

A Holistic Approach to Building Sustainable Food Systems: The Concept and Paradigm of Permaculture

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Abstract: *The over-reliance on chemical pesticides and fertilisers, dependence on high-yielding crop varieties, and infringement on local farmers' rights to make decisions about food and agroecosystems have all contributed to the growth of commercial agriculture. As a result, permaculture has evolved to support the creation of self-sufficient and sustainable agroecological food systems that combine efficient use of resources, energy, and space. It focuses on developing agro-ecosystems that surpass traditional agriculture through a set of principles that foster the degree of interconnection between various components, yielding a sustainable food system, paving the path for a peaceful coexistence of human beings and nature. Permaculture is a viable approach to designing sustainable food systems where ecological landscapes and sustainable populations coexist since its principles are consistent with those of agroecology. Permaculture, as opposed to agroecology, emphasises the intentional design of sustainable systems by including different elements, resulting in a whole ecosystem where numerous species and breeds flourish. However, Permaculture is still in its infancy in India, despite its apparent scope, and it longs for a boost. The government ought to recognise and encourage permaculture throughout the nation by offering sufficient assistance.*

Keywords: Permaculture, Sustainable food system, Interconnectedness, Coexistence, Agroecology, Designing ecosystems.

INTRODUCTION

Commercial agriculture has ramified over the years due to the imprudent use of synthetic fertilisers and pesticides, reliance on high-yielding crop varieties, and the snatching of local farmers' rights in deciding food and agroecosystems. The sounds of dissent have started to rise from different parts of the world against the deterioration stemming from the dominance of corporations in agriculture, which has shaped a new culture in farming, alienated from the traditional practices, seeds, breeds, and values (Tilman, 1999). The massification of production to meet the increased market demand brought about a regime ruled by corporations, which decide what to produce, based upon market requirements rather than human need. Upscaling of production through the ruthless application of chemicals and gene modification has induced distortions in the cropping pattern, pushing some of the traditional crops into near extinction and leaving the soil barren after expropriating the nutrients. (Kumar, 2007). These encroachments over pristine nature and food systems often trigger a multitude of problems, such as soil nutrient degradation, loss of organic matter, elimination of greenhouse gases, contamination of water resources, loss of biodiversity, loss of habitat, and harmony between man and nature. Gradually, agriculture has become an activity that leaves a huge carbon footprint (Gomiero et al., 2011). Shifting towards sustainable agriculture has become an immediate necessity to protect the world from the deleterious effects of commercial agriculture without enduring a fall in production (Altieri, 1995; De Schutter, 2010). Agroecology emerged as such an alternative, which has been known for its capacity to develop sustainable landscapes where various components in the ecosystem co-exist through the integration of livelihood, sharing of knowledge and resources, supported by decentralized governance. (Francis et al, 2003; Gliessman, 2018). However, the shift to agroecological agriculture is a complicated undertaking that requires a range of input from external scientific organisations. Thus, agroecologists work alongside agroecological groups and traditional farmers. Permaculture is one such agroecological movement, which has a distinctive approach to system design and a wide global reach. (Ferguson, 2014). Perma Culture can foster the design of agroecological food systems that are both sustainable and self-sufficient, combining the effective use of space, energy, and resources. However, Perma culture can be deemed as an approach that transcends traditional agriculture, focusing on sustainably designed human-environmental systems. Agroecology, on the other hand, is both a science and a practice, extending beyond the farmland, depicting a holistic system, integrating an ensemble of stakeholders. (Krebs & Bach, S, 2018; Ferguson, 2014). Even though both practices embody a vision to usher in a sustainable food and farming system, the set of underlying principles diverges in similar but separate directions to accomplish their objectives.

METHODOLOGY

Although permaculture is regarded as a scientific method, similar to agroecology, its potential to mould sustainable food systems has not been thoroughly explored in the literature. This study is a qualitative review that delves into the meaning and scope of permaculture, its philosophy and practices, the resemblances and differences with agroecology, and how it complements agroecology and contributes towards designing an agroecological system. And the article attempts to highlight the leeway for Perma culture to gain acceptance in the Indian context.

RESULTS AND DISCUSSION

Agroecology and Permaculture are more than simply farming methods; they are living systems and ideologies that blend the natural rhythm with human interaction. Investigating these fields will immerse us in a world where farming emphasises ecological harmony, sustainability, and balance rather than just production.

Perma Culture: Origin, Foundation and Relevance.

Permaculture aims to create sustainable communities that coexist peacefully with their natural surroundings, supporting approaches to offer solutions to burgeoning social and environmental issues. Permaculture, which began as a farm design technique in Australia in the late 1970s, has evolved into a global social movement, used in many diverse contexts and at different scales around the globe (Fadaee, 2019). Permaculture was considered an international grassroots network that centers on the sustainable design of human settlements at the time of its inception. This dispersed, minimally institutionalised movement spreads a unique design system, philosophy, and set of related actions striving for a sustainable future. Holding a conviction in humanity and its capacity to restore sustainability by eradicating industrial practices in agriculture, through the vigorous use of biological resources and holistic farm mappings, which recreate natural ecosystems (Morel et al, 2019). Permaculture suggests practical methodological concepts based on scientific ecology, traditional indigenous knowledge, observation, and experimentation to construct independent, resilient, and egalitarian living areas. Advocating for sophisticated multi-strata polycultures in agricultural system design, that incorporate persistent plants, plant-animal integration, high habitat variety, comprehensive water resource management, and renewable energy production, it envisions an interconnected agro-eco system. Permaculture encourages practitioners to cultivate subjective and emotional connections with the earth, as well as to use their vision and creativity as vital components of the design practice, in addition to ecological design informed by science (Taylor Aiken, 2017; Morel et al, 2019). Despite the definitions of permaculture being broad enough to encompass a combination of social and ecological perspectives, Veteto & Lockyer (2008) have enhanced it by highlighting the significance of observing nature and reverting to tradition as means to build permaculture systems. They define permaculture as a complete design approach that draws from both traditional wisdom and contemporary scientific discoveries while observing nature up close. Departing from the centralised power structure, it expounds a doctrine of positive action and grassroots education which seeks to reconstruct society by vesting control over resources, such as food, water, housing, and means of subsistence for survival. (Veteto & Lockyer, 2008).

Furthermore, by moving beyond conservation and concentrating on mending the harm that has been done, permaculture promotes “rapid regeneration and significant improvements of natural resource base and yields.” Because sustainable solutions can eventually become unsustainable, permaculture places a strong focus on regeneration. Thus, the core of permaculture ideology is the creation of systems that are both regenerative and sustainable. A regenerative system is robust and adaptable, and its output exceeds its intake. Furthermore, a regenerative system can repair and enhance, in addition to feeding itself and continuously creating itself.

Consequently, permaculture should be viewed as a “community planning philosophy aimed at reconnecting humans with nature by regenerative means” in addition to being a system for producing food (Maye, 2018). The design system formulated by Permaculture employs the principles of systems thinking and agroecology to merge with the conditions of land and surroundings, the persisting level of site diversity, and environmental balance. David Holmgren has etched a set of twelve guiding principles which has been employed in the design and management of permaculture systems (Holmgren D, 2020).

Principle of Permaculture	Purpose and execution
Observation and Interaction	The capacity of farmers in agrarian communities to watch, evaluate, and execute both traditional and modern land use practices is a potent instrument in the development of new and more suitable systems in a more traditional and socially cohesive way. Since change is usually more difficult within communities for a variety of reasons, locally developed models that draw on the finest aspects of both traditional and modern ecological design have a higher chance of succeeding than externally imported pre-designed systems. Furthermore, a variety of these local models would inevitably provide creative components that may inspire comparable developments in other places.
Catch and Store Energy	Transcending the conventional notions of value, capital, investment, and wealth, which have undermined opportunities to capture local flows of both renewable and non-renewable forms of energy, permaculture deems natural resources as an opportunity in rebuilding capital, as well as securing a steady source of income. Sunlight and water are essential energy sources, and fertile soil with a high humus content and perennial plant systems—particularly trees—are the most significant stores of future value.
Generating Yield	The system that produced the yield is encouraged, maintained, and/or replicated by a prospective profit or income. This is how effective systems proliferate. These incentives, which intensify the initial process or signal, are referred to as “positive feedback loops”, which we must strive for in promoting sustainable design solutions.
Self-regulation	This concept addresses the self-regulatory elements of permaculture design that restrict or dissuade unwarranted activity or growth. We can create more self-regulating systems and lessen the effort required for harsh and frequent remedial management if we have a better grasp of how positive and negative feedback function in nature.
Valuing Renewable Resources and Services	Rather than using machinery or artificial fertilisers, traditional permaculture layouts utilise pigs or hens to prepare the ground for planting. Renewable services are those that we may acquire without consuming living things, including plants, animals, soil, and water. For example, we consume a renewable resource when we use a tree for wood, but we also enjoy non-consumptive advantages from the live tree that don't need energy harvesting when we use it for shade and shelter. This permaculture design highlights the potential for harmonious coexistence between humans and ecosystems while maximising the usage of non-consumptive natural services to lower user demands on resources.
Recycling	All the waste generated in the system will either be recycled or reused as energy sources, fuelling the working of the farm system.
Following Natural Patterns	‘Permaculture’ was inspired by the forest ecosystem as a natural archetype for agriculture. Activities like designing permaculture systems have been deemed as an opportunity to retrieve agroforestry, analogue forestry, and related practices, which were buried under the waves of modernity. It is possible to organise the environmental elements, such as fire, wind, and sun, in sections around a single focal point. The permaculture designer uses these sectors’ bioregional and site-specific characteristics to assist them in understanding a site and incorporating suitable design components into a functional system.

Integrate instead of Segregate	Building communities of plants, animals, and humans to benefit from mutual interactions should focus on many kinds of links that bind different constituents together in more closely integrated systems. A greater degree of integration and self-regulation can be achieved by strategically placing plants, animals, microbes, and other infrastructure, negating the need for ongoing human intervention in corrective management. Poultry scratching under forage woods, for instance, may be utilised to collect litter for downslope garden systems in the right places. Permaculture is a part of a long history of ideas that prioritise symbiotic and mutualistic interactions above predatory and competitive ones.
Sticking to Small and Slow Solutions.	Systems have to be built to carry out tasks at the smallest feasible and energy-efficient scale possible. Human size and ability ought to serve as the benchmark for a sustainable, democratic, and compassionate society
Use Edges and Value the Marginal	This notion is based on the idea that it is important to acknowledge and preserve the marginal and invisible features of any system, as well as the value and contribution of edges, and that expanding these aspects can improve system stability and productivity. Increasing the boundary between a field and a pond, for instance, can boost both areas' output. It is possible to view alley farming and shelterbelt forestry as systems in which production has increased due to the growing boundary between field and forest.
Creative Utilization and Responding to Change.	The concept is divided into two parts: creating to utilise change purposefully and collaboratively, and responding or adapting creatively to significant system change, transgressing the existing capacity. This idea is expressed in permaculture literature and practice through the acceleration of natural succession within farmed systems, which exemplifies these two themes.

Table 1: Principles of Permaculture

Sources: (Compiled from Holmgren, D, 2020; Morel, K et al, 2019; Ferguson et al, 2014)

Perma culture to design sustainable agro-food systems.

The fields of agroecology and permaculture are similar in that they emphasise the relationship between ecology and agricultural production, have a normative approach to agroecological transition, and are associated with popular movements that are mostly made up of farmers and environmentalists. (Gomiero et al. 2011). Permaculture has garnered relatively little attention in the agroecological literature, despite these similarities. Agroforestry, perennial polycultures, agroecosystem design, ecosystem mimicry, and agrobiodiversity are all positively, although briefly, linked to permaculture (Francis & Porter, 2011). Later on, permaculture has evolved as a tool to design agroecosystems with a high degree of interconnectedness where human beings harmoniously coexist with other elements in the system. The process of permaculture design embarks on a thoughtful review of land and crops, an evaluation of the level of heterogeneity, microclimate, and the level of existing vegetation cover. Local and regional vegetation and terrain, which can influence microclimate effects, are used to find locations for marginal crops and to improve energy efficiency. Ponds, equatorially inclined hills, buildings, and woody vegetation have been pinpointed as crucial areas where very cold temperatures are mitigated by thermal mass and heat-trapping, potentially allowing vulnerable breeds or species to survive (Mollison 1988; Holzer 2011). Effective landscape management techniques such as fire barriers, wind breaks, buffer forests, and protective groves are diligently harnessed into the system to balance the level of output, ecosystem services, and environmental sustainability. Permaculture design language is ingrained in two broad conceptual foundations, such as ecosystem mimicry and system

optimization. Using species that provide yields for human use, the ecosystem mimicry criteria look at the makeup and functioning of unregulated habitats as templates in developing extremely productive ecosystems with similar features and characteristics. Instead of referring to a model ecosystem, the system optimization criteria searches for key points where little intervention may improve the performance of desired functions above and beyond what is seen in existing systems. (Lefroy 2009; Hatton & Nulsen 1999). On the choice of crops and species to be cultivated, a combination of both native and non-native varieties is selected to explore new possibilities without undermining the indigenous seeds and their wild relatives. In addition, all possible methods for soil regeneration and water conservation, such as contouring, ponds, check dams, and basins, will be integrated into the system (Ferguson, 2014).

What Perma Culture Offers: Permaculture can offer a list of services to the property, which can nurture the ecosystem and enrich the environment through synergies.

- Employing swales for water retention and collection, IBCs, or even a borehole to provide a fully self-sufficient water supply. This is particularly helpful when there is a drought.
- Grey garbage may be filtered with the use of reed beds.
- Food forests, supplying regenerative food sources such as nuts, fruits, fuel, furniture-making lumber, animal habitats, and mulch litter for soil regeneration and composting.
- Ponds providing wetlands, water retention, fish poop, frog habitat, fish food, water supply for wildlife, and manure.
- Vermiculture produces larvae for hooking fish, and composting boosts manure production, soil aeration, and regeneration.
- Compost piles supply organic matter for seeds, soil, and heating.
- Apiculture practices produce honey, other bi-products such as wax for candles, balms, and other items, and promote pollination.
- Insects and Birds, attracted to the ecosystem like ladybirds that consume aphids, facilitate biological pest control.
- In colder climates, eco-homes naturally give warmth, while in hotter climates, they provide cooler spaces.
- Utilising natural forces like a river or stream to power a turbine or installing solar panels or wind mills, depending on the nature of the terrain, to generate electricity.
- Recycling of organic and inorganic wastes, particularly the usage of wastewater for fertigation.

Permaculture in India

The permaculture movement in India was guided by Bill Mollison through the workshops he conducted to make the public aware of a way of farming that is familiar to them, but has never been formally taught. In 1987, the first permaculture demonstration farm was set up in the Andhra Pradesh district of Zahaerabad with the help of the Deccan Development Society, a development non-governmental organisation. Since then, individual farmers who share the movement's philosophies and goals have propelled it to become a movement with several demonstration sites, events, and organisations around the nation. (Fadaee S, 2019). Permaculture, still to receive the acknowledgement of the government, is believed to be spread across an area of fifty thousand hectares in the country, way below its potential. There are numerous

initiatives from various parts of the country that focus on permaculture as an integrated approach combining horticulture, apiculture, livestock, aquaponics, and sericulture.

Equality Empowerment Foundation: It works with more than 4,000 small and marginal farmers in Rajasthan and Bihar on permaculture initiatives. According to the organisation, permaculture and the ancient farming practices of tribal tribes are similar. After conducting an intensive research on the “Tribal food farming system through the prism of permaculture,” it suggests a community discussion that might increase the level of awareness of permaculture in the country.

Navadarshanam, Tamil Nadu: The people of Navadarshanam work to create a self-sufficient environment through the use of indigenous farming, rainwater gathering, and biodiversity conservation.

Sadhana Forest, Tamil Nadu: The Sadhana forest community embraces permaculture practices to conserve water, improve soil, extend forest cover, and restore barren land.

Tribal Health Initiative, Tamil Nadu: This is another Tamil Nadu initiative that uses permaculture to raise the standard of living for tribal populations. The main goals of the project are to improve the adaptability of regional ecosystems, advance organic farming, and create sustainable food systems.

Punarchith, Kerala: Punarchith endeavours to restore deteriorated land, adopting the principles of agroecology to anchor towards sustainable development.

CONCLUSION

Permaculture is a holistic approach that encourages communities to understand the interconnections and dynamics of the web of life. In other words, it aims at improving all elements of an environment or system. Permaculture creates sustainable food systems through a set of principles that nourish the level of interconnectedness between different components, ushering in a way for a harmonious coexistence between human beings and nature. The principles of permaculture are coherent with the principles of agroecology, making it a possible way to design sustainable food systems where sustainable communities coexist with ecological landscapes. In contrast to agroecology, permaculture focuses on designing sustainable systems deliberately by adding various components, leading to a comprehensive ecosystem where multiple species and breeds thrive. This process requires deliberate planning, an understanding of various sites and their particulars, before selecting the desired component to be inserted into the existing system or envisioning a new system with unknown and untried components. Even though the scope of permaculture is undeniable, it is still in its nascent stages in India, longing for a thrust forward. The permaculture practices across the country should be acknowledged and supported by the government through the provision of adequate support.

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