenges that need to be address while promoting VCM.

Ensuring transparency in the VCM ecosystem is important especially in agriculture sector where we are dealing with mostly small and marginal farmers or community. Quality and integrity of carbon credit has to be ensured. Awareness and capacity building of farmers is crucial to achieve quality and sustainability of VCM. Good agriculture practices adopted by farmers have to be sustained for a long period of time. Further there is no standard pricing of Carbon Credits and therefore, many VCM projects may not be economically viable in absence of standard price. Feasibility of having floor price can be explored. Also, the amount of credit prices that the farmers actually received can be manipulated by the project developers resulting in farmers receiving lesser than their entitlement. VCM must be required to share the proceeds of credits that the farmers/community rightly entitled. It is also equally important to keep the whole market cycle of VCM simple and easy for the interest of the stakeholders.

The Ministry of Agriculture and Farmers' Welfare (MoA & FW) can play a crucial role in facilitating the adoption of VCM by stakeholders. To achieve successful implementation, it is important to focus on farmer education, capacity building, research, and finance, which can be facilitated by the Ministry through knowledge-sharing sessions, exposure visits, and farmer workshops. The Ministry can also create awareness among its state-level officials to initiate carbon programs. On the demand side, the Ministry can promote the inventory/database as a marketplace for buyers and provide additional information about the project's location and co-benefits to help them choose projects. For this purpose, the Ministry may identify any institution to maintain knowledge and data platform of all activities under VCM. The platform may collate data from VCM Registries on projects, achievements, best practices etc. Such institutions may oversee the entire eco system of carbon credit program in the country and guide the Government on any policy interventions required to facilitate the growth of VCM.

Ministry of Power notified Carbon Credit Trading Scheme(CCTS) 2023 under the provision of Energy Conservation Act, 2001. The Scheme provides for carbon market under compliance mechanism. The National Steering Committee has been set up under the Scheme to oversee the governance of Indian carbon market and matters related to it. Similarly, MoEFCC notified Green Credit Programme Implementation Rules, 2023 creating a market-based mechanism for providing incentives in the form of Green Credits. VCM should work in close coordination with CCTS and Green Credit Program to achieve the national priorities.

To facilitate the VCM, a multi-stakeholder accelerator comprising various stakeholders such as agri-companies, NABARD, and large foundations can be created to blend finance for these programs. Agri-companies can provide the necessary technical expertise for implementing carbon projects in the agriculture sector. NABARD, being a development bank, can provide the necessary financing and expertise for project implementation, monitoring, and reporting. Large foundations can provide funding support and contribute to building the capacity of local communities to participate in carbon projects.

8. Conclusion

The Government through National Mission for Sustainable Agriculture (NMSA) continues to evolve and implement strategies to make Indian agriculture more resilient to the changing climate and to sustain increase in production. While significant achievements have been made in agricultural productivity, it is equally important to enhance natural capital-land, water, biodiversity which form the natural base of food production systems.

Important steps have been taken under National Mission on Sustainable Agriculture (NMSA) towards achieving Sustainable Development Goals (SDGs). The promotion of Natural Farming and Organic Farming through the Paramparagat Krishi Vikas Yojana (PKVY) has been done by combining traditional and modern knowledge and has the potential to contribute towards climate change adaptation, disaster risk reduction and biodiversity conservation. The Soil Health Management (SHM) intervention focuses on limiting the use of chemical fertilizers through the use of soil health cards (a sub scheme under SHM), while also promoting the use of bio-fertilizers, manures and organic fertilizers to enhance and restore soil health, thereby contributing to improved soil health. Such schemes focus on protection, restoration and promotion of sustainable use of terrestrial resources like land, halt and reverse land degradation with improved life on land. Further, Indian Council of Agricultural Research (ICAR) under National Innovations in Climate Resilient Agriculture (NICRA) project is working to enhance resilience of the agriculture sector to climate vulnerabilities.

The proposed framework for the domestic voluntary carbon market in the agriculture sector of India is a comprehensive guide that covers various aspects of the carbon market which is seen as an important step towards upscaling sustainable agriculture practices. The framework includes the background, existing policies and programs, implementation framework, and stakeholder landscape at each stage. It outlines the opportunities and challenges involved in each step and highlights the roles of different stakeholders, including the government, farmers, NGOs, and project developers. The framework's primary objective is to promote sustainable agricultural practices, encourage the adoption of regenerative farming and build climate resilience in the food production systems. By establishing a transparent, reliable, and robust carbon market, the framework has the potential to benefit farmers and the agriculture sector economically, socially, environmentally while also promoting soil health and food security. The VCM framework in the agriculture sector can play a critical role in supporting the country's sustainable development. VCM in agriculture will promote restoration and promotion of sustainable use of terrestrial resources like land, water, biodiversity and agriculture landscape and will enhance resilience of the agriculture sector to climate vulnerabilities and risks contributing to SDG goals..

Annexures-A

Glossary

Agroforestry: A sustainable land-use system that maintains or increases total yields by combining food crops (annuals) with tree crops (perennials) and/or livestock on the same unit of land, either alternately or at the same time, using management practices that suit the social and cultural characteristics of the local people and the economic and ecological conditions of the area.

Alternate Wetting and Drying (AWD): a water-saving technology to reduce water consumption in rice fields in which water is applied a few days after the disappearance of the ponded water. Hence, the field gets alternately flooded and non-flooded. The number of days of non-flooded soil between irrigations can vary from 1 to more than 10 days.

Carbon Credits: A unit of trade in carbon markets that represents one metric ton of carbon dioxide equivalent (tCO_2e) that has been avoided or removed from the atmosphere.

Carbon Offsets: A credit for greenhouse gas reductions made by one entity that can be purchased by another entity to offset their own greenhouse gas emissions.

Carbon Registry: A database or system that tracks verifies, and records the issuance, transfer, and retirement of carbon credits, ensuring their transparency, integrity, and accountability.

Carbon Rights: The ownership and ability to trade or sell carbon credits.

Carbon Sequestration: Refers to the process of removing carbon dioxide from the atmosphere and storing it in long-term carbon sinks such as forests.

Climate-Resilient Technologies: Refers to innovative technologies and practices that improve the ability of an agricultural systems to anticipate and prepare for, as well as adapt to, absorb and recover from the impacts of changes in climate and extreme weather.

Conservation Tillage: Agricultural practices that minimize soil disturbance, such as reducing or eliminating ploughing, to improve soil health, water retention, and carbon sequestration.

Cover Crop: A non-cash crop that provides soil protection, seeding protection, and soil improvement between periods of normal crop production.

Crop Diversification: Refers to the practice of growing a variety of different crops within a specific agricultural area or cropping system. It involves deliberately introducing and rotating different crop species, cultivars, or varieties over time.

Direct-seeded Rice (DSR): A method of rice cultivation where rice seeds are sown directly into the field without transplanting seedlings. It involves broadcasting or drilling the seeds directly into a prepared seedbed or paddy field, eliminating the need for nursery establishment and manual transplanting.

Free, Prior and Informed Consent (FPIC): A principle and process recognised internationally that ensures the rights of indigenous peoples and local communities to make informed decisions regarding projects or activities that may affect their lands, territories, resources, or livelihoods. FPIC requires that these communities are provided with accurate and accessible information, given sufficient time to understand and discuss the proposed project, and have the opportunity to freely express their consent or refusal without coercion.

Greenhouse Gas (GHG) Emissions: The gases that trap heat in the Earth's

atmosphere and contribute to climate change, including carbon dioxide, methane, nitrous oxide, and fluorinated gases.

Jhum Cultivation: A form of shifting cultivation which involves clearing a patch of land, burning the vegetation, and cultivating crops for a few years until the fertility declines.

Mulching: The practice of covering the soil with organic material to improve soil health, prevent erosion, and retain moisture.

National Determined Contributions (NDCs): The climate action plans submitted by countries under the United Nations Framework Convention on Climate Change (UNFCCC), outlining their efforts to reduce greenhouse gas emissions.

Nature-based Methodologies: Refers to the use of natural systems and processes to mitigate climate change, such as reforestation, soil conservation, and agroforestry.

Net Zero Targets: Goals set by companies or governments to achieve a balance between the amount of greenhouse gas emissions produced and the amount removed from the atmosphere, resulting in no net increase in emissions.

Nitrification Inhibitor: A substance applied to soil to slow down the conversion of ammonium into nitrate, thereby reducing nitrous oxide emissions.

NTFP: Non-Timber Forest Products, are biological materials extracted from forests for human and animal use, excluding timber. They include items like fuelwood, bamboo, animal products, medicinal plants, and herbs. NTFPs have both consumptive and exchange value and play a vital role in local livelihoods and biodiversity conservation.

Nutrient Management: The strategic application of fertilisers and other soil amendments to optimise nutrient availability for crops while improving nutrient use efficiencies.

Organic Farming: A farming system that uses organic inputs and avoids the use of synthetic fertilizers, pesticides, genetically modified organisms (GMOs), and growth regulators.

Regenerative Farming: Farming that focuses on improving soil health, biodiversity, and ecosystem resilience while promoting sustainable agricultural practices.

Small and Marginal Farmers: Refers to farmers with less than 2 hectares of land, who make up the majority of farmers in India.

Soil Organic Carbon: Refers to the carbon component of soil organic matter, which includes decomposed plant and animal residues. It plays a vital role in nutrient cycling, water retention, and soil structure.

Voluntary Carbon Market (VCM): Refers to a market where individuals or organizations can buy and sell carbon credits voluntarily to offset their carbon footprint or support climate mitigation projects.

Vintage Year: The year in which a carbon credit is generated, which affects its eligibility for certain programs and the price it can fetch on the market.

Annexure-B
Methodologies for Agriculture
2

Agriculture

- VM0042 - Methodology for Improved Agricultural Land Management, v1.0 - VERRA
- VM0044 Methodology for Biochar Utilization in Soil and Non-Soil Applications, v1.0 - VERRA
- Small-Holder Agriculture Monitoring and Baseline Assessment (SHAMBA) methodology - Plan Vivo
- Soil Organic Carbon Activity Module: Increasing Soil Organic Carbon through Improved Tillage Practices - Gold Standard
- Water and Erosion Impact Assessment of Sustainable Agricultural Land Management Projects - Gold Standard
- AMS-III AU - Methane Emission Reduction by Adjusted Water Management Practice in Rice Cultivation - CDM

Afforestation

- AR-ACM0003 - Afforestation and reforestation of lands except wetlands - CDM
- AR-AMS0007 - Afforestation and reforestation project activities implemented on lands other than wetlands - CDM
- Methodology for afforestation, reforestation and revegetation projects - VERRA
- Automating Forest Carbon Quantification - Plan Vivo
- Afforestation/Reforestation GHG Emissions Reduction & Sequestration Methodology - Gold Standard

Energy (CDM Methodlogy)

- AMS I B - Mechanical energy for the user with or without electrical energy - CDM
- AMS II F - Energy efficiency and fuel switching measures for agricultural facilities and activities - CDM
- AMS II P - Energy efficient pump-set for agriculture use - CDM
- AMS II G - Energy efficiency measures in thermal applications of non-renewable biomass - CDM