

Regenerative Agriculture: A New Paradigm for Sustainable Indian Agriculture

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ABSTRACT

Regenerative agriculture has emerged as a promising approach for addressing the interconnected challenges of soil degradation, climate change, biodiversity loss, water scarcity and declining resource-use efficiency in agricultural systems. This review examines the concept, importance and core principles of regenerative agriculture, with particular emphasis on its relevance to sustainable Indian agriculture. The approach extends beyond conventional sustainability by focusing on the restoration of soil health, ecological functions and resilience through practices such as minimizing soil disturbance, diversifying crops, maintaining continuous soil cover and living roots, and integrating livestock. These practices contribute to improved soil fertility, nutrient cycling, water management, biodiversity conservation and carbon sequestration, while reducing dependence on external inputs and enhancing farm resilience. The review also highlights emerging policy support in India through initiatives such as the National Mission on Natural Farming, PRAGATI and the BRICS Network of Centres of Excellence on Agro-Ecology and Regenerative Agriculture. Case examples from Karnataka and the Chandigarh-Panchkula region demonstrate the practical potential of regenerative and permaculture-based approaches for resource restoration and livelihood sustainability. Overall, regenerative agriculture offers a holistic pathway towards productive, climate-resilient and ecologically sustainable farming systems in India.

INTRODUCTION:

Agriculture plays a fundamental role in ensuring global food security, rural livelihoods and economic development. However, in recent years, the agricultural sector has come under increasing pressure due to accelerated climate change, land degradation, biodiversity loss and water scarcity (FAO, 2022). These challenges are intensified by rising food demand, which is expected to grow significantly as the global population approaches 9.7 billion by mid-century (UN, 2022). Conventional agricultural practices primarily dependent on intensive tillage, monocropping, synthetic fertilizers and chemical pesticides that have contributed to soil degradation and ecological imbalance, raising serious concerns about long-term sustainability. Consequently, global discourse has shifted toward climate-resilient, restorative and ecologically sound food production systems that can rebuild natural resources rather than merely conserve them. In this context, regenerative agriculture (RA) has gained major attention over the last four years as a holistic and forward-looking approach that aims to revitalize soil health, enhance biodiversity and improve ecosystem functioning. The ultimate goal of regenerative agriculture is to create the resilient agricultural system that supports long term productivity, ecological resilience and climate stability. Unlike conventional systems that often degrade natural resources, RA focuses on restoring soil organic matter, rebuilding soil structure, improving nutrient cycling and supporting ecological resilience (Khangura *et al.*). Regenerative agriculture goes beyond sustainability by actively reversing environmental damage and improving ecosystem services that have been compromised by decades of intensive agriculture. This makes RA a vital strategy for addressing soil degradation that currently affects more than one-third of global

agricultural land (FAO, 2022). Soil health is central to regenerative agriculture, as soil is increasingly recognized as a living, dynamic and biologically active ecosystem. Recent studies have emphasized that healthy soil improves water-holding capacity, enhances carbon sequestration, promotes nutrient availability and increases crop productivity under climate stress (Khangura *et al.*). Core RA practices such as reduced or zero tillage, continuous soil cover, crop rotation, cover cropping, livestock integration, agroforestry and organic amendments work synergistically to improve soil structure and biological activity while reducing external input dependence. These practices not only support soil regeneration but also contribute to climate-change mitigation by enhancing carbon sequestration and reducing greenhouse gas emissions (IPCC, 2022).

Although regenerative agriculture has historical roots in indigenous and traditional farming systems, its scientific adoption and global recognition have expanded dramatically over the last four years as governments, research institutions and agri-food industries prioritize climate-smart and nature-based solutions (FAO, 2022). Economically, regenerative agriculture offers multiple benefits to farmers by reducing input costs, stabilizing yields and creating additional income streams through diversified cropping systems, agroforestry products and emerging carbon-credit markets. Socially, RA strengthens rural resilience by improving ecosystem health, enhancing food security and supporting long-term livelihood sustainability. Overall, regenerative agriculture represents a promising pathway for transforming global agriculture into a climate-resilient, ecologically restorative and economically viable system. With its increasing evidence base and global adoption in the last four years,

RA stands out as a key nature-based solution capable of restoring degraded ecosystems while ensuring sustainable food production for future generations.

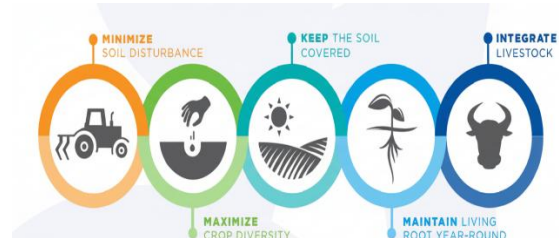
Importance of regenerative agriculture

- **Restoring the soil health:** Regenerative agriculture rebuilds soil health by increasing organic matter, enhancing soil structure and promoting beneficial microorganisms. Practices like cover cropping, minimal tillage, compost use and crop rotation help revive depleted soils. Healthy soils improve nutrient cycling, reduce erosion and support resilient crop growth, ensuring long-term agricultural sustainability.
- **Combating the climate change:** Regenerative agriculture mitigates climate change by capturing atmospheric carbon and storing it in soils through practices like agroforestry, cover crops and organic amendments. Reduced chemical use and minimal tillage lower greenhouse gas emissions. Enhanced soil carbon sequestration plays a critical role in building climate-resilient landscapes and reducing global warming impacts.
- **Promoting the biodiversity:** Biodiversity flourishes under regenerative agriculture due to diverse cropping systems, reduced chemical usage, and habitat restoration. Integrating trees, livestock and cover crops creates ecological balance. These practices support pollinators, beneficial insects, soil microbes and wildlife, strengthening ecosystem stability and enhancing natural pest control and productivity.
- **Supporting the rural community:** Regenerative agriculture strengthens rural communities by creating employment, promoting local markets and improving farmers' livelihoods. It encourages low-

input, cost-effective farming systems that reduce dependency on chemicals. By increasing productivity and resilience, it supports income stability and empowers farmers to adopt sustainable practices that ensure long-term social and economic well-being.

- **Enhancing the food security:** Regenerative agriculture boosts food security by improving soil fertility, increasing yields and ensuring long-term productivity. Diverse cropping systems reduce risks of crop failure and enhance resilience to climate extremes. Healthier soils produce nutrient-rich food, while sustainable practices maintain continuous production, supporting stable food supplies for growing populations.
- **Improve the water management:** By enhancing soil organic matter and structure, regenerative practices increase water infiltration, retention and availability to plants. Practices such as mulching, contour farming and agroforestry reduce water runoff and evaporation. This leads to efficient water use, reduced irrigation needs and better resilience to droughts, ultimately supporting sustainable farming.

Principles of regenerative agriculture-

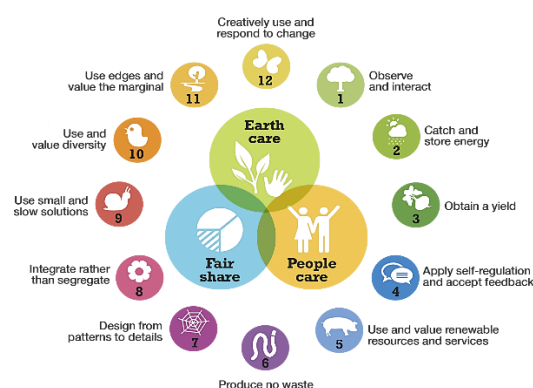


1. **Minimizing the soil disturbances:** Reduce excessive tillage, overgrazing and unnecessary use of fertilizers and pesticides. No-till or minimum-tillage practices protect soil structure, earthworms and microorganisms, improve water infiltration, and help increase soil organic carbon.

2. **Maximize the crop diversity:** Avoid continuous monocropping and promote crop rotation, intercropping, cover crops and crop-livestock diversification. Greater crop diversity improves soil fertility, biodiversity, pest and disease management, and resilience to drought and flooding.
3. **Keeping the soil covered:** Keep soil protected with cover crops, crop residues, mulch or living vegetation. Soil cover reduces wind and water erosion, conserves moisture, improves soil structure and encourages microbial and earthworm activity.
4. **Maintain the living root year-round:** Keep living roots in the soil as much as possible through cover crops, perennial crops and suitable crop rotations. Living roots support soil microorganisms, improve nutrient and water uptake, increase organic matter and contribute to carbon sequestration.
5. **Integrating the livestock:** Integrate livestock with crop production through well-managed grazing and the use of manure and slurry as organic inputs. Proper livestock integration improves nutrient cycling, soil fertility, biodiversity, organic matter and soil carbon while supporting sustainable farm productivity.

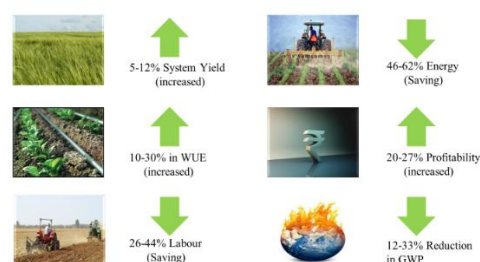
Permaculture: It is a holistic and sustainable farming approach that focuses on designing agricultural systems by mimicking natural ecosystems. It was derived from the concept of “*permanent agriculture*,” permaculture emphasizes long-term ecological balance, resource efficiency and human well-being. It was coined and popularized by bill mollison and david holmgren, permaculture integrates ecological science, traditional knowledge and ethical decision-making to address challenges such as soil degradation, biodiversity loss, climate change and food insecurity. It is

guided by three core ethics which are earth care means taking the care of natural resources and planet, people care means meeting the human needs in sustainable ways and fair share means ensuring that resources are equally distributed and nothing is wasted. All three ethics promote conservation of natural resources, social equity and responsible use and redistribution of surplus resources. Permaculture is not limited to farming alone; it extends to landscape planning, water management, community development and socio-economic systems. It also serves as a bridge between agroecology and practical land-use design, offering an effective pathway toward sustainable agriculture, ecosystem restoration and improved human livelihoods in the modern era. The framework of permaculture is built upon twelve design principles. These principles support the development of resilient agro-ecosystems that rely on renewable resources, nutrient recycling, minimal external inputs and strong interconnections among plants, animals, soil and humans.



Principles of Permaculture

Benefits of Regenerative agriculture



Government Initiatives Promoting Regenerative Agriculture in India:

PRAGATI Scheme

Union Minister of Agriculture and Farmers Welfare & Rural Development, Shri Shivraj Singh Chouhan, has launched PRAGATI (Promotion of Regenerative Agriculture through Gender-inclusive Agri-entrepreneurship initiative) in July 2026, a multi-stakeholder initiative aimed at creating 20,000 agri-entrepreneurs and directly supporting over 20 lakh smallholder farmers across India. The programme brings together leading national and international organisations to promote regenerative agriculture, rural entrepreneurship and climate-resilient farming. The initiative is backed by the PepsiCo Foundation, SBI Foundation, Gates Foundation, IDH, Heifer International, Environmental Defense Fund (EDF), Global Agri Entrepreneurship Academy, Sustainable Agriculture Foundations International Association (SAFIA), Agri Entrepreneur Growth Foundation (AEGF) and Transform Rural India Foundation (TRIF).

PRAGATI builds on an existing network of over 26,000 agri-entrepreneurs and aims to expand it by creating another 20,000 entrepreneurs across Madhya Pradesh, Bihar, Uttar Pradesh, Assam, West Bengal, Jharkhand, Maharashtra and Rajasthan. The programme is expected to benefit more than 20 lakh farmers through advisory services, improved market access, financial inclusion and the adoption of regenerative agricultural practices. According to the programme partners, PRAGATI aims to increase participating farmers' incomes by at least 30%, improve yields of key crops such as paddy, maize and potato by 15–20% and encourage the adoption of regenerative agriculture among at least 20% of participating farmers. The initiative will also focus on strengthening

climate resilience and expanding access to formal financial systems in rural communities.



Union Minister Shivraj Singh Chouhan Launches PRAGATI to Train 20,000 Agri-Entrepreneurs Across India

Other Schemes

India is increasingly giving policy attention to regenerative, climate-resilient and sustainable agriculture. The Government of India has identified regenerative agriculture as a key agronomic priority for addressing climate change, resource degradation and sustainable food security. The National Mission on Natural Farming (NMNF), approved in November 2024 with an outlay of ₹2,481 crore, is one of the major initiatives aligned with regenerative principles such as improving soil health, restoring ecosystems, reducing external input dependence and integrating livestock with diversified cropping systems. As of 5 March 2026, 18,786 clusters covering 8.80 lakh hectares had been formed and 18.19 lakh farmers enrolled under NMNF. The mission also provides an output-based incentive of ₹4,000 per acre per year for two years, subject to a maximum of one acre per farmer.

A significant recent development came in June 2026, when India, under its BRICS chairship, announced the establishment of the BRICS Network of Centres of Excellence on Agro-Ecology and Regenerative Agriculture. The network will promote joint research, knowledge sharing and capacity building in natural, organic and regenerative agriculture,



with ICAR–Indian Institute of Farming Systems Research (IIFSR), Modipuram, playing a key role as India's Centre of Excellence on Natural Farming. This initiative reflects India's growing emphasis on regenerative and climate-resilient farming as part of the transition towards sustainable and future-ready agricultural systems.

Case study of Regenerative Agriculture

Case 1: The case of Puttappa Karadi, a smallholder farmer from Aladakatti, Haveri, Karnataka, highlights a successful shift to regenerative farming. He adopted holistic practices such as the use of *Jeevamrit* and *Beejamrit* to improve soil health and seed vitality. By integrating intercropping with legumes like cowpea and mixed cropping of maize with groundnut and cluster beans, he enhanced soil fertility, biodiversity and land use efficiency. Pest management through *Neemastra* and sticky traps, along with tree planting on bunds, helped control pests, reduce erosion and conserve moisture. As a result, Puttappa achieved a complete elimination of chemical fertilizers, improved soil microbial activity, reduced input costs and secured diversified income sources, making his farming system more resilient and sustainable.

Case 2: Aanandaa Permaculture Farm, located near the foothills of the morni hills in the Chandigarh-Panchkula region, was established in 2010 by manisha lath gupta and her husband Agam on approximately six acres of degraded and barren land. The site initially faced poor soil fertility, rocky terrain, limited vegetation, deep groundwater and severe monsoon runoff. The founders adopted permaculture principles to restore the land by harvesting rainwater, improving soil organic matter, using mulch and establishing a diverse food forest. Over time, the degraded land was transformed into a productive and biodiverse ecosystem with thousands of trees and a variety of fruits, vegetables and other plants. The farm also

promotes direct marketing of surplus produce through local farmers' markets and serves as a demonstration and learning centre for sustainable farming, water conservation, biodiversity and ecological living.



CONCLUSION

Regenerative agriculture presents a vital framework for cultivating sustainable and resilient farming system. Its core principles such as minimizing the soil disturbance, fostering crop diversity, maintaining living root, keeping the soil covered and integrating livestock, collectively revitalize soil health, mitigate climate change, enhance biodiversity and boost rural economies. This holistic approach demonstrably leads to significant reduction in chemical inputs, improved soil fertility, diversified income streams and greater farm resilience. The success of a smallholder farmer in Karnataka, who achieved a 100% reduction in chemical fertilizers and enhanced soil health through these practices, vividly illustrates these benefits. Moving forward, continued research, policy support and farmer education are crucial to broaden the adoption of regenerative practices, ensuring a sustainable, productive future for food systems and the environment.

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