Sattva Knowledge Institute SKI primer

EVOLVING CONVENTIONAL AGRICULTURE THROUGH REGENERATIVE PRACTICES

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Acknowledgements

About the Authors

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EXECUTIVE SUMMARY

Emerging Need for Regenerative Agriculture (RA)

Unsustainable land use practices in agriculture are resulting in the critical depletion of natural resources. To mitigate the damage, several alternatives to traditional agriculture have emerged and evolved from time to time. Regenerative agriculture is a principled approach that refers to the integration of sustainable farm practices and operations to reverse degradation of agricultural resources, the main objective being the rehabilitation and conservation of nature.

Many agricultural practices like natural farming, no tillage, composting, usage of biochar, and keyline subsoiling achieve one or more objectives of RA at regional and local levels. The benefits of RA are seen at the systemic level, in the form of improvement in living outcomes and quality of natural resources, and farm levels, manifesting as reductions in input and subsidy, as well as environmental costs.

Existing Landscape: Growing Interest in India and globally

Regenerative agriculture can play a key role in addressing climate change issues, and has witnessed increasing interest among government and corporate stakeholders. The valuation of RA has been estimated at around US $20 billion by 2030. Governments across the world have shown interest in regenerative agriculture, with initiatives like '4 per 100' initiative in France, 'Rizoma Agro' in Brazil, 'Regenerative Agriculture Association' in South Africa. Additionally, global corporations like Olam, FAO, EcoFarm, and RegenAg are aligning their processes and programmes with forward-looking sustainability goals focusing on regeneration of ecosystems.

In India, private corporations are venturing into this space through establishment of networks and collaboratives, creation of organisational frameworks, and funding of projects on farmer capacity building and evidence-based assessments at the farm level. Moreover, individual farm-level innovators and entrepreneurs have been using innovative techniques, including natural farming and permaculture, on their farms as opposed to conventional practices. India has also started focusing on natural farming as a sub-component of regenerative agriculture. The Government of India, as well as the state governments aim to double the area under natural farming to around 2 million hectares by 2025.

Challenges and Opportunities

Scaling up RA is difficult - less than 2% of cultivable area in India is currently under RA. Even states with critically overexploited levels of water levels are yet to actively consider any regenerative farming alternatives to their existing modes of farming. Even with growing interest among stakeholders, Regenerative agriculture has remained a programme-level intervention, and faces challenges due to heterogeneity in understanding and defining clear objectives for interventions. The major challenges centre around farmers' behavioural skew towards conventional farming, lack of homogeneity in understanding, inadequate skill sets among farmers and the lack of access and availability of resources like capital, natural inputs and technology.

Call for Action

There is a need to develop systems for collaborative and continued efforts which are based on robust evidence, symmetric information and understanding of the ground-level realities at the farm level to make this alternative work.

Short-term Priorities:

Ground-level evidence based assessment and research, farmer training and capacity building, strategic communication of benefits of Regenerative Agriculture

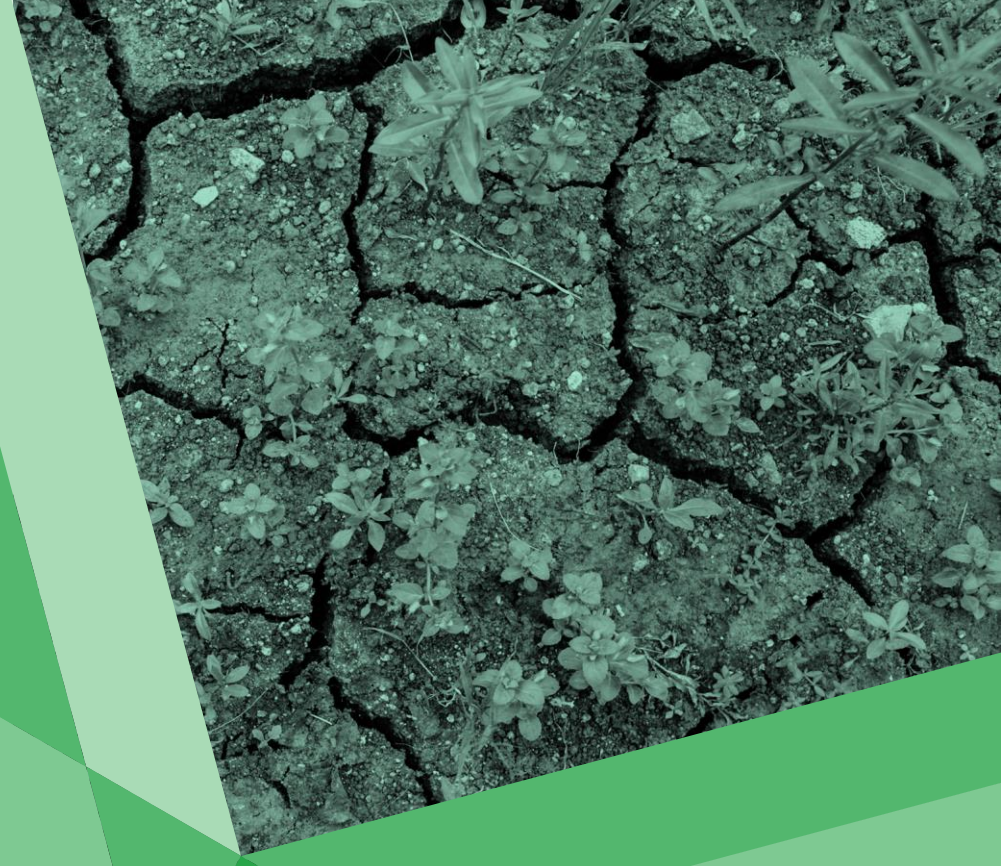
Medium-term Priorities:

Designing products and services (e.g. financial) and creating networks and collaboratives around RA.

Long-term Priorities:

Creation of common terminologies, influencing incentives for farmers at the policy level, and using technology as an enabler.

EMERGING NEED FOR REGENERATIVE AGRICULTURE



What is Regenerative Agriculture?

Regenerative Agriculture (RA) refers to the integration of sustainable farm practices and operations to **reverse degradation of agricultural resources.** Its main objective is the rehabilitation and conservation of nature.

Regenerative Agriculture works on processes and principles like…

- Soil Regeneration
- Improvement of Water Life Cycle
- Carbon Sequestration
- Increasing Biodiversity
- Creating Sustainable Food Systems
- Agricultural Diversification*

…to achieve overall outcomes like

1. Land and Soil Conservation
2. Water Conservation
3. Biodiversity Conservation
4. Climate Conservation
5. Sustainable Food Systems
6. Social and Cultural Diversity

*Diversification - Both crop-based, like cover cropping, multi-cropping and intercropping, and activity-based, like integration of livestock into processes

Regenerative Agriculture involves a number of processes and techniques.

Soil Regeneration

- Natural Farming
- No-till farming, minimum tillage
- Usage of terra preta/biochar
- Agricultural crop diversification
- Composting
- Perennial cropping
- Agroforestry

Water Life Cycle Improvement

- Natural farming
- Keyline subsoiling
- Conservation agriculture
- Regenerative ocean farming
- Wetland restoration
- River restoration

Carbon Sequestration

- Carbon farming
- Holistic pasture and grazing e.g. silvopasture
- Mulching
- Afforestation
- Agricultural diversification
- Crop residue and livestock management

Increasing Biodiversity

- Polyculture
- Soil microbe management
- Usage of leguminous cover crops
- Biodynamic farming
- No synthetic input usage

Sustainable Food Systems

- Nutrient cycling soil techniques
- Optimal post harvest activities
- Nature-based production techniques
- Improved plantations and existing cultivation

What differentiates Regenerative Agriculture from other similar solutions?

Regenerative Agriculture goes **one step further** as compared to other sustainable modes of farming like organic farming, carbon farming, conservation farming, and permaculture.

SUSTAINING VS IMPROVING

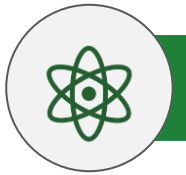
Regenerative Agriculture does not focus only on sustaining existing resources, but rather on **restoring and improving** current quality.

PRACTICES VS PRINCIPLES

Regenerative Agriculture is not just a set of practices, but **a set of principles** which governs all practices.

PROCESSES VS OUTCOMES

Regenerative Agriculture not only focuses on processes and techniques employed, but also on the active assessment and **improvement of outcomes.**



FARM-SPECIFIC VS HOLISTIC

Regenerative Agriculture is not just focused on direct farm activities, but also the **holistic integration** of off-farm processes like integration of livestock and forests, and inclusion of social communities into farming.

There are growing adverse effects of human activities across natural ecosystems which enhance the need to employ regenerative practices.

Context	Change witnessed by natural ecosystems	How regenerative practices fit in
Diminishing Land and Soil Quality	• Estimated 111% increase in global area of managed land from 1900 to 2000 (SYSTEMIQ 2019). • Trebling of mean crop and crop residue yield from 1900 to 2000 (SYSTEMIQ 2019). • Global population is predicted to grow to around 10 billion by 2050, straining carrying capacity of resources increasingly (SYSTEMIQ 2019). • Estimates indicate that around 24% of greenhouse gas emissions pertain to agriculture, forestry and existing land use patterns (EPA). • BY 2030, over 70% of agricultural land is expected to suffer from soil-related constraints (FAO 2001).	• On-farm soil carbon sequestration can potentially sequester all of our current annual global greenhouse gas emissions of roughly 52 gigatonnes of carbon dioxide (Rodale Institute). • Improved management of agricultural land with known, low-cost practices has the potential to both reduce net greenhouse gas emissions and to act as a direct CO2 sink (Rodale Institute). • Reducing or eliminating tillage, using cover crops and enhancing crop rotations ensure that land will not be left bare and soil carbon will be fixed, rather than lost.
Overexploitation of Water	• Increase in irrigated land has been thrice the increase in farmland globally since 1961 (FAO 2001). • About 70% of freshwater is used for farming globally (FAO 2001). • Nearly 30% of groundwater wells in India have shown decline in water levels recently (Central Ground Water Board 2021).	• Cover crops increase soil carbon, reduce nitrogen leaching and discourage wind and water erosion. • Soil benefits translate into greater soil health and productivity through reduction of water or fertiliser needs.

There are growing adverse effects of human activities across natural ecosystems which enhance the need to employ regenerative practices.

Context	Change witnessed by natural ecosystems	How regenerative practices fit in
Threats to Biodiversity	• Significant decrease in biodiversity with loss of several indigenous flora and fauna worldwide (FAO 2001). • The decline has been driven by unsustainable land use practices leading to erosion, flooding and field fires. • 15% of all land is currently protected due to special biodiversity and ecosystems on it. (IUCN 2016) • Global food systems have put 86% of biodiversity at risk of extinction. (Benton et. al. 2021)	• Sparing land is a technique which is claimed to de-stress resources and enhance conservation of biodiversity associated with the same land (SYSTEMIQ 2019). • Pollinating species such as birds, invertebrates, and other fauna also thrive due to conservation agriculture.
Transformation of Farming and Food Systems	• Evolving view from a top-down perspective to a holistic approach which combines better livelihoods, food security and institutional structure • Food supply chains contribute to 1/3rd of overall GHG emissions (Our World in Data 2019). • The focus on quality of food is also low. The lowest 30% of the population spending on food is undernourished.	• Regenerative agriculture may provide a higher premium in some cases, and lead to long term economic benefits for farmers. • Diversification of crops and allied activities would cover for food insecurity gaps, and restoring soil fertility would increase nutrient availability in food.

There are growing adverse effects of human activities across natural ecosystems which enhance the need to employ regenerative practices.

Context	Change witnessed by natural ecosystems	How regenerative practices fit in
 **Threats to Climate**	• Agriculture contributes to nearly 15% of the total greenhouse gas emissions of India - the highest contributors being activities like enteric fermentation, followed by rice cultivation, fertiliser and manure usage, and inefficient management of agricultural waste.	• Activities like diversification to grow a variety of crops, to optimise the usage of resources, and avoid the negative effects of monocropping is one way to mitigate carbon emissions. • Agroecological approaches like natural farming, organic farming and conservation agriculture techniques can induce ecosystem and biodiversity conservation. • Usage of renewable energy like solar plants, and low fossil fuel usage can complement the processes.

Regenerative agriculture has systemic benefits which can balance the distress caused by conventional farming, without having to substitute conventional farming entirely.

Regenerative agriculture has the ability to bring sustained impacts on economic, environmental and social fronts.

Impact Outcomes

Improved living outcomes for communities

- Better products and diversified supply: Increased product quality and supply diversification, improved food quality.
- Increased awareness and empowerment: Social awareness and usage of eco-friendly products.
- Affluent economy: Communities get more employment and income opportunities.
- Holistic development: Overall equality - gender, economic and social, and progress of the community in a holistic manner.

Improved quality of natural resources, climate and life

- Improved soil health: Improved fertility, quality, and conservation.
- Improved Water Usage Efficiency: Increased percolation, retention, and preservation.
- Biodiversity conservation: Effective protection, preservation, and regulation of exploitative practices.
- Reduction in carbon levels: Carbon sequestration
- Controlling pollution: Abatement of pollutants like CO2 due to excessive wastage of resources.

Improved viability of sustainable practices

- Better income and yields: Higher agricultural output in absolute as well as relative terms.
- Sustained employment: People engaged in agriculture which is sustainable for the future.
- Low long-term costs: Reduction of input costs and other expenses, and focus on building sustainable models.
- Resilience: Improved ability to handle risks within the uncertainties of agriculture.

The viability of Natural Farming is not based on higher crop yield, but lower costs incurred, which can help realise better prices for farmers.

30-80% potential reduction in input costs depending on the crop type

- More than 80% reduction in input costs for rice cultivation.
- Nearly 10-30% reduction in input costs for crops like maize and groundnut.
- 80-90% reduction in fertiliser usage across various crops.

40-50% potential reduction in subsidy costs, subject to policy scenarios

- 40-50% savings were seen on average from the gap in actual subsidy outlay and actual usage of the subsidy.
- This also depends on the amount of cropped area and the state of policy regulations.

30-50% reduction in environmental costs

- Soil erosion reduction by nearly 30%.
- Water level regeneration by 60%.
- 20% soil carbon sequestration.
- Soil nitrogen fixation by 20%.

Source: Inferences based on ZBNF model in Andhra Pradesh

ADOPTION TRENDS AND UNTAPPED POTENTIAL

Countries across the world are increasingly adopting Regenerative Agriculture.

13 CLIMATE ACTION

USA
Market attractiveness and state support activities like certification and training programmes.

France
4 Per 100 Initiative as a resolution to increase the mean level of carbon in soil through regenerative practices.

Russia
Food security initiatives by the Putin government to promote Genetically Modified varieties of organic food.

China
Self sustained, localised models of farming and agriculture.

South Korea
Natural Farming methods including fermentation.

India
Government-led initiatives like Natural Farming, and individual innovators at farm level.

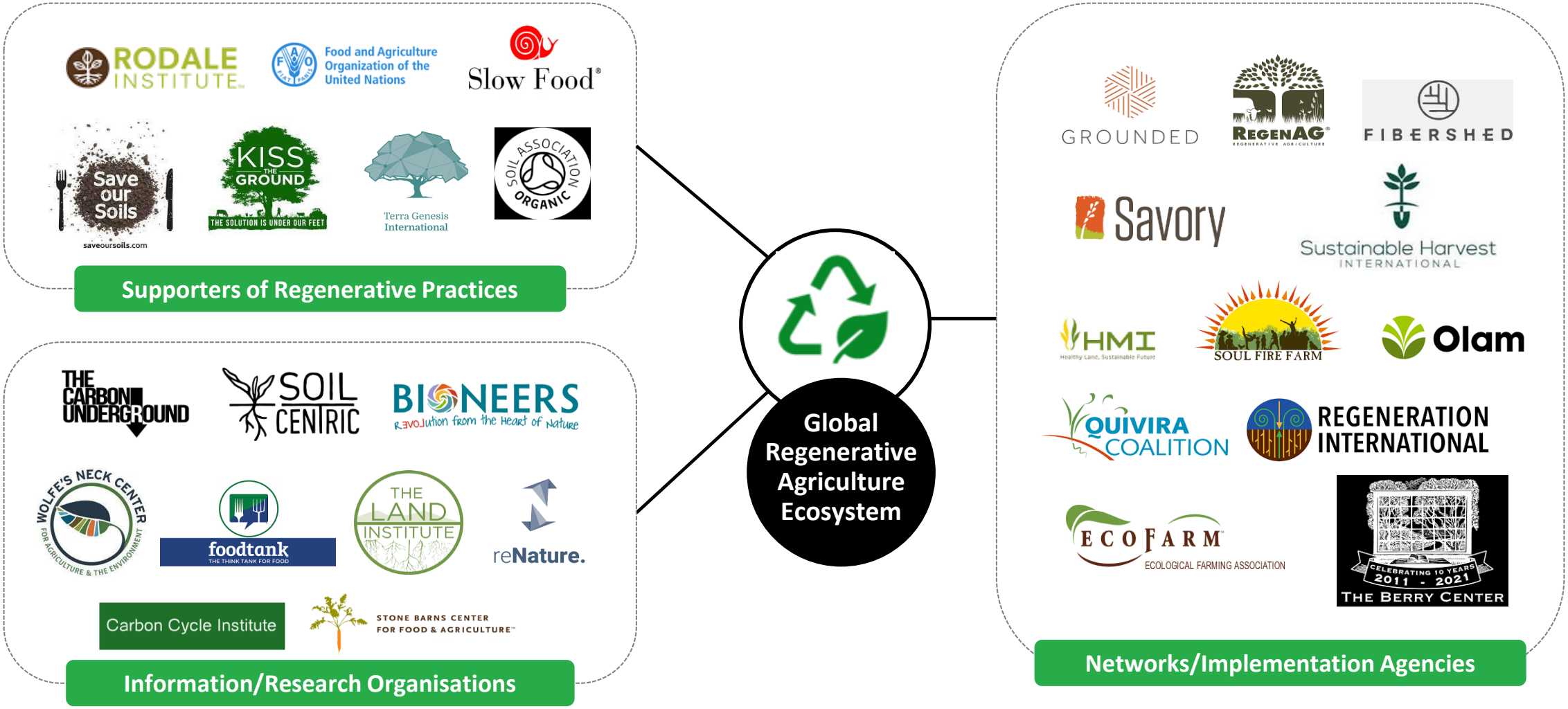
Brazil
Innovative regenerative institutions like Rizoma Agro promote organic foods, agroforestry, dairy, and citrus foods.

Indonesia
Initiatives like Integrated Pest Management (IPM) to reduce use of pesticides and chemical fertilisers.

South Africa
Setup of Regenerative Agricultural Association to reverse the effects of rampant industrial farming.

Australia
Mobilised associations of ranchers and progressive farmers with established networks.

Regenerative agriculture is emerging as a viable solution to rebuild ecosystems, with considerable support by global organisations.



Regenerative agriculture has its largest market in North America, with significant growth potential for the Asia-Pacific region, including India.

The concept of regenerative agriculture has emerged in prominent discussions, albeit under different terminologies, towards enabling sustainability in agriculture.

5th most discussed

among the **topmost searched activities** under Sustainable Agricultural Practices (Gupta et. al. 2021).

USD 7-8 billion

is the approximate 2021 **valuation of the market size** of global regenerative agriculture (Polaris Market Research 2022).

More than USD 20 billion

is the expected **revenue forecast** for the year 2030 under regenerative agriculture (Research & Markets 2022).

2.5 million farmers in India are practising regenerative agriculture (NITI Aayog).

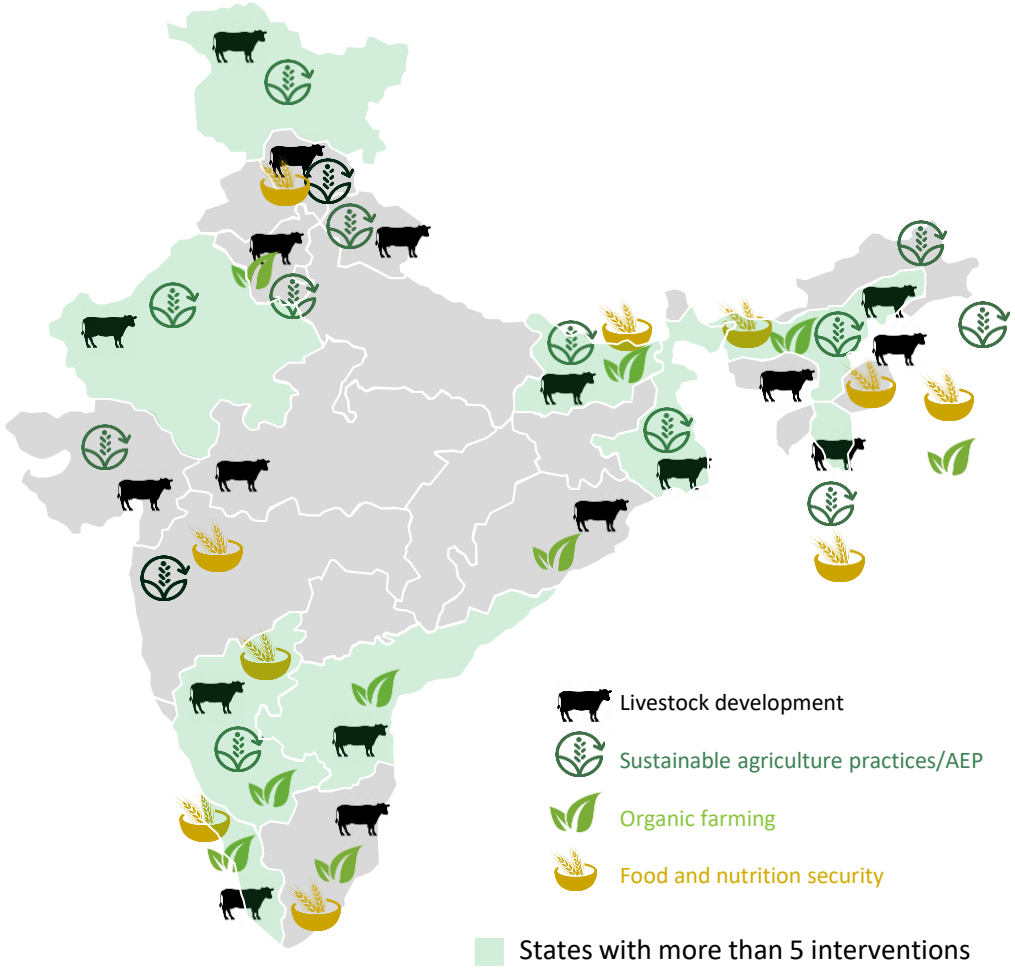
Nearly 1 million hectares

Current cultivable area under practices related to Regenerative Agriculture (Gupta et. al. 2021).

2 million hectares

of farmland under Regenerative Agriculture is the 2025 goal of the Government of India, nearly doubling the area under RA (NITI Aayog).

Government interventions related to sustainable agriculture in India focus on livestock development, sustainable and agro-ecological practices, and food nutrition - all of which fulfill one or more major outcomes of Regenerative Agriculture.



Source: NRLM data

Livestock development interventions are observed in 18 states; while Sustainable agriculture practices or Agro-ecological Practices (AEP) interventions are observed in 13 states.

Sustainable agriculture practices/AEP

- Sustainable agriculture practices/AEP include water conservation and management for farm activities, non-pesticide management, seed treatment, and more resource efficient farm practices, e.g. natural farming.

Livestock Development

- Complements Sustainable Agriculture and diversifies livelihood opportunities by training Community Resource Persons (CRPs) such as Pashu Sakhis; focus on better management of livestock including ruminants (dairy, goatery, piggery) and non-ruminants (backyard poultry, duckery).
- Ensures proper shelter and breed selection for livestock and training and supplementary income generation.

Food and nutrition security through agri-nutrient gardens

- The mission supports every rural poor household to have Agri Nutri Garden to fulfill the family's nutritional needs. Any excess production can also be sold for income generation.

Organic Farming

- Deendayal Antyodaya Yojana - National Rural Livelihoods Mission (DAY-NRLM) has promoted organic farming since 2018; this includes development of organic clusters in the states, organic cultivation of crops and marketing organic produce.

Several initiatives and programmes by the Government of India support the adoption of sustainable and regenerative farming practices.

Schemes by the government to support and promote Regenerative Agriculture

Supporting climate-resilient and regenerative practices like agroforestry

Ministry of Environment, Forest and Climate Change
Government of India

National Action Plan for Climate Change

Promoting techniques relevant to Regenerative Agriculture

कृषि एवं किसान कल्याण मंत्रालय
MINISTRY OF AGRICULTURE AND FARMERS WELFARE
सत्यमेव जयते

National Mission on Sustainable Agriculture

Emphasising on local and indigenous production through regenerative techniques like organic and natural farming

आत्मनिर्भर भारत

Atmanirbhar Bharat

- National Mission on Sustainable Agriculture (NMSA)
- National Mission on Micro Irrigation (NMMI)
- Paramparagat Krishi Vikas Yojana (PKVY)
- National Rainfed Area Authority (NRAA)
- Sub-Mission on Agroforestry (SMAF)
- Sub-Mission on Seeds and Planting Material (SMSP)

Sources: National Mission on Sustainable Agriculture; National Mission on Natural Farming Management and Knowledge Portal

State governments are also promoting regenerative agriculture through various policies and programmes, however, these are still at a nascent stage.

Zero Budget Natural Farming (ZBNF) was originally promoted by an Indian agriculturist, Subhash Palekar in the mid-1990s. While the term 'Zero Budget Natural Farming' assumes zero costs of input purchase from the market, there are still opportunity costs to using every input.

Zero Budget Natural Farming Scheme, Government of Uttar Pradesh

Rs 1.97 billion

Latest budgetary allocation by the state government.

51,450

Farmers to be targeted.

Zero Budget Natural Farming Scheme, Government of Andhra Pradesh

Rs 4.5 billion

Latest budgetary allocation by the state government.

6 million

Farmers to be targeted by 2024.

Zero Budget Natural Farming Scheme, Government of Rajasthan

Rs 6 billion

Latest budgetary allocation by the state government.

400,000

Farmers to be targeted.

Prakritik Kheti Khushal Kisan Yojana, Government of Himachal Pradesh

Rs 250 million

Latest budgetary allocation by the state government.

150,000

Farmers targeted by 2021.

Source: Union Budget 2022-23

Agricultural initiatives by corporations are reported under several broad sectors in company annual reports and are directly or indirectly related to outcomes targeted under regenerative and sustainable practices.

Vocational Skills or Skill Development

- Initiatives include capacity building for farmers to impart essential farming knowledge, ensuring timely information and providing support for better productivity.
- Examples
  - Livelihood Promotion for Farmers
  - Skilling and Entrepreneurship, Livestock development

Livelihood enhancement

- Initiatives aimed at supporting farmer productivity, thereby increasing income.
- Examples
  - Sustainable Livelihood Programme
  - Marking Integrated Transformation for Resourceful Agriculture (MITRA)

Environmental Sustainability

- Initiatives focused on sustainable agriculture, water and soil conservation, and climate-smart practices.
- Examples,
  - Water Conservation Projects
  - Integrated Village Development Project – Climate-smart agriculture

Eradicating hunger/poverty

- Initiatives range from crop and livestock management to supporting development of rural communities.
- Examples
  - Crop Practice Improvement
  - Support for integrated development of communities

Rural Development

- Initiatives include wide range of activities aimed at enhancing socio-economic lives of rural communities, like enabling technology interventions, establishing infrastructure, enabling land reform measures, and enabling increased economic participation of communities.
- Examples
  - Holistic Rural Development Programmes
  - Support towards improved Agriculture Practices

Key	Outcome
	Land & Soil Conservation
	Water Conservation
	Biodiversity Conservation
	Climate Conservation
	Sustainable Food Systems
	Social and Cultural Diversity

Organisations have been promoting regenerative agriculture as a part of their sustainability initiatives.

Intervention 1
Creating networks or collaboratives

Regenerative Production Landscape (RPL) Collaborative

- Implemented in Madhya Pradesh.
- Key stakeholders include the state government, private sector, producer groups or cooperatives, traders, and civil society.
- It aims to cover all the cotton-growing regions in the Chhindwara district of Madhya Pradesh under regenerative practices and landscapes by 2025.

Intervention 2
Aligning organisational decisions

- Businesses sourcing their raw materials responsibly from regenerative farms e.g. Pepsico's 2030 goal of deploying RA on 7 million acres of land.
- Creating frameworks, knowledge and strategising metrics for pushing regenerative agriculture as a practice e.g. Regenerative Agriculture Principles designed by Unilever.
- Enabling development of institutions that support regenerative practices.

Intervention 3
Programme-based interventions

- Capacity building of farmers by equipping them with knowledge and tools based on regenerative practices.
- Creating funds to provide grants for implementation of projects across geographies e.g. Regenerative Fund for Nature by Kering.

Regenerative farming techniques have also seen considerable interest from innovators and farm entrepreneurs.

Some important individual farm innovators

Tamil Nadu's Auroville

- Managed by Krishna McKenzie over six acres of land where 150 varieties of plants are grown through natural farming.
- Methods used: No-tillage, compost and residue farming, permaculture.

Haryana's Aananda

- Managed by Manisha Lath Gupta on the base of Morni Hills, Aananda is converted from a barren piece of land to a rich food ground with around 4,500 trees.
- Methods used: Permaculture

Telangana's Aranya

- Managed by Padma and Narsanna Koppula, who have converted a barren piece of land into a food forest.
- Methods used: Permaculture, water harvesting and percolation techniques.

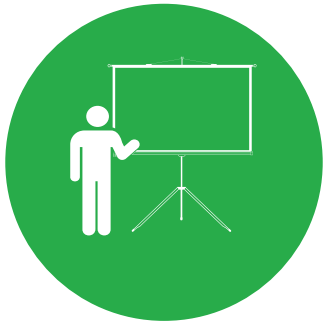
CHALLENGES AND OPPORTUNITIES

In the face of challenges to scaling up regenerative agriculture, less than 0.1 million hectares in India is cultivated using regenerative practices.

Inefficient models of viability, information asymmetries and **skepticism about regenerative farming** are the **major factors** which inhibit adoption.

Behavioural constraints due to heavily skewed preference of farmers towards conventional farming.

Lack of common understanding and vocabulary across stakeholders.



Inadequate set of common skills and knowledge among farmers.

Inadequate access to climate-resilient and climate-based finance in agriculture.

Lack of access to low-cost resources and inputs to employ RA techniques.

Encouraging regenerative agriculture in India requires three levers to be enabled.

The adoption of Regenerative Agriculture among Indian farmers, as **an alternative mode of farming, not a perfect substitute to conventional farming,** can be encouraged with **three major enablers.**

Unlocking value of existing knowledge of local, regionally contextual solutions employed across farms

- According to the NITI Aayog, there are around 2.5 million farmers in the country who are practising regenerative agriculture, and employ highly local and indigenous practices on their farms.
- Globally, approximately 370 million indigenous groups occupy nearly 22% of the land; hence, 80% of the world's total biodiversity has been covered under indigenous practices across communities (Perroni 2017).

Utilising emerging innovative financial solutions like carbon credits and blended finance models

- The global carbon market value for carbon credits under compliance till 2021 is USD 851 billion, which can be further directed towards regenerative agricultural practices to derive carbon credits (Refinitiv Analysts 2022).
- Blended finance models can cover the highly diversified and high-risk models for regenerative agriculture.

Strengthening social and gender inclusive models to build momentum

- High-impact states based on self help groups (SHG) and Mahila Kisan indicators include UP, Bihar, Maharashtra, Assam, Andhra Pradesh, all of which show high potential to adopt newer and innovative ways of farming.
- Leveraging regional or local communities by providing resources to the last mile can unlock a range of highly contextual regenerative agricultural practices.

CALL FOR ACTION

Ideas to influence action towards adoption, and elimination of barriers to Regenerative Agriculture.

An illustrative continuum of potential intervention ideas based on sustained engagement of key stakeholders in the government, private, and nonprofit sectors

Short Term

- Implementing evidence-based assessments and research projects across varying geographies to establish practical evidence around regenerative farming.
- Training and capacity building of farmers with techniques and knowledge to enable a bottoms-up approach, rather than a top-down approach which enables trust within the farming community.
- Communicating and showcasing the value of regenerative agriculture in the markets to the consumers.

Medium Term

- Designing products that are suited and customised to regenerative farming e.g. financial products and technological services.
- Ensuring and enabling information networks and collaboratives that can help establish trust and transparency among stakeholders, especially beneficiaries like farmers and consumers.

Long Term

- Creation of a common understanding and repository of standard terminologies for defining regenerative agriculture, and having a common set of metrics for assessing impact.
- Influencing decisions at policy levels through advocacy and research to incentivise regenerative models of farming as opposed to conventional agriculture.
- Supporting seamless integration of technology and data into all processes, where technology can be a great enabler to ensure suitability and adaptability of practices across regions.

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