Caritas Italiana
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The Joy of Service...

Manual on Integral Ecology

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Chapter 1

Integral Ecology

Introduction

Integral Ecology is the interconnectedness between humans and the natural world. Everything is interconnected and interdependent in nature and in our very being. God created everything with a purpose and hence the non-harmony in one of the parts affects the whole. In the encyclical Laudato Si, Pope Francis refers to "Integral Ecology" as a means "to protect our common home. By protecting the habitat of other species of God's creation, they will not enter the human habitations for their food and shelter. Biodiversity acts as a protective layer to prevent the spread of diseases from animals to humans. A healthy ecosystem, where our guests, the birds and mammals, live together in total harmony, will provide us a better environment, with no room for the spread of diseases. It is high time that we re-set the lost equation among the living beings and bring back the diseased earth back to its state of harmony and peace. Whatever affects one directly, affects all indirectly" This reminds us of the interconnectedness, injustice, and loss of biodiversity; human beings invading the habitats of other species, leading to ecological imbalance. Integral Ecology refers to an integrated and holistic approach to political, social, economic, and environmental problems. The concept of Integral Ecology is popularized by Pope Francis in the encyclical Laudato Si in 2015. The emergence of Integral Ecology as a term is resulted from a broad and urgent need to address current global environmental concerns in a sustainable way. Integral ecology is a holistic understanding of global challenges in relation to human activities, behaviours, and relationships. While some economies, businesses, and individuals have adopted "green" practices, the global system as a whole is still far from any practice of integral ecology.

It reminds everyone that the earth, our common home "is like a sister with whom we share our life and a beautiful mother who opens her arms to embrace us". People have forgotten that "we ourselves are dust of the earth (cf. Gen 2:7); our very bodies are made up of her elements, we breathe her air, and we receive life and refreshment from her waters."

What is happening to our common home?

- Pollution and climate change
- The issue of water
- Loss of biodiversity

Each year sees the disappearance of thousands of plant and animal species which we will never know, which our children will never see, because they have been lost forever. The time has come to connect our health and wellbeing with the protection of biodiversity, conservation of ecosystem, interconnectedness, and integrity of God's creations. The increasing degradation of production base and the imbalance in land-water-plant-human-animal system is leading to ecological imbalance and economic insecurity. The earth is not just for human beings alone, but for others as well, and hence protecting the rights of Mother Nature is a critical health imperative.

Evolution of Integral Ecology Pathway – LAUDATO SI

The first explicit use of the term "integral ecology" appeared in a 1958 marine ecology textbook by Hilary Moore (Moore 1958, 7). This term is re-emerged recently and used by Pope Francis in the encyclical Laudato Si in 2015. This has given rise to many theories and frameworks to address problems faced by the world. Many efforts in the past has been made to respond to the impact of climate change. Integral ecology attempts to capture the connection between humanity and the environment, offering a more

comprehensive understanding. Laudato Si cites many examples of both human and natural disaster, shows how they are intertwined and proposes integral ecology as the framework through which to address these issues and move forward.

These theories and frameworks include concepts such as ecofeminism, degrowth, the "Green Economy" model, and others. While each of these has a specific understanding of, and approach to, responding to our issues as a global community, the concept of integral ecology provides for a robust and holistic system that accounts for the varied relationships between different people, between different ecosystems, and between people and their ecosystems. The present-day problems like economic divisiveness, wealth inequalities, social injustice and exclusion, environmental degradation and climate change needs a holistic solution. Integral ecology needs to be approached as a moral and ethical framework to address the intersection of the political, the economic, the social, and the environmental concerns. Castillo (2016) say that integral ecology should be construed as a liberationist concept, similar to Gustavo Gutiérrez's concept of integral liberation, which could serve to combat a system built on developmentalism, colonialism, and globalization. Integral ecology can be practiced truly only when we can identify and address the root causes of these issue.

In seeking to reconcile the dichotomy of nature (cry of the earth) and culture (cry of the poor), Pope Francis is opposing the "colonizing dynamic inherent in such a dualism" (Apffel-Marglin 2018, 58). And, in acknowledging the ecological debt that the Global North owes the Global South, he is criticizing the current structures that allow for economic domination of the former over the latter.

Many factors has influenced the present situation. First, that humanity as a whole has failed to live harmoniously with the earth (our "common home"), which has resulted in high levels of environmental degradation and climate change. Second, that the effects of the damage that has been done to the earth predominantly by the Global North will be most experienced by the Global South, revealing a grossly unequal relationship of power. Consequently, the Global South is not only a direct economic victim of the Global North, but it is also an indirect environmental victim of the economic activities of the Global North. Carbine (2017) adds that "decreasing biodiversity, increasing climate change, deforestation, destruction of wetlands, and pollution of water, soil, land, and air by manufacturing, agribusiness, nuclear, and other industries... can then be construed as sins of eco-injustice against poor and marginalized peoples, especially indigenous peoples and women" (48), which echoes Pope Francis' claim that the "human environment and the natural environment deteriorate together....the deterioration of the environment and of society affects the most vulnerable people on the planet..." (Laudato Si, 48).

The Global South, characterized broadly as "the poor" and "the vulnerable," must be included in this integral ecology. However, it is not clear what this inclusion entails. The option for the poor that Pope Francis discusses is "the participation of the poor in a process of transformation from a paradigm of exploitation to a paradigm of caring". Yet, if the "cry of the earth" and the "cry of the poor" are one and the same concern, whose concern is it?

Understanding that there is a need for an integral ecology is not helpful unless we are able to go beyond this first step and develop a methodology that leads to a robust practice. Integral ecology must be able to prove its soundness "by showing the usefulness, the fruitfulness, the practical utility of the concrete distinctions" that it draws on as a framework. A clearly-articulated methodology is needed for the participation of the poor that integrates elements of decolonization and justice (among others).

Laudato Si provides "a basis for those with faith convictions to translate environmental concern into action and become active participants in their lifestyle choices". Philosophically, it provides "an accessible, ethical exploration of the relationship between people and nature, and highlighting the importance of ethical discussion in scientific debate" (O'Neill 2016, 752). Finally, in terms of public policy, the encyclical provides a catalyst for "discussions on the role of the market and problems of global inequality, and the roles of institutions and individuals" (O'Neill 2016, 753). Pope Francis sees that "decreased growth is necessary in some parts of the world so as to resource 'healthy growth' in other parts and to repay some of the global North's 'ecological debt'" (O'Neill 2016, 753). This refers to the related concepts of "degrowth" and "right-sizing" that others have proposed but that have not received widespread political traction or support. This may be explained, in part, by the reality that the Global North would not willingly

downsize its lifestyle or quality of life so long as the dominant world paradigm remains based on capitalist ideals and colonial structures.

The field of integral human development (IHD) is a field that combines elements of peace, development, ethics, and economics to arrive at a holistic understanding of a human-centered theory of development in an ecologically minded context. IHD focuses on the development of the whole of each and every person, deriving its ethics from principles of Catholic Social Teaching with a particular emphasis on human dignity. IHD recognizes the universalism of human rights but contends development should be done with the goal of developing each and every whole person. People, then, are not merely means to a development end, but an end in and of themselves.

We must recognize that there are caveats to institutionalizing integral ecology at the policy level, especially if responsibility for this project is to be primarily assumed by the Global North. Such caveats include reinforcing structural inequality and colonial relationships, maintaining paternalistic relations to the Global South, and/or using a framework of integral ecology to justify intervention and neo-imperialistic behaviours. The current global paradigm based on capitalist ideals and colonial structures cannot remain if we are to practice integral ecology on a large scale. In short, we cannot institutionalize integral ecology at the policy level without pivoting away from the current world order. The current world order is what gave birth to the need for integral ecology in the first place.

Integral ecology can be understood broadly as the connection between humans and our environment, and more specifically as an approach to global problems that would rectify the ecological debt that the Global North owes the Global South. Although the conceptual definition of integral ecology is clear, what is less clear is the methodology that would lead us to a practice of integral ecology.

Discussion points: Discuss the practical requirements of implementing an Integral Ecology Partway in your place?

Chapter 2

Ecosystem

The ecosystem is the communion of organisms like plants, animals, and biomass (microorganisms) interacting with their surrounding environment such as air, water and soil is a particular area. It contains both biotic and abiotic components. The ecosystem provides a home for a wide range of wild plants and animals while promoting the growth of various food chains and food webs. A balanced ecosystem allows people to live longer lives. The ecosystem conservation involves the conservation and protection of natural habitats to maintain biodiversity. Protecting ecosystems involves the following aspects:

- Create a healthy ecosystem through protecting and conserving the endangered species and natural habitat.
- Promote responsible management of natural resources to reduce overexploitation.
- Reduce the pollution of air, water and soil through biodiversity conservation, waste management and sustainable practices of resources.
- Safeguard ecosystem and manage resources following the laws and regulations.
- Create awareness among individuals on the importance of protecting the ecosystem.
- Promote the planting of native plant species (multispecies) and avoid invasive plants for biodiversity conservation.
- Reduce the emission of greenhouse gases through adapting to the change climate and through climate resilient measures. Resilience is the ability of the ecosystem to recover to the disturbance event.
- Work with individuals, communities, organizations (institutions), and governments in conserving/protecting the ecosystem.
- Maintain the soil moisture, groundwater availability through conserving, preserving, and protecting the water resources. Measures like soil and water conservation, soil health management to be adopted.

A healthy ecosystem with active biodiversity, where our guests, the birds and mammals, live together in total harmony, will provide us a better environment, with no room for the spread of diseases. It is high time that we re-set the lost equation among the living beings and bring back the diseased earth back to its state of harmony and peace. Researchers and environmental activists today strongly feel that the destruction of biodiversity creates favourable circumstances for the new viruses and diseases like corona. This can be linked with the outbreak of Corona virus wherein we invade the habitat of other species with our greed for manipulating them for our profit.

The year 2021 to 2023 as the decade of Ecosystem Restoration:

Towards resetting our relationship with Nature, UN general assembly declared 2021-2030 as the decade on ecosystemwith the purpose of massively scale up the restoration of degraded and destroyed ecosystems as a proven measure to fight the climate crisis and enhance food security, water supply and biodiversity. The need to respect the ecosystem has started gaining momentum due multifaceted environmental issues and challenges. The eco-spirituality connects human beings with environment and understand the interconnectedness and interrelationships between all living beings while considering the importance of interdependency and ecological balance.

Role of Biodiversity in Integral Ecology:

Biodiversity, the variety of life on Earth, is the cornerstone of integral ecology, a holistic approach that recognizes the interconnectedness of environmental, social, and economic systems. Biodiversity is a fundamental pillar of integral ecology, influencing the stability of ecosystems, providing essential services, and contributing to the well-being of human societies. It is

imperative to delve into the importance and relevance of biodiversity within the framework of integral ecology. Biodiversity encompasses the diversity of species, ecosystems, and genetic variations within and among species. According to the Convention on Biological Diversity (CBD), biodiversity is organized into three main levels: genetic diversity, species diversity, and ecosystem diversity. Genetic diversity refers to the variation in genes within a population, species diversity relates to the variety of species in a given area, and ecosystem diversity involves the range of ecosystems present on Earth.

Biodiversity is fundamental to the stability and resilience of ecosystems. Diverse ecosystems are better equipped to withstand environmental changes, including climate fluctuations and natural disasters. Biodiversity provides essential ecosystem services that underpin human well-being and economic activities. These services include pollination of crops by insects, water purification by wetlands, and regulation of climate by forests. The Millennium Ecosystem Assessment (2005) estimates that 60% of ecosystem services are in decline, emphasizing the economic significance of preserving biodiversity. Biodiversity holds immense cultural and aesthetic value for societies around the world. Indigenous communities, for example, often depend on specific species for cultural practices, rituals, and traditional knowledge. Additionally, biodiversity contributes to the beauty of landscapes, promoting tourism and recreational activities. The interconnectedness of environmental systems, the social and economic implications of biodiversity loss, and the ethical considerations inherent in integral ecology underscore the urgency of action. By acknowledging the importance of biodiversity and implementing effective conservation measures, we can work towards a sustainable and harmonious coexistence with the natural world. As stewards of the Earth, it is our responsibility to ensure the preservation of biodiversity for the benefit of present and future generations.

Relevance to Integral Ecology

- **Interconnectedness of Environmental Systems:** Integral ecology recognizes the interconnectedness of environmental systems and the intricate web of relationships between species, ecosystems, and human societies. Biodiversity is a key component of this interconnectedness, influencing the functioning of ecosystems
- **Social and Economic Implications:** Integral ecology goes beyond the purely environmental aspects and integrates social and economic dimensions. The loss of biodiversity can have profound implications for communities that rely on natural resources for their livelihoods. For example, a decline in fish species can impact the livelihoods of coastal communities dependent on fishing.
- **Ethical Considerations:** Integral ecology emphasizes the ethical responsibility of preserving biodiversity for current and future generations. The Earth Charter, an international declaration of fundamental principles for building a just, sustainable, and peaceful global society, underscores the need to protect biodiversity and respect the intrinsic value of all species.
- **Challenges and Threats:** Despite the recognized importance of biodiversity, numerous threats jeopardize its existence. Habitat destruction, pollution, climate change, overexploitation, and invasive species are among the key drivers of biodiversity loss (CBD, 2019). For instance, the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) reports that up to one million species are at risk of extinction due to human activities.
- **Government and NGO Initiatives:** Governments and NGOs play a pivotal role in addressing the challenges posed to biodiversity. The Convention on Biological Diversity, established in 1992, is a key international treaty that aims to conserve biodiversity, ensure sustainable use of its components, and promote fair and equitable sharing of benefits. Various national governments have implemented strategies and plans to safeguard biodiversityin collaboration with NGOs and local communities.

Harnessing the Power of Agroforestry

In the pursuit of sustainable and resilient agricultural practices, agroforestry has emerged as a transformative approach that integrates trees and shrubs into traditional farming systems. This article endeavours to provide a comprehensive understanding of agroforestry for academic, non-governmental organization (NGO), and government stakeholders. With a focus on principles, and benefits, this article aims to emphasize the significance of agroforestry in promoting ecological resilience, biodiversity, and socio-economic development. Agroforestry represents a holistic land management system that combines trees and shrubs with

crops and/or livestock in a mutually beneficial manner. Unlike traditional monoculture systems, agroforestry recognizes the inherent synergy between agriculture and forestry, promoting sustainable land use practices.

Agroforestry stands as a powerful ally in the quest for sustainable and resilient agricultural systems. Its ability to simultaneously address environmental, economic, and social objectives makes it a compelling solution for a wide range of stakeholders. As academic, NGO, and government entities, our collaborative efforts are paramount in promoting agroforestry principles, supporting research initiatives, and advocating for policies that facilitate its widespread adoption. Through these collective endeavours, we can usher in a new era of agriculture that is not only productive but also harmonious with the natural world.

- **Diversification of Land Use:** Agroforestry encourages the intentional integration of trees and shrubs within agricultural landscapes, diversifying land use and providing multiple products and services.
- **Enhanced Biodiversity:** The inclusion of trees in agroforestry systems fosters biodiversity, creating habitats for various flora and fauna. This diversity contributes to pest control, pollination, and overall ecosystem health.
- **Soil Health Improvement:** Trees play a crucial role in enhancing soil structure and fertility. Agroforestry practices, such as alley cropping and silvopasture, contribute to reduced soil erosion, improved water retention, and increased nutrient cycling.
- **Climate Change Mitigation and Adaptation:** Agroforestry systems act as carbon sinks, sequestering atmospheric carbon dioxide and mitigating the impacts of climate change. Additionally, the shade provided by trees helps regulate temperature, offering adaptation benefits for crops and livestock.

Benefits

- **Environmental Sustainability:** Agroforestry promotes sustainable land management by reducing deforestation, conserving biodiversity, and preventing soil degradation.
- **Economic Viability:** Agroforestry systems often lead to increased economic returns for farmers. The diversified products, including timber, fruits, nuts, and non-timber forest products, provide additional income streams, making agricultural practices more economically viable.
- **Climate Resilience :** The adaptability of agroforestry systems to changing climatic conditions enhances the resilience of farming operations. This is particularly valuable in the face of unpredictable weather patterns and extreme events.
- **Community Livelihoods:** Agroforestry has the potential to uplift rural communities by providing employment opportunities, supporting local industries, and fostering a sustainable relationship between people and their environment.

Challenges and Opportunities

- **Land Tenure and Policy Challenges:** Ambiguous land tenure and conflicting policies often pose challenges to the widespread adoption of agroforestry. Clear and supportive policies are essential to overcome these barriers and incentivize farmers to embrace agroforestry practices.
- **Knowledge Gaps and Extension Services:** Farmers may lack the knowledge and skills required for successful agroforestry implementation. Strengthening extension services and providing targeted education are critical components for addressing this challenge.
- **Market Access and Certification:** Access to markets for agroforestry products can be hindered by certification requirements and limited market demand. Developing certification programs and creating market linkages are essential for ensuring economic benefits for agroforestry practitioners.

The Vital Role of Community Forest Management in Sustainable Development

In the pursuit of sustainable development, one often-overlooked cornerstone is the empowerment of communities through effective forest management. This NGO-level article aims to illuminate the critical role of Community Forest Management (CFM) in fostering sustainability. With a professional tone, we will delve into the multifaceted dimensions of CFM, exploring its

impact on environmental conservation, socio-economic upliftment, and community resilience. As the global community grapples with the imperative of sustainable development, it becomes increasingly evident that harnessing the power of local communities is pivotal. Community Forest Management stands out as a beacon of sustainable and inclusive development. This article will delve into the profound impact of CFM, emphasizing its role in empowering communities and contributing to a more sustainable future.

Community Forest Management (CFM): Community Forest Management refers to the sustainable management of forests by local communities who have a direct stake in the resources. It involves the collaborative and participatory management of forested areas, balancing ecological conservation with the socio-economic needs of the community. Community Forest Management emerges as a powerful tool in the journey towards sustainable development. By empowering local communities, CFM not only safeguards natural resources but also catalyses socio-economic progress. As we navigate the complexities of global sustainability, recognizing and supporting the pivotal role of CFM is not just beneficial; it is imperative for building a resilient and equitable future for all.

The Pillars of Community Forest Management

- **Local Empowerment and Governance:** CFM empowers local communities by granting them a central role in decision-making processes. This not only fosters a sense of ownership but also ensures that the management strategies align with the community's unique needs and aspirations.
- **Biodiversity Conservation:** Community involvement in forest management often leads to more sustainable and biodiversity-friendly practices. The intimate knowledge that local communities possess about their ecosystems contributes to the conservation of flora and fauna.
- **Socio-Economic Benefits:** CFM plays a pivotal role in enhancing the socio-economic fabric of communities. By responsibly harvesting forest resources, communities can generate income, create employment opportunities, and improve their overall standard of living.
- **Climate Change Mitigation:** Local forest management practices, when aligned with sustainability goals, contribute significantly to climate change mitigation. Healthy forests act as carbon sinks, helping offset the impacts of climate change.

Chapter 3

Challenges

Policy Support and Recognition: Despite its proven benefits, CFM often faces challenges in terms of policy support and official recognition. Advocating for robust legal frameworks that acknowledge and support community-led initiatives is crucial.

Capacity Building and Training: Building the capacity of local communities to effectively manage forests requires ongoing training and support. Investment in education and skill development is essential for the sustained success of CFM.

The Way Forward

Partnerships and Collaborations: Strengthening partnerships between local communities, NGOs, and governmental bodies is vital. Collaborative efforts can enhance the impact of CFM initiatives and ensure long-term success.

Incentivizing Sustainable Practices: Governments and NGOs can play a pivotal role in incentivizing sustainable practices within CFM. Financial and non-financial incentives can encourage communities to adopt and maintain environmentally friendly approaches.

Soil erosion

Soil erosion is the removal of topsoil by the physical forces of erosion-causing agents at a greater rate than the rate of its formation. Initially, erosion removes the nutrient-rich fertile top layer of soil which leads to the reduced production potential of soil. Soil erosion is classified into two categories, i.e., accelerated and geological erosion. Geological erosion is a natural phenomenon, occurring through the constant process of weathering and disintegration of rocks in which the rate of erosion remains lower than the soil formation rate. In contrast, in accelerated erosion, the rate of soil erosion exceeds a certain threshold level and becomes rapid. Anthropogenic activities such as slash-and-burn agriculture, overgrazing, deforestation, mining, and intensive and faulty agriculture practices are accountable for accelerated soil erosion. This higher rate of soil erosion leads to the removal of organic matter and plant nutrients from the fertile topsoil and eventually lowers crop productivity. Hence, the conservation and management of natural resources are essential. Although soil erosion cannot be eliminated, however, it must be reduced to the level that can minimize its adverse impact on productivity and agricultural sustainability.

In the past, there was a system of farming which provided for the replenishment of soil nutrients and hence the natural regeneration of soil fertility. Thus, the traditional package of agricultural practices did not pose any threat to the stability of the ecosystem. The agricultural production was also by and large sufficient to meet the requirements of the population. However, with an attempt to ensure food security, farmers were forced to use chemical fertilizers and pesticides which resulted in the increase of production in the initial stages. Later, more quantity of chemicals was required to sustain the same production. In the long run, while the target was to produce more, due to the excessive use of chemical fertilizers and pesticides, soil fertility as well as quality of the grains was affected and this gave way to the pollution of soil and water.

What happens when the soil goes? The top few centimetres of soil are critical to crop and pasture growth. This is because topsoil is usually the most fertile portion of the soil profile, and any loss of it will therefore result in a loss of soil fertility. While the loss of a few millimetres of soil may not seem critical in any one year, over several years this loss will cause decreased crop growth and yield, thereby, leading to an increase in fertilizer requirements. Soil erosion can take many forms, including gully, rill, wind, sheet and water erosion. In general, soil erosion occurs because of human factors like over-clearing the land for cultivation and construction

or over-grazing of livestock and natural factors like rain and strong winds. Balanced ecosystems (healthy soil, water and biomass) are very important for the survival of mankind. Any disturbance in this ecosystem results in an imbalance which is revealed through the degradation of soil structures, soil erosion leading to topsoil loss, the excessive surface flow of rainwater leading to floods, water depletion leading to droughts, low productivity, health problems etc. Water and wind are two key agents that degrade soils through various kinds of erosion processes. Runoff removes the soil particles from sloping and bare lands while the wind blows away loose and detached soil particles from unprotected lands. Other processes of land degradation are - soil compaction, waterlogging, acidification, alkalinization, and salinization depending on parent material, climatic conditions, and crop management practices. In this chapter, we will discuss soil erosion by different types, processes, factors, and management.

The accelerated soil erosion significantly influences the soil quality, agricultural production and nutritional quality. Higher soil erosion results in the removal of fertile topsoil along with nutrients which leads to reduced agronomic yield, land degradation, and terrain deformation. The main causal factors affecting the rate of soil erosion are - parent material, soil texture, slope steepness, plant cover, tillage, and climate. Moreover, the intensive and erratic rainfall results in higher soil erosion which leads to reduced infiltration and eventually less water availability to the vegetation. Thus, soil loss by water and wind severely affects the productive efficiency of all ecosystems. The comprehensive impacts of erosion on soil and water resources are liable to reduce agricultural productivity in higher order. Vegetation cover is imperative for moderating surface runoff and water erosion from agricultural lands. The rate of runoff, soil, and nutrient loss is predominantly determined by the type of vegetation, canopy cover, slope gradient, and rainfall characteristics. The higher canopy cover and crop residue mulching on the soil surface results in a reduced rate of surface runoff and also reduces the impact of rainfall erosivity and soil erodibility. Vegetation cover reduces the detachment of soil particles along with the protection of soil surface from intensive rainfall. Moreover, it also conserves soil moisture and retains sediment and organic materials. To sustain agricultural productivity, it is imperative to reduce runoff, soil loss, and nutrient loss through water erosion.

Global Warming & Climate Change

World is getting warmer and climate change is a reality. We are already bearing the brunt of its consequences, and this happens when the world is facing multiple climate irregularities which is manifested in the increased incidences of extreme weather conditions leading to water stress, variation in food production and disasters. Agriculture sector remains the main source of livelihoods of majority of the families in India but faces the challenges of Climate Change. Extreme weather conditions, high intensity rainfall, uneven and untimely rainfall are more frequent which is affecting the farmers especially small holders. Smallholder Farmers/Landless Labors/ Fishermen are directly dependent on climate, since temperature, sunlight and water are the main drivers of crop growth. Agriculture being the only source of subsistence and income for our target communities. This is being adversely impacted by climate change effect. Community living in the tribal belt and coastal areas are extremely vulnerable to extreme climate sensitivity impacts, like change in temp, recurrent drought spell, water shortage and inundations which affects agriculture production.

The coping mechanism of the poor and marginalized crumbles with the extreme change in the climate leading to the loss of lives and livelihoods. Hence it is high time to initiative community managed coping with the climate change consequences through climate resilient measures which are ecologically sensitive, economically viable, socially adaptive, traditionally practiced and culturally acceptable. Community led approach to climate justice would break the culture of merely being a beneficiary of a program and would centre people at the foundation of their development. Care for Creation should be "an integral part of our mission and an expression of our worship to God. Therefore, our ministry of reconciliation is a matter of great joy and hope and we would care for creation even if it were not in crisis. Considering the breadth and depth of the consequences of climate change leading to the loss of biodiversity, deforestation, glacial retreat, disruption of food system and supply Climate change, disruption of the food supply, loss of energy etc. leads us to take up comprehensive actions towards environment management and bring back our relationship with nature.

Climate Change Scenario in India:

India is a global biodiversity hotspot as well as the home to different types of ethnic groups which is a rich cultural heritage and

indigenous knowledge of eco-system. The intensive use of fossil fuels, unplanned developmental activities, massive deforestation, excessive use of chemical fertilizers and pesticides, change in cropping system, land use change, mining etc. contributed to high concentration of greenhouse gases in the atmosphere. Climate Change is predicted to impact on the natural resource base of the country such as water resources, agriculture, soil, animal husbandry, forestry through extreme weather events, change in monsoon season, change in rainfall pattern, temperature and wind velocity. Climate change in India poses extra stress on the ecological and socio-economic condition of the country. The country is experiencing effects of climate change in the form of frequent disasters, soil erosion, depletion of water resources, pest and diseases, pollution, crop loss etc. which is adding to the difficulties especially of the poor and marginalized. Hence it is the high time to have initiatives that support the communities in coping with the climate change consequences through proactive mechanisms and timely interventions.

Ozone layer depletion

Ozone layer is a region of stratosphere that contains relatively high concentration of ozone molecules (O3). It is situated around 10-20 kilometres above earth's surface. Though ozone is dangerous to our health, it plays a major role in protecting life on earth by absorbing and filtering Ultra Violet Radiations. Ozone molecules in the ozone layer absorbs UV rays and breakdown into less harmful forms of energy such as heat. Ozone layer is getting depleted due to the release of some human made chemicals such as Chlorofluorocarbons (CFCs), Carbon tetra chloride, halons, methyl chlorine and bromine atoms. These elements contain Chlorine and Bromine atoms causing damages to ozone molecules. We usually call ozone hole, but ozone hole is not actually hole, but a region that contains low concentration of ozone.

As the quantity of ozone layer substances are increasing leading to the depletion of ozone layer and the subsequent entry of ultra violet rays to the earth, efforts have been made to reduce the quantity of ozone depleting substances through international agreements like Montreal Protocol. The depletion of ozone layer cased also by the Polar stratospheric clouds (PSCs) which occurs during winter and early spring at high latitudes like the Antarctic ozone hole. PSCs enable the formation of ozone depleting compounds such as chlorine nitrate and hypochlorous acid. These components when released to the stratosphere can destroy ozone layer when exposed to sunlight.

Navigating Change: The Imperative of Climate Change Adaptation

In an era defined by the ever-growing spectre of climate change, the imperative for effective adaptation strategies has never been more urgent. This article deals with the intricacies of climate change adaptation, exploring key strategies and initiatives essential for building resilience in the face of environmental uncertainty. Climate change, characterized by rising temperatures, extreme weather events, and shifting climate patterns, poses unprecedented challenges to ecosystems and societies globally. The need for adaptive measures is critical, requiring a concerted effort from NGOs, governments, and communities alike. This article examines the landscape of climate change adaptation, emphasizing its significance in fostering sustainability and resilience. Climate change adaptation refers to the adjustment in natural or human systems to a new or changing climate. This encompasses an array of strategies, policies, and actions designed to minimize the adverse impacts of climate change and seize opportunities that may arise. Climate change adaptation is an imperative that transcends geographical boundaries and socio-economic disparities. In navigating this complex landscape, NGOs play a pivotal role in facilitating knowledge exchange, building resilience at the community level, and advocating for policies that prioritize adaptation.

Key Drivers of Adaptation

- **Scientific Understanding:** A robust understanding of climate science is fundamental for informed decision-making. Adaptation initiatives must be grounded in scientific knowledge, accounting for current and projected climate trends.
- **Risk Assessment:** Identifying and assessing vulnerabilities is crucial for effective adaptation planning. Comprehensive risk assessments enable the prioritization of interventions and resources.

Key Strategies for Climate Change Adaptation

- **Ecosystem-Based Adaptation:** Harnessing the resilience of ecosystems can significantly contribute to adaptation efforts. Preservation and restoration of natural habitats, such as mangroves and wetlands, act as natural buffers against climate-induced impacts.
- **Infrastructure Resilience:** Building climate-resilient infrastructure is paramount in safeguarding communities. This includes constructing buildings to withstand extreme weather events and developing robust water management systems.
- **Community Engagement and Social Equity:** Community involvement is central to successful adaptation. Local knowledge, traditional practices, and community-based strategies enhance the effectiveness and sustainability of adaptation initiatives.

Challenges

- **Limited Financial Resources:** Adequate funding remains a persistent challenge for climate change adaptation. Mobilizing resources for large-scale adaptation projects, especially in developing countries, requires international cooperation and innovative financing mechanisms.
- **Policy and Institutional Gaps:** Many regions face challenges in integrating adaptation into policy frameworks. Addressing these gaps requires collaboration between governments, NGOs, and international bodies to create coherent and effective strategies.

Opportunities

- **Technology and Innovation:** Advancements in technology offer new opportunities for adaptation, from climate-resilient crop varieties to innovative early warning systems. Investing in research and development can unlock the potential of these solutions.
- **Cross-Sectoral Collaboration:** Collaboration between sectors, governments, and non-governmental organizations is essential. Integrated approaches that consider the interconnected nature of climate change impacts can lead to more effective and sustainable adaptation strategies.

Chapter 4

Strategies to Restore Integral Ecology

Climate Change Mitigation: A Unified Approach for All

In the face of escalating climate challenges, the imperative for effective mitigation strategies resonates across diverse sectors and audiences. This NGO-level article end eavors to unravel the intricacies of Climate Change Mitigation, maintaining a professional yet accessible tone to engage readers at various levels. With a unique blend of generic insights and distinctive perspectives, this piece aims to foster a collective understanding of the shared responsibility in combatting climate change. Climate Change Mitigation stands as a collective endeavour transcending geographical, social, and economic boundaries. The urgency to address this global predicament calls for a unified approach, where governments, NGOs, and individuals play pivotal roles. This article navigates through the nuanced landscape of climate change mitigation, appealing to a broad readership while offering distinctive insights. As we confront the complexities of climate change mitigation, a harmonized approach that resonates with diverse audiences becomes essential. Governments, NGOs, and stakeholders each have a distinctive role in the collective effort towards a sustainable future. By embracing innovative strategies, fostering collaboration, and addressing challenges head-on, the global community can navigate the path towards effective climate change mitigation.

Understanding Climate Change Mitigation: Climate Change Mitigation is a comprehensive strategy aimed at curbing the causes and consequences of climate change. At its core, it involves reducing greenhouse gas emissions, enhancing carbon sinks, and fostering sustainable practices. These objectives, outlined by leading climate authorities, provide a foundational understanding of the mitigation imperative.

The Pillars of Mitigation

- **Transition to Sustainable Energy:** Shifting from fossil fuels to renewable energy forms the bedrock of climate change mitigation. This necessitates not only governmental policy shifts but also active participation from NGOs in advocating for renewable energy initiatives and engaging communities in sustainable energy practices.
- **Afforestation and Reforestation:** Expanding forest cover and restoring degraded lands emerge as powerful tools in sequestering carbon. The role of NGOs becomes crucial in implementing afforestation projects, raising awareness, and ensuring sustainable forestry practices.
- **Sustainable Agriculture Practices:** The agricultural sector, a significant emitter, requires a shift towards sustainable practices. Governments can implement policies supporting sustainable agriculture, while NGOs play a key role in disseminating knowledge about agroecology and advocating for sustainable farming techniques.

Tailoring Mitigation Strategies for Diverse Audiences

- **Government Engagement:** Governments wield immense influence in shaping and implementing policies that drive national mitigation efforts. Key considerations include:
- **Policy Frameworks:** Developing comprehensive policy frameworks that prioritize renewable energy, afforestation, and sustainable agriculture. Integrating climate considerations into existing policies fosters a holistic approach to mitigation.
- **Incentive Mechanisms:** Establishing financial incentives and regulatory measures to encourage businesses and industries to adopt low-carbon practices. Collaborating with NGOs is crucial in ensuring the effective implementation of these incentives.
- **NGO Involvement:** Non-governmental organizations play a pivotal role in advocacy, community engagement, and bridging gaps between governmental bodies and grassroots initiatives. Key roles for NGOs include:

- **Community Empowerment:** Engaging local communities in climate change mitigation initiatives fosters a sense of ownership and sustainability. NGOs can initiate community-based projects, such as reforestation campaigns or renewable energy cooperatives, to empower individuals.
- **Advocacy and Education:** Advocating for strong climate policies and raising awareness about the impact of individual and corporate actions on climate change. NGOs can facilitate educational programs to build capacity and empower communities to contribute to mitigation efforts.

Stakeholder Collaboration

Effective collaboration among various stakeholders is crucial for the success of mitigation strategies. Key aspects of stakeholder engagement include:

- **Public-Private Partnerships:** Facilitating collaborations between governmental bodies, NGOs, and private enterprises accelerates the transition to a low-carbon economy. Public-private partnerships can drive innovation and investment in sustainable technologies.
- **International Cooperation:** Promoting global collaboration and information exchange is vital. Shared research initiatives, technology transfer, and mutual support among nations can amplify the impact of individual mitigation efforts.

Challenges

- **Political Will:** The lack of consistent political will remains a significant impediment to effective climate change mitigation. Shifting political priorities and short-term perspectives hinder the long-term planning required for successful mitigation.
- **Technological Barriers:** The need for rapid technological advancements to facilitate a smooth transition to renewable energy and sustainable practices poses a challenge. Investment in research and development is crucial to overcoming these barriers.

Future Perspectives

- **Innovation and Adaptability:** Embracing innovation and fostering adaptability will be key to addressing emerging challenges. Continued investment in research and development will drive technological breakthroughs, making mitigation strategies more effective and feasible.
- **Global Cooperation:** Strengthening international cooperation is imperative. Collaborative efforts in research, technology transfer, and financial support can enhance the global community's ability to collectively address climate change.

Building Climate Resilience: An Approach

Climate resilience stands as a linchpin in our collective response to a changing climate. As professionals from diverse backgrounds navigate the complexities of their respective fields, understanding and integrating climate resilience becomes essential. The challenges posed by climate change necessitate a collaborative and proactive approach. Professionals from health, urban planning, agriculture, business, and environmental sciences each have a unique role to play in building climate resilience. By embracing adaptive strategies, advocating for policy changes, and fostering interdisciplinary collaboration, professionals can collectively contribute to a more resilient and sustainable future.

Understanding Climate Resilience: Climate resilience refers to the capacity of individuals, communities, and systems to anticipate, prepare for, respond to, and recover from the adverse impacts of climate change. It involves not only bouncing back from shocks and stresses but also adapting and transforming to thrive in a changing climate.

Key Components of Resilience

- **Anticipation and Preparedness:** Climate-resilient professionals are proactive in anticipating climate-related risks and

preparing for potential impacts. This involves risk assessments, scenario planning, and the development of robust contingency plans.

- **Adaptive Capacity:** Professionals must possess adaptive capacity—the ability to adjust and learn from experiences. This includes staying informed about emerging climate trends, engaging in continuous learning, and fostering a culture of innovation.
- **Robust Infrastructure and Systems:** Resilient professionals advocate for and contribute to the development of robust infrastructure and systems capable of withstanding climate-related stresses. This could involve sustainable urban planning, resilient agricultural practices, and climate-resilient supply chains.
- **Anticipating Health Risks:** Health professionals play a crucial role in anticipating and preparing for the changing health landscape due to climate change. This involves understanding the impacts of heatwaves, changing disease vectors, and the mental health effects of extreme weather events.
- **Building Adaptive Health Systems:** Resilient health professionals contribute to the development of adaptive health systems that can respond effectively to climate-related health challenges. This includes robust healthcare infrastructure, early warning systems, and public health campaigns.
- **Designing Climate-Resilient Cities:** Urban planners and architects are instrumental in designing and retrofitting cities to withstand the impacts of climate change. This involves creating green spaces, improving drainage systems, and incorporating sustainable building materials.
- **Integrating Climate Considerations in Planning:** Resilient urban planning professionals integrate climate considerations into their projects, considering sea-level rise, extreme heat events, and the increased frequency of natural disasters in their designs.
- **Adopting Climate-Smart Agriculture:** Agriculture professionals are at the forefront of climate resilience, adopting climate-smart agricultural practices that enhance productivity while minimizing environmental impact. This involves precision farming, agroforestry, and sustainable water management.
- **Biodiversity Conservation:** Environmental scientists contribute to climate resilience by focusing on biodiversity conservation. Protecting diverse ecosystems ensures that they can adapt to changing climatic conditions and continue to provide essential services.
- **Resilient Supply Chains:** Professionals in business and supply chain management contribute to resilience by building climate-resilient supply chains. This involves diversifying suppliers, conducting climate risk assessments, and incorporating sustainability into business strategies.
- **Climate Risk Disclosure:** Resilient professionals in business advocate for and engage in climate risk disclosure. This involves transparent reporting on climate-related risks and the integration of climate considerations into financial decision-making.

Challenges

- **Limited Resources:** Professionals across sectors face challenges due to limited resources for implementing climate resilience measures. This calls for innovative financing mechanisms and increased collaboration between the public and private sectors.
- **Policy Integration:** Despite growing awareness, the integration of climate resilience into policies remains a challenge. Professionals must advocate for the mainstreaming of climate considerations into decision-making processes.

Opportunities

- **Technology and Innovation:** The future of climate resilience lies in technological advancements and innovation. Professionals must actively engage in research and development to create cutting-edge solutions that enhance resilience.
- **Interdisciplinary Collaboration:** The interconnected nature of climate challenges calls for increased interdisciplinary collaboration. Professionals from different fields must work together to develop holistic and effective resilience strategies.

Guiding Resilience: The Essential Need for Thorough Vulnerability Assessment

In the realm of sustainable development, understanding and addressing vulnerabilities is paramount. Vulnerability Assessment, a critical component of sustainable development strategies, serves as the compass guiding initiatives to safeguard communities and ecosystems. This article will traverse the landscape of vulnerability assessment, elucidating its nuanced facets and underscoring its role in fostering resilience. Vulnerability Assessment is a systematic process aimed at understanding the susceptibility of a system to harm. Whether the focus is on social, economic, or environmental dimensions, the assessment provides a lens through which vulnerabilities can be identified, analysed, and addressed.

Vulnerability assessment emerges not only as a diagnostic tool but as a compass guiding communities and policymakers toward resilience and sustainability. Acknowledging vulnerabilities, understanding their complex interplay, and implementing targeted strategies are essential steps in navigating the path to a more secure and resilient future for all. By valuing vulnerability assessment as a proactive and integral part of sustainable development, we pave the way for adaptive strategies that ensure communities and ecosystems can withstand and recover from the myriad challenges they face. Through collaboration, innovation, and a commitment to inclusivity, vulnerability assessment becomes a cornerstone in the edifice of a more resilient and sustainable world.

Key Components

- **Social Vulnerability:** Examining the social fabric is integral to vulnerability assessment. Factors such as income inequality, access to healthcare, and educational disparities contribute to a community's vulnerability. Understanding these dynamics is foundational for creating targeted interventions.
- **Environmental Vulnerability:** Ecosystems face vulnerabilities rooted in environmental stressors. Biodiversity loss, habitat degradation, and climate change impacts are pivotal considerations. A robust vulnerability assessment in this context informs conservation efforts and sustainable resource management.
- **Economic Vulnerability:** Economic structures play a crucial role in determining vulnerability. Assessing economic vulnerabilities involves scrutinizing income sources, employment patterns, and the overall economic resilience of a community or region.

Methodologies in Vulnerability Assessment

- **Participatory Approaches:** Engaging communities in the vulnerability assessment process ensures that local knowledge and perspectives are considered. Participatory methods foster a sense of ownership and empower communities in resilience-building efforts.
- **Geographic Information Systems (GIS):** Utilizing GIS technology enhances the spatial understanding of vulnerabilities. Mapping environmental stressors, socio-economic indicators, and community assets contributes to a holistic vulnerability profile.
- **Scenario Analysis:** Scenario-based assessments explore potential future vulnerabilities under different conditions. This forward-looking approach aids in developing adaptive strategies and building resilience to uncertainties.

Applications of Vulnerability Assessment

- **Climate Change Adaptation:** Vulnerability assessments are instrumental in climate change adaptation strategies. Understanding how climate change impacts intersect with existing vulnerabilities informs adaptive measures and facilitates the development of resilient communities.
- **Disaster Risk Reduction:** In disaster-prone regions, vulnerability assessments are foundational for effective disaster risk reduction. By identifying susceptibilities and weaknesses, communities can formulate strategies to mitigate the impact of disasters.
- **Conservation Planning:** Biodiversity conservation benefits from vulnerability assessments, guiding conservationists in identifying areas at risk and prioritizing interventions. This ensures the preservation of critical ecosystems and the species they support.

Challenges

- **Data Limitations:** Data gaps pose a significant challenge in vulnerability assessments, especially in developing regions. Limited access to reliable data hampers the accuracy of vulnerability profiles and impedes the formulation of effective strategies.
- **Interconnectedness of Vulnerabilities:** Vulnerabilities are often interconnected, making it challenging to address them in isolation. A holistic approach is necessary, but it requires a nuanced understanding of the complex web of vulnerabilities.

Way Forward

- **Policy Integration:** Embedding vulnerability assessments in policy frameworks is essential for informed decision-making. Governments and institutions must prioritize the integration of vulnerability data into policies related to climate change, disaster management, and sustainable development.
- **Community Empowerment:** Empowering communities to conduct their vulnerability assessments fosters resilience from the ground up. Capacity-building initiatives and knowledge transfer enable communities to actively participate in the identification and mitigation of vulnerabilities.

Intergovernmental Panel on Climate Change -IPCC

The IPCC stands for the Intergovernmental Panel on Climate Change. It is a scientific body established by the United Nations Environment Programme (UNEP) and the World Meteorological Organization (WMO) in 1988. The primary role of the IPCC is to provide policymakers with comprehensive assessments of the scientific knowledge about climate change, its potential impacts, and potential mitigation and adaptation strategies.

Key aspects of the IPCC include:

Assessment Reports: The IPCC creates detailed Assessment Reports that cover scientific, technical, and socio-economic information regarding climate change. These reports encompass the current state of knowledge on climate change, its effects, potential future risks, and available strategies to mitigate the rate of climate change. The IPCC publishes comprehensive assessment reports approximately every 5 to 7 years, which summarize the latest scientific research on climate change. These reports are based on contributions from thousands of scientists worldwide and undergo extensive peer review.

Synthesis Reports: The IPCC also releases synthesis reports that consolidate the findings from the three working groups, providing policymakers with a comprehensive overview of the state of knowledge on climate change.

- **Special Reports:** In addition to the assessment reports, the IPCC periodically publishes special reports on specific topics or emerging issues related to climate change, such as oceans and cryosphere, land use, and climate change, among others.
- **Policy-Relevant Guidance:** The reports produced by the IPCC provide policymakers and governments with scientific information and guidance that can inform climate policy development, international negotiations, and decision-making related to climate change mitigation and adaptation strategies.
- **Consensus-Based Approach:** The IPCC operates on a consensus-based approach, meaning that its reports are based on the collective agreement and scientific consensus of a wide range of experts from various disciplines and countries.

The IPCC is considered a leading authority on climate change science, and its assessments are influential in shaping global climate policies and actions. Its reports serve as a foundation for international climate negotiations, including those under the United Nations Framework Convention on Climate Change (UNFCCC), providing a scientific basis for addressing climate change at local, national, and international levels.

National Action Plan on Climate Change

Introduction: Climate change stands as a paramount global challenge in the present era. Recent occurrences have strongly shown our increasing susceptibility to its effects. These impacts are ranging from influencing agriculture and posing a greater threat to food security to rising sea levels, rapid erosion of coastal areas, increased frequency of natural calamities, extinction of species, and the expansion of diseases transmitted by vectors. The National Action Plan on Climate Change (NAPCC) is a comprehensive framework initiated by the Government of India in 2008 to address various challenges related to climate change. The plan aims to outline strategies and actions to mitigate greenhouse gas emissions, adapt to the impacts of climate change, promote sustainable development, and enhance resilience across various sectors of the economy.

Key elements of India's National Action Plan on Climate Change include:

1. It stresses that maintaining a high growth rate is essential for increasing the living standards of the vast majority of people of India and reducing their vulnerability to the impacts of climate change. There are eight -National Missions that form the core of the National Action Plan. They focus on promoting understanding of climate change, adaptation and mitigation, energy efficiency, and natural resource conservation.

   The NAPCC comprises eight national missions focusing on specific sectors and strategies to address climate change:
   - National Solar Mission
   - National Mission for Enhanced Energy Efficiency
   - National Mission on Sustainable Habitat
   - National Water Mission
   - National Mission for Sustaining the Himalayan Ecosystem
   - National Mission for a Green India
   - National Mission for Sustainable Agriculture
   - National Mission on Strategic Knowledge for Climate Change

2. **Adaptation and Mitigation:** The plan emphasizes both adaptation and mitigation measures. It aims to reduce the country's greenhouse gas emissions intensity and enhance its resilience to the impacts of climate change.

3. **Sectoral Approach:** Each mission under the NAPCC focuses on specific sectors, such as energy, water, agriculture, forestry, urban development, and knowledge management, to address climate change challenges within those sectors.

4. **Renewable Energy and Energy Efficiency:** The NAPCC promotes the adoption of renewable energy sources, such as solar, wind, and biomass, and emphasizes energy efficiency measures to reduce carbon emissions and enhance energy security.

5. **Water Management:** The National Water Mission aims to improve water use efficiency, sustainable water management practices, and the conservation of water resources in the country.

6. **Afforestation and Sustainable Agriculture:** Missions such as the National Mission for a Green India and National Mission for Sustainable Agriculture focus on afforestation, biodiversity conservation, and promoting sustainable agricultural practices.

7. **Himalayan Ecosystem:** The mission aims to conserve the fragile Himalayan ecosystem and enhance the resilience of mountain communities to climate change impacts.

8. **Policy Implementation and Coordination:** The NAPCC emphasizes policy implementation, coordination among different sectors, and the involvement of multiple stakeholders to achieve its objectives.

India's National Action Plan on Climate Change serves as a guiding framework for the country's climate-related policies, strategies, and actions. It reflects India's commitment to addressing climate change challenges while simultaneously promoting sustainable development and ensuring environmental sustainability.

Nationally Determinant Contributions (NDC)

Nationally Determined Contributions (NDCs) are a key element of the Paris Agreement, which was adopted in 2015 under the United Nations Framework Convention on Climate Change (UNFCCC). Nationally Determined Contributions (NDCs) are individual commitments made by countries as part of the Paris Agreement. These pledges outline what each country will do to support the global aim of limiting temperature rise to 1.5°C, adapt to climate changes, and secure financial support for these actions. NDCs serve as short- to medium-term plans that must be revised every five years, aiming for more ambitious goals over time based on each country's abilities and resources.

Key points about NDCs include:

1. **Country-Specific Goals:** Each country determines its own NDCs, considering its national circumstances, capabilities, and development priorities. NDCs typically include targets for reducing greenhouse gas emissions, as well as plans for adapting to the impacts of climate change.

2. **Mitigation and Adaptation:** NDCs encompass both mitigation and adaptation efforts. Mitigation focuses on reducing emissions, such as through transitioning to renewable energy, improving energy efficiency, and enhancing forest conservation. Adaptation involves measures to increase resilience to the impacts of climate change, such as building climate-resilient infrastructure and implementing agricultural practices that can withstand climate variability.

3. **Regular Updating and Enhancement:** Countries are encouraged to periodically review and update their NDCs, with the expectation that successive NDCs will demonstrate increased ambition in addressing climate change. This is to ensure that global efforts align with the long-term goal of limiting global temperature rise to well below 2 degrees Celsius above pre-industrial levels, and preferably to 1.5 degrees Celsius.

4. **Transparency and Reporting:** Countries are required to submit their NDCs to the UNFCCC and provide transparent and consistent information on their progress toward meeting their commitments. This includes regular reporting on emissions, implementation efforts, and the effectiveness of their actions.

5. **Support and Implementation:** Developing countries, in particular, are encouraged to outline their needs for financial support, technology transfer, and capacity-building to effectively implement their NDCs. International cooperation and support are essential for countries to achieve their climate goals.

NDCs play a pivotal role in the global response to climate change by providing a framework for countries to outline their contributions and commitments toward reducing greenhouse gas emissions and adapting to the impacts of climate change. They serve as a foundation for collective action and international cooperation in addressing one of the most significant challenges facing the world today.

United Nations Framework Convention on Climate Change (UNFCCC)

UNFCCC stands for the United Nations Framework Convention on Climate Change. It is an international treaty adopted at the Earth Summit in Rio de Janeiro in 1992 and entered into force in 1994. The primary objective of the UNFCCC is to address the issue of global climate change and its impacts on the environment, economies, and societies around the world. UNFCCC is the foundational treaty that has provided a basis for international climate negotiations since it was established, including landmark agreements such as the Kyoto Protocol (1997) and the Paris Agreement (2015).

Objective: Goal of UNFCCC is to stabilize greenhouse gas concentrations in the atmosphere at a level that prevents dangerous human-induced interference with the climate system.

Parties and Commitments: The Convention has nearly every country in the world as its "Parties." These countries have agreed to undertake various commitments and actions to mitigate climate change and adapt to its impacts. The Convention has been backed by 197 states that have committed to act on climate change and regularly report on their progress

Principles: The UNFCCC is based on principles such as the common but differentiated responsibilities (CBDR), recognizing that developed countries, historically, have contributed more to climate change and should take the lead in reducing emissions and providing support to developing countries for adaptation and mitigation efforts.

Annual Conferences (COP): The Conference of the Parties (COP) is the supreme decision-making body of the UNFCCC. It holds annual meetings where countries discuss and negotiate actions to address climate change, set targets, and review progress.

Landmark agreements:

1. **Kyoto Protocol:** The Kyoto Protocol, adopted in 1997 as an annex to the UNFCCC, established legally binding emission reduction targets for developed countries. It provided a framework for these countries to reduce their greenhouse gas emissions within specified time frames.

2. **Paris Agreement:** The Paris Agreement, adopted in 2015 under the UNFCCC, is a landmark international treaty aiming to strengthen the global response to climate change. It includes commitments by all countries to undertake efforts to limit global temperature rise to well below 2 degrees Celsius above pre-industrial levels and pursue efforts to limit it to 1.5 degrees Celsius. The agreement emphasizes nationally determined contributions, where each country sets its own climate targets and plans.

Impact of the UNFCCC: From its inception in 1992, the UNFCCC has led to the adoption of several subsequent agreements. It has spurred the development of key infrastructure and policies at the international and national levels that serve as cornerstones of today's climate action, including measuring tracking, and reporting emissions and impacts; generating knowledge and research, and building the capacity to address the causes and effects of climate change. The most recent major development in the UN climate change agenda has been the adoption of the **Paris Agreement,** produced at the 21st session of the Conference of the Parties (COP21) in 2015. And in 2021 nations adopted the **Glasgow Climate Pact,** which aims to **"turn the 2020s into a decade of climate action and support"**. The UNFCCC and its associated agreements and protocols form the foundation of global efforts to combat climate change. It provides a platform for international cooperation, policy development, and implementation of actions to mitigate greenhouse gas emissions, adapt to the impacts of climate change, and promote sustainable development worldwide.

Laudato Si & Climate Change:

The very existence of Gods creations is at stake due to the extreme environmental degradation and the simultaneous extinction of various species on the earth. The extreme climate variability's adding more to the difficulties. LAUDATO SI', mi' Signore" – "Praise be to you, my Lord". In the words of this beautiful canticle, Saint Francis of Assisi reminds us that our common home is like a sister with whom we share our life and a beautiful mother who opens her arms to embrace us. This beautiful encyclical usher us to intervene though it is too late. Pope has written in his encyclical of the urgent need to reduce GHG emissions and remove excess concentration of CO2 from the atmosphere. The scientific evidence that climate change is exacerbated by our activity is utterly compelling.

Climate change threatens all. It is a threat to the whole of the natural world, and we are just one species among thousands, but we are the only species that has the power to do something about it. Humans are part of nature, not its overlords, and caring for ourselves and for nature is inseparable in caring for our common home. Pope Francis calls global warming a major threat to life on the planet and says it is mainly caused by human activity. He argues there is an "urgent" need for policies that reduce carbon emissions, among

other ways, by "substituting for fossil fuels and developing sources of renewable energy." It highlights the depletion of clean water and the loss of biodiversity.

Prospects in intervening in Climate Change:

Civil Society Organisations have a greater role in mobilizing and organising the community in mitigation and adaption of climate change through creating awareness, linking with Governmental agencies in promoting climate adaptive farming practices and through networking with likeminded organisations. If we all go in for a little local action – changing the things we can change within our own immediate surroundings for the better – the effects can be surprising and if every local community were to do the same, they could be truly staggering. Preventing climate change really can begin at home! It is very important to build the local knowledge on different aspects of climate change and the risks associated with the changed climate. This can be done through trainings and community education process.

The **Community led approach to Integral Ecology and climate justice** would break the culture of merely being a beneficiary of a program and would centre people at the foundation of their own development. The impacts of climate change span across the global physical environment, ecosystem, and human society. The perceptible impacts are felt in terms of extreme weather events like tropical storms, high rainfall variability, wildfires, severe droughts, and heat waves, thus, adversely affecting crop production and human and biodiversity health. Anthropogenic increase in **the emission of greenhouse gases is the main perpetrator** of global warming and thus climate change. Besides the visible effects on people's livelihoods, **increasing emission is predicted to have a strong and adverse impact on human health** globally. Despite, the developing and less developed countries having low historical emission, the IPCC projections show these countries are more likely to be affected by the vagaries of climate change. This calls for building resilience and enhancing adaptation potential of these countries to climate change.

In the UN Climate Change Conference in Glasgow(COP26), the participating countries reaffirmed the Paris Agreement goals of limiting global warming to 1.5°C which requires rapid, deep, and sustained reductions in global greenhouse gas emissions, including reducing global carbon dioxide (CO2) emissions by 45 per cent by 2030 relative to the 2010 level and to net zero around mid-century as well as deep reductions in other greenhouse gases. The COP26 also stressed upon accelerated action in this critical decade, on the basis of the best available scientific knowledge and equity, reflecting common but differentiated responsibilities and respective capabilities in the light of different national circumstances and in the context of sustainable development.

Nature Based Solutions (NBS) – Soil Health, Water Use Efficiency

Nature-based solutions (NBS) refer to approaches that use natural processes and ecosystems to address environmental challenges and provide sustainable solutions. These solutions leverage the inherent capabilities of ecosystems and biodiversity to enhance resilience, mitigate the impacts of climate change, and contribute to the overall well-being of both human societies and the environment. Nature-based solutions are often considered more sustainable and cost-effective than traditional, engineering-based solutions.

Nature-based solutions are recognized for their multi functionality, as they often deliver a range of benefits beyond the specific environmental issue they aim to address. These solutions align with the principles of sustainability and resilience, acknowledging the interconnectedness of ecosystems and human well-being. They play a crucial role in achieving broader goals related to climate change mitigation, adaptation, and the conservation of biodiversity. As a principle, Nature-Based Solution is using and enhancing natural processes, biodiversity, and ecosystems.

Types of Nature-Based Solutions

- **Ecosystem-based Adaptation (EbA):** Using ecosystems to adapt to climate change - Restoring degraded ecosystems, such as forests, wetlands, and mangroves, to improve biodiversity, enhance carbon sequestration, and protect against natural disasters like floods and storms. Preserving or restoring natural features like mangroves, dunes, and coral reefs to provide coastal protection against storms and erosion. Preserving or restoring natural features like mangroves, dunes, and coral reefs

to provide coastal protection against storms and erosion. Planting trees in deforested or degraded areas to sequester carbon, prevent soil erosion, and promote biodiversity. Rehabilitating rivers and urban water bodies to improve water quality, enhance flood control, and provide recreational spaces.

- **Green Infrastructure:** Incorporating natural elements into urban planning - Incorporating natural elements, such as parks, green roofs, and urban forests, into urban planning to manage stormwater, reduce urban heat island effects, and enhance biodiversity.
- **Agroecology:** Sustainable agriculture practices that mimic natural ecosystems - Promoting agricultural practices that mimic natural ecosystems, such as agroforestry and organic farming, to enhance soil fertility, reduce the need for synthetic inputs, and promote biodiversity.

Policy barriers, funding issues, and social acceptance are the major challenges in the implementation of NbS. Technological advancements, policy changes, and emerging NBS practices will improve the awareness and understanding to facilitate better implementation of the concept. Collaboration between ecologists, urban planners, engineers, and policymakers are essential in exploring the social, technical, financial and economic to pave a sustainable pathway for NbS implementation.

Discussion points: What are the various Nature Based Solutions you are aware about?

Soil & Water Conservation Measures

Soil and water conservation measures are the important aspects in the context of the increase in soil erosion leading to topsoil loss, rainwater run off leading to less infiltration of rainwater to the subsurface strata causing groundwater depletion. Watershed management basically involves harmonizing the use of soil and water resources between upstream and downstream area within a watershed towards the objectives of natural resources conservation, increased agriculture productivity and a better standard of living for its inhabitants. Uneven climate events manifested through irregular rainfall pattern, rise in temperature, evaporation, pest and diseases leading to crop loss etc.

The regular occurrence of drought, floods, soil erosion, topsoil loss, excessive use of chemical fertilizers and pesticides are adding to the ecological imbalances. Drought is engulfing the green cover or vegetation which resulted into the bald mountain/hill and open fields. On the other hand, heavy rain and flood affect the environment. Lack of rain at appropriate time or heavy rain at the season of cultivations affect the life of people. Comprehensive soil and water conservation measures through watershed approach is the solution to solve these problems. We need a long perspective planning with sustained drought proofing measures and proper channelizing the rainwater with the active involvement and participation of the community or people. As a huge area in the country falls under arid and semi-arid climatic region, watershed management is considered the best approach to revitalize the agrarian economy through the improvements in production systems. The basic reason for conserving soil is to maintain it as a permanent, useful resource. It is not necessary to retain every soil particle in its present location, but the rate of soil loss should be limited to a value that will not destroy the productivity of the soil. This rate varies from one soil to another according to the nature of the soil and the rate at which new soil can be formed. Soil conservation is everybody's business. Every person relies on products that come from the soil for food, clothing, shelter, and other materials. An increasing population and an increasing standard of living, result in an increased demand for these products. This increasing demand needs to be translated into careful use of soil and not into exploitation. Future needs for productive soil promise to be even greater than present needs.

Water level depletion &Water conservation

Water, one of earth's greatest natural resources, plays a major role in creating the earth's climate. In its passage through the earth's systems, it transports all kinds of materials, both dissolved and suspended. Human beings use large quantities of water for most of their activities, personal, agricultural, and industrial, and in the process, induce changes, both in quality and quantity. Since only a small fraction of the total water on earth is directly usable, the impacts of human activities are significant. Yet this precious asset of mankind, is taken for granted, is depleted, is exploited, leading to its sure exhaustion of this resource in the coming years. The continuous degradation of production base and imbalance in land-water-plant- human – animal system is leading to an ecological imbalance and economic insecurity.

Water poses a paradox– we are witness to the absurdity of surplus water as well as a dearth of water at various times of the year. Drought or a scarcity of water is the flip side of floods-excessive water. Year after year we battle these two watery twins. Yet how often do we delve into the crux of the problem—i.e. the causes of drought and floods? Just doing relief work is not enough, getting to the bottom of it is necessary to prevent its recurrence. The need of the hour is CONSERVATION of this Liquid Gold, as termed by Sir Arthur Cotton in 1950. What exactly do we mean by conservation? It means the protection or preservation of the natural resources of the Earth. A good question would be –why do we need to conserve water? Water conservation is not just for drought. India receives a lot of rainfall at some times of the year yet at other times reels under the impact of drought. So it's important to remember that water conservation is not just for times of water shortage. Sound water use practices reduce the amount of stress that we place on our resources, both by limiting water withdrawals and by decreasing wastewater discharges. Water conservation is the only known way to protect the lands and to solve the water scarcity. Several methods are available to reduce the effect of extreme drought situation, and it can only succeed if there is widespread and genuine participation in the programs by the land users/community in the whole planning and implementation process.

A severe drought affects food production, deplete productive assets, exacerbate rural poverty, forced migration, contract demand for non-agricultural goods and services and lead to over-exploitation of natural resources, including land and water. Soil & water conservation is the only known way to protect the productive lands and to solve the water scarcity. In a predominantly agricultural country like India, where droughts, famines and floods cause chronic food scarcity, soil & water conservation not only increases crop yields, but also prevents further deterioration of land and water. In creating earthen structures for soil and water conservation, employment can also be created for farmers.

Community involvement in soil & water conservation

Soil & water conservation programs can only succeed if there is widespread and genuine participation in the programs by the land users in the whole planning and implementation process. The role of the extension worker must become that of a facilitator, constantly encouraging the land users to analyze their problems, seek solutions and develop self-reliance. In most cases, they will need some assistance in putting these solutions into practice, but the resulting programs must remain their programs, run and implemented by the farmers themselves to the extent possible. There is a need to impart strong awareness among the people on the importance of soil and water conservation measures. MGNREGA has been a platform in promoting water conservation efforts across rural India. Through the active involvement of the job card holders. Construction of new ponds, desilting/deepening of existing ponds, renovation of traditional water bodies, construction of check dam, land development, embankment, field bunds, field channels, plantations, contour trenches etc. are the activities being performed under this scheme.

Objectives of soil and water conservation

- To enhance and sustain productivity of available land stock for primary production systems of crop cultivation, live-stock raising and forest management.
- To generate additional employment opportunities and income through secure livelihood in rural areas.
- To maintain beneficial relationship between land and water cycles and mitigate the hazards of drought and flood.
- To retard Watershed degradation caused by deforestation, soil erosion, sedimentation, land degradation and hydrologic deterioration of the watersheds.
- To locate, reclaim and develop cultivable Wastelands, fallows other than current fallows and degraded lands to meet increasing and competing demands for additional land stock for various sectors.

By managing water flow it is possible to slow the rate at which topsoil moves out of the catchment and thus the most fertile part of the soil can be retained. Hence let the water walk instead of allowing it to run In soil and water conservation plan, top down approach is more relevant as work starts at the highest point of the piece of land. Control water there first, and then work the way down the slope, putting the design into effect. Some of the common measures of soil and water conservation are as follows:

Contour trench: Contour trench is the excavation of trenches (pits) along a uniform level across the slope of the land in upper reaches of the catchment area. Bunds may be formed in the transition and lower reaches from the soil excavated from them.

Contour trenches decrease the length of slope into smaller sections which retard the rate of runoff and soil erosion. Water collected in these trenches increase the moisture content and support the growth of vegetation. Contour trenches break the velocity of runoff and the water percolates through the soil slowly and travels down. They also protect the contour or boundary bunds in agricultural land from the runoff from the upper portion of the catchments. Contour trenches are used both on hill slopes as well as on degraded and barren waste lands for soil and moisture conservation and afforestation purposes.

Contour Bund: Contour bund is the narrow-based trapezoidal embankments (bunds) constructed on contour lines to impound runoff water behind them so that all the impounded water is absorbed gradually into soil profile and hence the surrounding areas will have better soil moisture. It is important that the bund should be ideally spaced and the spacing between bunds is commonly expressed in terms of the vertical interval (Vertical interval is the difference in elevation between two similar points on two consecutive bunds). Contour bunding is to reduce surface runoff and soil erosion considerably. The construction should start from the top of the catchment area and proceed downwards. No intermediate bund is kept unfinished or half-finished. Soil for construction of the bunds is taken from borrow pits/trenches of suitably chosen size and numbers. Spacing between contour bunds is an important determinant. As the water flows fast through a slope it attains erosive velocity.

Water Absorption Trenches (WAT): Water Absorption trenched otherwise called as staggered trenches are the conservation measure for allowing the rainwater to be collected for recharging the groundwater resources of the area. Trenches will have the dimension of 5 feet length 2 feet width and 2 feet depth. The trench of this dimension can conserve 560 litres of rainwater. More rain will conserve more water in the trenches and hence the water potential of the area will be increased through infiltration of rainwater. Water flowing in the nearby areas can also be diverted to WAT. For example: 2000 Water Absorption trenches of 5 feet length, 2 feet width and 2 feet depth will be able to 1132000 litres of rainwater. 30 times of collection of these trenches will conserve 3,39,60,000 litres of water in a year.

Gully Plugs: The main purpose of gully control measures is to reduce the amount of water runoff through gullies. They prevent formation of gullies and help to reclaim gullied lands. The streams originating and flowing through sloping grounds erode the soil and create gullies. The runoff water flowing through these gullies carry along with them the soil which is coarse grained and pebbles which are deposited in the downstream. This erosion can be arrested and controlled through the construction of gully plugs of 10 feet length, 5 feet bottom width, 2 feet top width and 4 feet height. This measure also will reduce the velocity of running water which in turn helps to reduce soil erosion. The construction of several gully plugs along the upstream side of the catchments area will tremendously reduce soil erosion. The construction of several gully plugs along the upstream side of the catchments area will tremendously reduce the soil erosion and the simultaneous dumping of soil in the ponds, reducing the storage capacity of the ponds. There are boulder gully plugs and vegetative gully plugs.

Check dam: Check dams are small barriers built across the direction of water flow on nala, shallow rivers and streams for the purpose of water harvesting. A check dam is generally constructed on small streams and long gullies formed by the erosive activity of water. There are different types of check dams. A check dam serves many purposes such as, it cuts off the runoff velocity and reduces erosive activity and the water stored improves soil moisture of the adjoining areas and allows percolation to recharge the aquifers. Check dams are constructed for the purpose of capturing the runoff rainwater and make it to percolate in the soil profile. This helps in increasing the groundwater level of the surrounding areas as the water in the check dam percolates in to the subsurface strata. It gives protective irrigation in times of moisture stress to increase the production and productivity of the crops. The water stored in various water harvesting structures can be made used for livestock and domestic needs

Construction of ponds: Pond is a small water body, usually smaller than a lake. Ponds play a major role in conserving rainwater and the recharging of groundwater. During rainy season, water collects in these ponds, a portion of which will be recharged, and the remaining will be stored for irrigation and drinking purpose. Most of the ponds are now being occupied / encroached for cropping and settlements. To store more water and to avoid floods we need to make more ponds of different sizes, or the encroached ones should be reclaimed. To reduce the effect of drought and improve soil moisture, it is important to make more ponds of different

sizes. Deepening of the existing pond will enable to store more water during rainy season and the same can be used for irrigation and a part of it will infiltrate into the earth to recharge groundwater. It will increase the area of irrigated land and production of crops.

Rooftop Rainwater Harvesting: Rainwater falling on the roofs can be collected by approximately fixing and arranging channels and pipes to take the water from the roof to storage tanks or containers. Water from the roof is channelised into a ferrocement tank constructed overground just outside the dwelling. Simple filter to be placed to remove dust and other particles. Suitable sized storage tanks can retain and provide sufficient water for a reasonably long duration till the next rainfall and can therefore, provide considerable relief to villagers. Rainwater harvesting from roof tops has several advantages. For example- the drudgery and time spent by people, especially women, in fetching water from distant sources can be eliminated or considerably reduced; It provides very high quality water, soft and low in minerals;. Rainwater being contamination – free is safe for drinking and can thus minimize health risk from water borne diseases; stored rainwater can also be used for drinking by animals, for other domestic purposes, kitchen gardens and so on.

Well Recharging: Well recharging is the technique to collect rainwater falling on the roof surface to the well through proper filtering. It helps in improving the groundwater of the surrounding areas by feeding the sub-surface aquifers. It also helps in avoiding the surface runoff and water stagnation. Hence, well rechanging is not only important in rural areas but also in urban areas, where rapid urbanization has resulted in decreased infiltration of rainwater into the soil, reducing groundwater recharging and resulting in drying up of water sources. This simple and cost-effective technique is adopted to conserve rainwater received during rainy season and to recharge the groundwater after filtering into open wells. The water received on the rooftops are collected using split pipes and downpipes. The water collected is allowed to flow into a filter unit and then this filtered water is recharged into the well.

Community Involved Practices: Need of the hour:

The community involved practices towards clean energy transition, massive afforestation of multi species, soil and water conservation measures to mitigate droughts and floods, sustainable farming practices to ensure food production needs to be activated through strong technical support of the team members of the desk. Community involvement in performing these measures will bring greater ownership from their end. If we all go in for a little local action – changing the things we can change within our own immediate surroundings for the better – the effects can be surprising and if every local community were to do the same, they could be truly staggering. Preventing climate change can begin at home! The oxygen belts of multi species plants needs to be promoted on the sides of the river (specially mangrove afforestation), on the roadside and on the embankments of the ponds and lakes in addition to the plantation in open spaces and barren land. Need to have innovations in renewable energy sources such as solar energy and wind energy. Presence of a pond for water storage and a sacred grove as a unit of local biodiversity were common in antient times. Join the carbon fast of reducing our carbon footprints. It is the high time for us to promote soil and water conservation measures like making trenches, bunds, earthen dams. Natural farming practices can also reduce the emission of nitrous oxide to the atmosphere.

Energy Efficiency & Renewable Energy

Green Initiatives: There are multiple options for making an institution/residence and location climate resilient with promoting natural lighting, waste management, water management and conservation, judicious use of resources, reduce the carbon foot print of Parishioners, eco-friendly building construction, promoting multi species tree planting, integrated organic farming etc. Forming a creation care team, also known as a green team, can be a great way to incorporate caring for creation and working against the climate crisis into the everyday work of the area. Identify environmental issues of concerns such as the climate crisis, droughts, environmental justice, or energy use. Following aspects to be promoted:

- Green audit (Water, Waste and Energy audit) to be conducted prior to the promotion of green protocol and the audit statement will be published. Preparation of the operational plan of green protocol and strictly implement it.
- Plant multispecies trees and nurture them. Trees can directly remove carbon dioxide. 1 tree of 15 years will absorb 21 Kg carbon per year and release 118 kg of oxygen.

- Grow your food and eat...to avoid transportation of food and hence reduce pollution. Eat food that is grown or made locally and less red meat. Taste the difference, feel better and support the local economy!
- Conserve, preserve, and protect water resources. Improve soil health through promoting Natural Farming/Organic Farming

Carbon Fast: Our daily actions lead to the release of greenhouse gases. The average footprint of a person living in town/cities is 10 tons while the average is only 2 tons. The global average is 4 tons. Air travel is responsible for higher emission followed by gas consumption, car travel and electricity use. Lowering the carbon footprint requires special efforts from each one of us. The carbon fast shall provide myriad ways for the us to get involved in enhancing climate justice. Join the carbon fast because we can change the world a little in 40 days. But more importantly, we could change ourself a lot. Look back over the year and see how much fuel (petrol/diesel) did we use? How much did we spend? Reflect on how we have treated the environment.' People should commit themselves to living simple, besides having simple food, less travel and sharing resources with others in need. We should plant saplings and nurture them since trees can directly remove carbon dioxide and store it as wood and foliage. "We have to build an economy that will support, not undermine, future generations. It is not only the responsibility of the governments, but also of the citizens to engage in efforts to establish climate justice

"No to Plastics" Campaign: Plastic bags made of poor-quality materials contain many harmful compounds that can easily mix with food and enter the human system. They are highly toxic and non-biodegradable. They can never be got rid of, except burning which itself releases toxic fumes named dioxane. Burning of 1 kg of plastic bags produces approximately 50 micrograms of toxic compounds called Dioxin (report of Centre for Science and Environment). Dioxins released from plastic bags in garbage dumps and landfill sites contaminate water. These lethal compounds are known to suppress the human immune system and also become toxic to our nervous system. Further, these compounds may be deposited in various organs, leading to cancers. Toxins from plastic bags leach into soil making it barren. We need to protect our environment and conserve our precious natural resources by saying goodbye to the single use plastic shopping bag and investing in a reusable shopping bag. As a single use disposable form of packaging, plastic bags are typically used for a short period of time but take hundreds of years to break down.

Solar Energy: Solar power is an effective source of energy as Sun emits enough power onto the Earth. Technological inventions in solar energy sources have increased the reliance on solar energy by decreasing costs and promise to augment this solar usage by further decreasing costs and increasing solar panel efficiency. Setting up of a solar roof top system can generate solar energy for our use. There is 40% and more subsidy for installation. India has earned the title of the fastest developing solar power industry on a global scale and for producing lower-cost solar power in the world. Various schemes have been launched to encourage the domestic use of solar power. Solar irrigation schemes are also available for the farmers groups. International Solar Alliance (ISA)is an alliance of more than 120 signatory Countries aims at promoting solar energy sources such as deployment of solar energy, reduce the cost of solar power generation, provide clean and sustainable energy access to all and cooperation among solar-rich countries. This alliance was launched at the United Nations Climate change conference in Paris in 2015 towards the concern about climate change and to switch to low carbon emission strategies. ISA headquarter is in Haryana, India. This alliance is also called International Agency for Solar Policy and Applications (IASPA). India has pledged to bring 40% of electricity generation capacity from non-fossil fuel energy sources.

Biogas promotion: Biogas is a natural produce biofuel from the decomposition (or fermentation) of organic wastes such as food scraps, animal wastes. When these organic matters break down or exposed to an environment in the absence of oxygen (anaerobic), they release a blend of gas which is mostly methane and carbon dioxide. Other gases too are released in small quantity. The process is called anaerobic digestion as the decomposition happens in the absence of oxygen. Biogas is an eco-friendly energy source as it alleviates environmental problems such as the reliance on fossil fuel. Biogas is one such alternate sources of energy which has been identified as a useful hydrocarbon with combustible qualities as that of other hydrocarbons. Though its calorific value is not high as some products of fossil oil and other energy sources, it can meet some needs of household and farms. **This will help in creating a hygienic environment and healthy surrounding for individual household as well as general public.** It contributes to climate change mitigation by saving greenhouse gas emissions from decay of organic materials and promotes the preservation of the

traditional extensive uses of the ecosystems. Anaerobic digestion is a simple technology widely used for processing the biodegradable, organic waste for the biogas production. Animal manure (cow dung) is used as inoculum, pre-treatment of substrate. During the process biomass are broken down into smaller molecules by chemicals and microorganisms. Upon completion of the anaerobic digestion process, the biomass is converted into biogas, (methane, carbon dioxide and traces of other contaminant gases), as well as liquid digestate (nutrient rich fertilizer).

Carbon Sequestration Strategies

- We should commit ourselves to live simple by having simple food, less travel and sharing resources with others in need and hence reduce your carbon foot prints.
- Plant multispecies trees and nurture them since trees can directly remove CO2. 1tree of 15 years can absorb around 21 Kg carbon/year and give 118 kg of oxygen.
- Grow your food and eat...to avoid transportation of food and hence reduce pollution
- We should conserve, preserve, and protect water, to be shared with all creations, to be protected for future generations too.
- Improve soil health & human health by practicing Natural Farming/Organic Farming
- Engage our team efforts to establish climate justice. We should come together, pray together and act together for climate justice and to solve the climate crisis.
- Conserve rainwater as every drop counts (water is a liquid gold)
- Promote renewable energy sources (solar, biogas etc.)
- Reduce the use of non-degradable resources, reuse, and recycle biodegradable resources
- Turn off lights and unplug devices when you're not using them.
- Eat food that is grown or made locally and less red meat.

Farming System Approach (Components & Connections)

The Farming System Approach (FSA) is a comprehensive and integrated method of analyzing and planning agricultural development that considers the farm as a system with various components working together. It views a farm as a complex system consisting of various interacting components, including crops, livestock, soil, water, climate, and socioeconomic factors. It recognizes that farms are complex entities influenced by a multitude of factors, including ecological, social, economic, and technological elements. The goal of the Farming System Approach is to enhance agricultural productivity, sustainability, and the well-being of farmers by addressing the interrelationships among different components of the farming system. The approach considers the interdependencies and interactions among these components and aims to optimize their integration to achieve sustainable and productive agriculture. The Farming System Approach is a strategic framework for ecosystem development that goes beyond individual components and practices. It provides a systematic way to understand, plan, and manage farming systems for the benefit of farmers, the environment, and society. By adopting the Farming System Approach, projects and policies can be designed and implemented in a way that considers the complexity and diversity of farming systems, leading to more sustainable and resilient farms.

The Farming System Approach takes a holistic view of the farm, considering all the elements and their relationships within the system. Instead of focusing on individual components in isolation, it examines the farm as a unified and interconnected entity. It involves collaboration across different disciplines, such as agronomy, horticulture, animal science, forestry, pisciculture, soil and water management, economics, and sociology. This interdisciplinary approach is essential for understanding the diverse factors influencing farming systems. It emphasizes sustainable agricultural practices by promoting resource-efficient and environmentally friendly methods. This includes attention to soil conservation, water management, biodiversity, and the long-term viability of agricultural production. It encourages the active involvement of farmers and local communities in decision-making processes. Farmers' knowledge and experiences are considered valuable, and their participation helps ensure that interventions are context-specific and culturally appropriate. Recognizing the dynamic nature of agriculture, Farming System Approach considers the need for flexibility and adaptability. It addresses the challenges posed by changing climatic conditions, market dynamics, and other

external factors. It promotes integrated farming interventions that address multiple aspects of the farming system simultaneously. This could involve combining improved crop varieties with sustainable water management, pest control strategies, and animal husbandry practices. In addition to environmental and social factors, Farming System Approach pays attention to the economic viability of farming systems. It seeks to enhance the income and livelihoods of farmers by optimizing resource use and improving overall farm productivity.

Farming System Approach involves a 'systems thinking' perspective, treating the farm rather than focusing on individual components in isolation. It recognizes the interconnectedness of different elements, such as crops, livestock, soil, water, climate, and socio-economic factors. Farms are diverse, and the FSA considers the diversity of crops, livestock, and other resources on the farm. It seeks to optimize the interactions among these components to achieve maximum efficiency and sustainability. It involves the active participation of farmers and local communities. Farmers' knowledge and experiences are valued, and they play a crucial role in decision-making processes. This farmers collective led participatory approach ensures that interventions are context-specific, culturally relevant and ensures farmers' control.

The Farming System Approach emphasizes sustainable agricultural practices that promote long-term productivity without compromising the natural resource base. This includes attention to soil health, water management, biodiversity conservation, and the use of environmentally friendly technologies. It recognizes the dynamic nature of farming systems and the need for flexibility in agricultural planning. It considers changes in climate, market conditions, and other external factors, aiming to build resilient farming systems that can adapt to evolving circumstances. Rather than focusing on a single aspect of farming, the FSA encourages integrated interventions. For example, it may involve combining improved crop varieties with efficient water management practices, pest control measures, and animal husbandry techniques to optimize overall farm productivity. In addition to environmental and social considerations, FSA places importance on the economic viability of farming systems. It aims to improve the income and livelihoods of farmers by optimizing resource use and enhancing productivity.

The focus of the farming system approach is to optimise the number of components and the connections between the components to ensure resilience, sustainability, resource efficiency, optimise production, economic benefits, environmental flow and farmers' control. The importance of components and connections in a farming system lies in the understanding that a farm is a complex and interconnected system where various elements interact with each other. Recognizing and managing these components and connections is crucial for achieving sustainable, productive, and resilient agricultural practices.

Components and connections provide a holistic view of the farming system, allowing farmers and planners to consider all aspects simultaneously. This holistic approach helps in making more informed and integrated decisions, considering the interactions between crops, livestock, soil, water, and other factors. Understanding the connections between different components allows farmers to optimize resource use. For example, integrating crop and livestock systems can lead to more efficient nutrient cycling, reducing the need for external inputs like fertilizers. A diverse and interconnected farming system is often more resilient to external changes such as climate variability, market fluctuations, or pest outbreaks. By managing the connections between various components, farmers can build systems that can adapt to and recover from disturbances. Recognizing the connections within a farming system is essential for promoting sustainable practices. Sustainable agriculture involves managing resources in a way that meets current needs without compromising the ability of future generations to meet their own needs. Understanding how components interact helps in achieving this balance. Components and connections contribute to the delivery of ecosystem services. For example, maintaining a diverse plant cover and healthy soil in an agroecosystem provides services like pollination, water purification, and carbon sequestration, benefiting both the farm and the surrounding environment.

Managing connections within a farming system helps in spreading risks. For instance, a diversified farming system with multiple crops and livestock enterprises is less vulnerable to the failure of a single component due to disease, pests, or adverse weather conditions. Optimizing connections between components can lead to increased overall productivity. For instance, integrating livestock into a cropping system through practices like agroforestry or cover cropping can enhance soil fertility and reduce the incidence of pests, ultimately improving crop yields. Understanding the connections between different components allows for the

consideration of social and economic factors. For example, integrating agro-processing enterprises into the farming system can add value to products, creating additional income opportunities for farmers.

The farming system approach helps the farmers to make informed decisions that enhance productivity, resilience, and the overall well-being of the agricultural system and the communities it supports.

Discussion points: Discuss and identify the components and connections in a farm.
Identify the interconnectedness of the components and discuss howthese connections could be improved? Can you identify any improvements in the components / connection?

Exercise:

Task : Prepare a diagram of a farm & mark the components and connections.
Identify the new components to improve resilience of the farm to climate change.

Promoting sustainable farming systems:

It is the high time to promote sustainable farming system as the soil is degraded due to the excessive use of chemical fertilisers and pesticides. These toxic chemicals find its way to the water resources polluting drinking water causing health implications. Residues of chemicals find its ways to the food we consume. In this situation, it is very important to promote safe to eat food through promoting organic farming/natural farming. Natural faming employs low-input climate resilient systems, that avoids the use of chemical agro-inputs and rather encourages farmers to use low-cost, local resources inputs for example, cow dung and urine, mulch, cover crops etc. This directly enhances, stimulates and ensures soil health management, favourable for cultivation of crops. Reports have indicated both increase and decrease in crop yields for various types of crops and reduced pest attacks. Natural farming will ensure better quality and nutritious produce, which in turns directly has health benefits.

Process in promoting Sustainable Agriculture

- Participation: Consciously promote public awareness, human resources development and promotion of people's participation and roles of people's organizations, especially women's groups, youth, indigenous people, local communities and small farmers, in sustainable agriculture and rural development
- Management of Problem Soils & Soil Conservation: Give high priority to reclamation of degraded and fallow lands as well as problem soils to optimize their productive use. Special emphasis is to be given to conserving soils and enriching their fertility.
- Watershed Management: Integrated and holistic development of rainfed areas has to be promoted by conservation of rainwater by vegetative measures on watershed basis and augmentation of biomass production through agro and farm forestry with the involvement of the watershed community.
- INM and IPM : Promote balanced and conjunctive use of bio-mass, organic and inorganic fertilizers and controlled use of agro chemicals through integrated nutrients and pest management (INM & IPM) to achieve the sustainable increases in agricultural production
- Waste Management and Recycling: Promote utilization of rural and urban garbage, farm residues and organic waste for organic matter repletion and pollution control by encouraging in-situ and ex-situ composting methods
- Promote diversification of farm production, cropping patterns and farming system
- Promote organic farming and natural farming practices including Low External Input Sustainable Agriculture (LEISA), biodynamic farming
- Promote traditional crops and traditional knowledge around food production and distribution, biodiversity conservation and NRM
- Patronize adoption of innovative agricultural and NRM practices like Organic Rice/Wheat Cultivation, backyard nutrition garden, herbal gardening

- Facilitating marketing of agri-produce, particularly those produced by small and marginal farmers, tribals, fishers etc. and assist them in going up in value chain
- Climate Change Preparedness: Convergence and integration of traditional knowledge and practice systems, information technology, geospatial technologies and biotechnology must be relied upon to monitor and evaluate climate change and recommend changes in agricultural practices
- Promote social and economic research and policies that encourage sustainable agriculture development, particularly in fragile and vulnerable ecosystems
- Respect and appreciate contributions of farmers as resource conserver and breeder and that of gender in the conservation and enhancement of bio-resources. The recognition procedures for prior informed consent (PIC) and benefit sharing must also be considered.
- Promote documentation of Traditional Knowledge through Community Biodiversity Registers with the involvement of women, who hold much of this knowledge.
- Tribal and rural women and men should get support in revitalising their in situ on-farm conservation traditions.
- Support livestock keepers' inherent rights to continue to use and develop their own breeding stock and breeding practices

Integrated and Participatory Water Resources Management

- Water resources development and management will have to be planned for a hydrological unit such as drainage basin as a whole or for a sub-basin, multi-sectorally, taking into account surface and ground water for sustainable use incorporating quantity and quality aspects as well as environmental considerations.
- Prioritize support to vulnerable ecosystems and to small and marginal water-users (farmers, fishers etc.) especially of poor, tribal communities facing water-crisis
- Promotion of conjunctive use of surface and groundwater, accord special attention to water quality and the problem of receding ground-water levels.
- Support proper on-farm participatory integrated management of water resources for enhanced water use efficiency through adoption of appropriate irrigation technology, right choice of crop and cropping pattern, in situ moisture conservation, promotion of water harvesting structures and suitable water conveyance systems
- Promote source protection, catchment treatment and integrated watershed management through extensive soil and water conservation for optimized water yield and enhanced and sustainable biomass productivity
- Support judicious and control use of groundwater resources and encourage recharge for sustenance of aquifers and their water quality
- Promote monitoring and enforcement components for water quality through involvement of local communities and other stakeholders
- Promote conservation of aquatic ecosystems, especially wetlands
- Facilitate efforts towards mitigation of effects of flood and drought

Promote Biodiversity Conservation

- Biodiversity and livelihoods: Facilitate agro, forest and wetland biodiversity conservation for livelihoods improvement of the rural poor, tribal communities, fisher-folk, graziers etc. Biodiversity in commons (CPR) are critical to poor's livelihoods, hence their sustainable use must be prioritized.
- Focus on biodiversity hotspots/ fragile ecosystems in coastal, wetland and hilly areas and integrate strategies for the conservation of biological diversity as well as the sustainable use of biological resources.
- Foster the traditional methods and the knowledge of indigenous people and their communities, emphasizing the particular role of women, relevant to the conservation of biological diversity and ensure the opportunity for the participation of those groups in the economic and commercial benefits derived from the use of such traditional methods and knowledge

- Biodiversity Conservation Areas: Support initiatives towards conservation of Natural heritage sites, including endemic "biodiversity hotspots", sacred groves and landscapes through use of National Biodiversity Act, 2002 and National Environmental Policy, 2006.
- Value of Biodiversity vis-à-vis Development Projects: In appraisal of environmental cost of projects or in their cost-benefit analysis, biodiversity resources must be assigned value at or near the upper end of the range of uncertainty.
- Promote inter-sectoral coordination and planning with other governmental institutions, non-governmental organizations and, indigenous people and their communities

Household nutrition garden:

In the context of increased incidences of health issues, we need to seriously think of eating what we know...eating what we grow and grow what we eat. Strong awareness will be generated among women on the importance of consuming locally grown organic vegetables and fruits. As part of promoting natural farming/IFF, people can be trained on the preparation of organic manures like vermicomposting, pipe composting and growth promoters like Jeevamruth, fish amino acids, Lactic Acid Bacteria etc. Integrated Pest Management Practices will also be adopted through Pest Prevention Planting Pattern and pest repellents. Nutrition garden will have at least 10 types of vegetables, medicinal plants, fruit plants in addition to Banana, Moringa and Papaya (BMP). Household nutrition garden is to ensure healthy food in the small space available in the households.

It is the high time to cultivate food that we eat to ensure its safetyto reduce our food mile. Thousands of miles some food is shipped leads to a big carbon footprint. Farmers who follow organic and sustainable cultivation practices with local resources minimize their food's environmental impact. Local food is fresher and tastes better than food that has been trucked or flown in from thousands of kilometers away. Money that stays in a local community, instead of supporting large-scale industrial agribusinesses thousands of miles away, encourages growth in that community. The land owned by each family keeps their land as active farmland of diversified crops and livestock.

Reduce the emission of Nitrous Oxide through promoting Organic Farming:

It is the high time for each one of us to seriously think on promoting organic farming in favour of cultivators as well as consumers. Continues overuse of chemical fertilizers and pesticides has damaged the soil and other resources. Its effect in the long run will be more that what we expect. The overdose of chemical fertilizers and pesticides to the crop initially increase the crop yield but deplete the soil structure and contaminate the crop, soil as well as the groundwater. Affecting our health is yet another problem due to the consumption of chemical/pesticide residues. Enhanced by the initial increased productivity from modern methods of farming, improved seed varieties and concomitant use of pesticides and chemical fertilizers, the farmers had lost their own traditional system of sustainable agriculture. Eventually, however, some of them have realised that despite their hard toil, the productivity of the land had gradually decreased while investment had increased. The forms of nitrogen provided by chemical fertilizers are readily transformed in the soil, resulting the emission of nitrous oxides into the atmosphere. The scientific findings have confirmed that these nitrous oxides are 300 times more damaging than CO_2 in contributing to greenhouse gas emissions.

Hence it is important to bring back the confidence of farmers in organic farming. This is possible by experiments of the existing practice with the integrated organic farming practices through action research of cost benefit analysis done in control plot systems. Organic system has got a great contribution to the sustainable agriculture, as it establishes an honourable relationship with nature. Awareness among farmers is important in various aspects of integrated organic farming such as the measures to improve the fertility of soil through mulching, organic manure, growth promoters, pest management through mixed cropping, intercropping, crop rotation, pest traps and applying pest repellents. Demonstrations of such practices and constant accompaniment help farmers in building their confidence as the cost of external input is reduced and net income is increased.

Carbon Farming:

Carbon farming (also called **carbon sequestration**) is a system that helps the agricultural land to store more carbon and reduce the amount of greenhouse gases emissions into the atmosphere. Carbon farming will compensate farmers for increases in soil organic carbon. Supporting farmers to restore the depleted carbon in the soil offers a promising opportunity for climate resilience. Plants

absorbs carbon from the air and use it to store energy and build their stems, leaves and roots. Plants absorbs carbon pollution and turn it in to useful things such as food, wood and soil carbon. Plants add carbon to the soil both by leaking it in gradually while they live, or all at once when they die. As a result, soils hold three times more carbon globally than the atmosphere. This is not only good for our climate, but also good for the health and productivity of our soils. Implementation of a mix of low-carbon technologies to reduce its carbon footprint and inspire other citizens of the Villages. Following are the proposed actions of Community Carbon Collectives

- Nature of Integration
- Well Recharging: Artificial recharging of rainwater
- Roof Top Rainwater Harvesting
- Root Zone Fertigation Technology: Fruit plants
- Organic Manures/Growth Promoters: Vermicomposting, Jeevamruth, FAA etc.
- Integrated Pest Management: Pest Repellents, Multi-cropping, vegetative hedges
- Promoting organic cow feeds (Azola +) in the project villages
- Bee keeping for honey, money, and pollination
- Promoting Sustainable farming systems/Organic Farming
- Household Nutrition Gardening/Integrated Family Farming
- Waste Management
- Renewable energy: Biogas promotion/Solar energy
- Crop performance study among farmers
- Green audit/green protocol

Nature of integration: Integrated Organic Farming is a system which follows nature's principles where not only the varieties of crops but also varied types of plants, animals, birds, fish and other aquatic flora and fauna are utilized for production which will solve the issues of smallholder families falling in between the modern and primitive production systems. The complete involvement of family members in the basic principles of enhancing the ecological diversity through mixed cropping, strip cropping, crop rotation, intercropping, incorporation of livestock management etc. with careful soil and water conservation and management give way for family food sufficiency, nutrition security. There will be less competition for space while following multistorey arrangements so that the area available is effectively utilized.

The simple unit of an integrated family farming system is as follows:

- Cultivation of different types of vegetables, pulses, cereals, fruit plants in the households. In corporate poultry, fishery, ducks, rabit, cows, bee keeping, mushroom in the system which will ensure the nutritional value of the family members. This will also reduce the dependency of external food. Ensuring the quality of food is also possible through cultivating our own food in our family farm. By producing grains, vegetables, fish and livestock products, the community becomes self-sufficient in regard to food and this contributes to a high degree of self-reliance.
- A small pond for storing rainwater which will be helpful in the recharging of groundwater and hence water availability for the households. Water in the pond can also be used for irrigation to the crops cultivated nearby.
- The chicken raised by the side of fish farms for the use of the family members. The poultry house, built on a wooden platform erected on the pond would fertilise fishponds directly. The droppings of the chickens fall straight into the pond can be good feed for the fish grown in the pond. This can avoid the consumption of broiler chicken (with added hormones) coming from faraway places. The droppings of chicks rich in nitrogen and phosphorus would fertilise fishponds. Construction of a poultry shed separately in the backyard is also a good plan in family farming.
- Water in the fish pond is a good source for irrigation for the crops cultivated near the pond. There is no need for any other fertilization for the crops as the water in the fish pond will have enough for the growth of plants. Fish pond silt is an excellent fertilizer for land crops and is commonly used by farmers. The leaves, stalks or other waste products are chopped or crushed and fed directly to the fish or composted to be used as fertilizer. Fish culture in combination with agriculture or livestock is a unique and lucrative venture and provides a higher farm income, makes available a cheap

source of protein for the rural population, increases productivity on small land-holdings and increases the supply of feeds for the farm livestock. Duck farming in fish pond will also add to family income.

Crop Performance Study:

To understand the present situation of farming in the context of changed climate and other aspects, it is proposed to conduct crop performance study **in 10 different locations of the project area.** Few plots of equal size, physiography will be identified for this purpose and each plot will be divided into 2 for conducting this study. In plot No. 1 farmer will cultivate what they do already and in plot No. 2 he/she will practice integrated farming with growth promoters/organic manures/pest management practices etc. and see which is better for the farmer. This will help them to get convinced on which is better for their livelihoods. This will also help to develop Package of Practices (PoP) for different agro-climatic zones of the project area and this package of Practice can be followed by farmers in verification plots. Following are the different aspects for the study:

- **Mapping** of the area and the plot.
- **Photograph** of the area/plot from same angle
- **Soil testing** before and after the action (from plot No. 1 and 2)
- **Crop Performance:** Measure the height, breadth, health of crop, gain size, grain numbers per plant, yield of each crop per plot etc.
- **Pest and Disease** Monitoring (in Plot No. 1 and 2)
- **Cost benefit Analysis:** Expenditure/returns from farming in both plots

Agroecology: A Paradigm for Sustainable Agriculture

In the realm of sustainable agricultural practices, agroecology stands out as a fundamental approach with far-reaching implications for integral ecology. This article delves into the significance of agroecology, examining its role in fostering a harmonious relationship between agriculture and the environment. The exploration encompasses key principles, benefits, and challenges associated with agroecology, all substantiated with pertinent data from reputable sources. Agroecology, as a holistic approach to agriculture, intertwines ecological principles with farming practices, emphasizing the interdependence between crops, livestock, and the environment. At its core, agroecology seeks to promote sustainable and resilient food systems while minimizing adverse environmental impacts. Agroecology emerges as a beacon of sustainable agriculture, offering a comprehensive approach to address the intricate challenges of our interconnected world. NGOs, with their commitment to environmental and social causes, can champion the cause of agroecology, fostering a paradigm shift towards integral ecology. By integrating principles of biodiversity, soil health, and water conservation, agroecology not only sustains agricultural productivity but also promotes resilience in the face of a changing climate. As we navigate the complex landscape of sustainable development, agroecology stands as a beacon of hope, showcasing a harmonious coexistence between humanity and the environment.

Principles

- **Biodiversity Enhancement:** Agroecology prioritizes the cultivation of diverse crops and the integration of various species. This approach not only enhances ecosystem resilience but also provides a buffer against pests and diseases, reducing the reliance on chemical inputs.
- **Soil Health and Fertility:** Practices such as cover cropping, crop rotation, and organic amendments contribute to improved soil structure, nutrient content, and water retention. This fosters long-term soil health, essential for sustainable agriculture.
- **Water Conservation:** Agroecology emphasizes water-efficient irrigation methods and rainwater harvesting, mitigating the impact of agriculture on water resources. This is crucial for regions facing water scarcity and climate variability.
- **Role of Agroecology in Integral Ecology:** Agroecology plays a critical role in integral ecology, which seeks the interconnected well-being of ecosystems, humans, and society. The carbon sequestration potential of agroecological practices contributes to mitigating climate change impacts. Reduced reliance on fossil fuels and incorporation of carbon-neutral practices makes agroecology a key player in climate-smart agriculture. The emphasis on diverse crops

and agroecosystem complexity creates habitats that support a variety of flora and fauna. This not only preserves biodiversity but also enhances ecosystem resilience. Agroecology fosters community engagement and local empowerment. By promoting small-scale and diversified farming, it contributes to food security, economic stability, and social cohesion.

Challenges and Opportunities

While agroecology presents a promising path, challenges persist. These include:

- **Knowledge and Training:** Farmers need access to information and training to adopt agroecological practices effectively. NGOs play a crucial role in disseminating knowledge and providing hands-on training.
- **Policy Support:** Governments and NGOs must work together to create policies that incentivize and support agroecological practices. This includes financial incentives, research funding, and the integration of agroecology into national agricultural strategies.

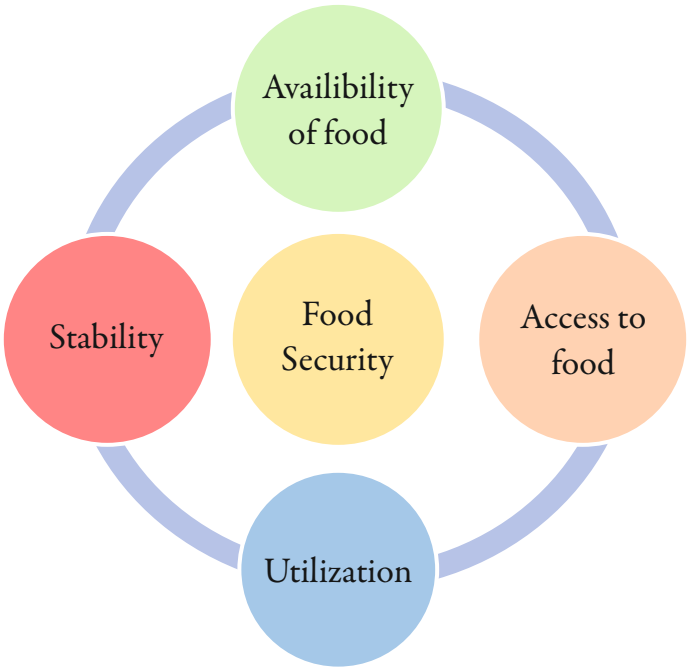
Chapter 4

Component of Integral Ecology

Food & Nutrition Security

A basic human necessity is adequate nutritious food. One of the most fundamental pre-conditions for an active, healthy, and respectable existence is that people can satisfy their nutritional requirements regularly, use and utilize adequate and safe food with the appropriate energy, protein, vitamin, and mineral content."Hunger is one of the worst violations of human dignity. In a world of plenty, ending hunger is within our grasp. Failure to reach this goal should fill every one of us with shame. The time for making promises is over. It is time to act. It is time to do what we have long promised to do - eliminate hunger from the face of earth." (Source: Kofi Anan, Secretary General of the United Nations, at the World Food Summit: five years later in June 2002 in Rome)

The United Nations General Assembly in 1966 established the International Covenant on Economic, Social and Cultural Rights, which officially recognized the right to food as a fundamental human entitlement. This right had been initially articulated in the United Nations' Universal Declaration of Human Rights in 1948 and was later reaffirmed in 1974. Food security is a concept that has evolved over time. According to a worldwide accepted definition (FAO 2000), Food security implies that "all people, at all times, should have physical, social and economic access to sufficient, safe and nutritious food which meets their dietary needs and food preferences for an active and healthy life" (FAO, 2000, reaffirmed officially in 2009).



There are four dimensions to the concept of Food Security

- Availability: It ensures that adequate food is available at peoples' disposal.
- Accessibility: Household has sufficient resources to obtain an appropriate diet.
- Utilisation: Depends on the biological and social environment and proper health care.
- Stability- Refers to food security, a population, household, or individual must always have access to adequate food. They should not risk losing access to food because of sudden shocks (e.g., an economic or climatic crisis)

(**Source:** Food And Nutritional Security In India Charting The Way To A Robust Agri-food System- Nabard Study)

Nutrition in the context of the Sustainable Development Goals:

No.	SDGs	Link to nutrition
1	**No Poverty**	Poverty limits access to adequate food intake and makes it difficult to reach nutritional recommendations
2	**Zero hunger**	Unsustainable food production causes undernourishment
3	**Good health and wellbeing**	Healthy and sustainable nutrition may reduce premature death including from non-communicable diseases
4	**Quality education**	Malnutrition affects learning abilities, while higher awareness may affect healthy and sustainable food choices
5	**Gender equality**	Empowering women to claim their rights leads to improved quality of life and nutrition; proper nutrition improves learning performance, which can be translated into better job opportunities
6	**Clean water and sanitation**	Access to safe drinking water and sanitation may reduce undernutrition
7	**Affordable and clean energy**	Creating independence from fossil fuels will reduce greenhouse gas emissions and environmental pollution, and ensure food security
8	**Decent work and economic growth**	Economic transformation may provide increased nutrition security and sustainable agriculture
9	**Industry, innovation and infrastructure**	Affordable access to technologies and infrastructure is essential for agriculture development and food security
10	**Reduced inequalities**	Inequalities cause disparities in income, food, health and education access
11	**Sustainable cities and communities**	Expansion into rural area increases food needs, creates competition for food and water resources, and finally dependence on food purchases
12	**Responsible consumption and production**	Meeting the nutritional needs of a growing population requires sustainable solutions for food production and access to water, as uncontrolled and inefficient food production causes greenhouse gas emissions and soil degradation.
13	**Climate action**	Climate change affects global food production and food security as well as access to freshwater resources
14	**Life below water**	Aquaculture reduces hunger and improves nutrition; however, overfishing limits biodiversity
15	**Life on land**	Change of land use causes soil degradation while reducing biodiversity and food production, and decreasing access to fresh water
16	**Peace and justice**	War causes malnutrition and death due to inadequate/insecure food supplies and reduced access to food
17	**Partnerships for goals**	To achieve the goals partnership between both diverse sectors and governments is needed

(**Source:** Nutrition in the context of the Sustainable Development Goals, Giuseppe Grosso, Alberto Mateo, Natalie Rangelov, Tatjana Buzeti, Christopher Birt on behalf of the Food and Nutrition Section of the European Public Health Association)

Food and nutritional security are the key to attaining the Sustainable Development Goals. Nutrition is an important factor that crosses all the SDGs, in one way or another."India has done well to expand food production and build up adequate safety stocks of food grains. For over 70 percent of rural Indian households, agriculture, including livestock, still remains the principal source of livelihood. With a six-fold increase in food grain production from 50 million tonnes in 1950-51 to nearly 300 million tonnes in 2019-20, India has become a net food exporter, being the ninth largest exporter of agricultural products in the world. The share of agriculture and allied sectors in the total Gross Value Added of the Economy have improved to 20.2 per cent in the year 2020-21 and 18.8 per cent in 2021-22. With these gains, India has transitioned from being a food-deficit nation to a self-sufficient food-producing country in the last 30 years. This has been possible through the 2013 National Food Security Act (NFSA), under which the Public Distribution reached 813 million people with subsidized monthly household rations (rice, wheat or millets)".

Challenges related to nutrition and food security involve several factors like:

1. Malnutrition in all Forms: There are forms of malnutrition, including undernutrition, micronutrient deficiencies, and overnutrition (such as obesity and diet-related diseases), which requires a multifaceted approach.
2. Limited Access to Nutritious Food: Many communities face barriers to accessing diverse and nutritious food due to factors like poverty, inadequate infrastructure, limited market availability, and high food prices.
3. Agricultural Productivity and Diversity: Enhancing agricultural productivity and promoting crop diversity is essential to ensure a consistent supply of nutrient-rich foods and combatting deficiencies.
4. Climate Change Impact: Climate change poses challenges by altering agricultural patterns, affecting crop yields, and creating food production uncertainties, thereby impacting food security and nutrition.
5. Quality of Food and Dietary Practices: Poor dietary habits, lack of knowledge about healthy eating, and the availability of processed foods high in unhealthy fats, sugars, and salt contribute to nutritional deficiencies and health problems.
6. Water and Environmental Sustainability: Ensuring sustainable water management practices and environmental conservation are crucial for maintaining agricultural productivity and safeguarding food sources.
7. Healthcare Access and Education: Access to healthcare, nutritional education, and awareness programs play a vital role in improving dietary choices, addressing malnutrition, and preventing diet-related diseases.
8. Social and Economic Factors: Socioeconomic disparities, gender inequality, and unequal access to resources can significantly impact nutritional status and food security, requiring attention to address these disparities.

Addressing these challenges demands a comprehensive and coordinated approach involving policymakers, governments, communities, healthcare providers, farmers, and various stakeholders. Strategies should focus on improving agricultural practices, promoting education on nutrition and healthy eating habits, enhancing access to diverse and nutritious foods, and addressing broader socioeconomic issues to ensure sustainable progress in nutrition and food security. Although the Government has outlined ways to enhance agricultural productivity, it remains uncertain whether these measures will deliver adequate benefits for small-scale farmers operating rain-fed plots, who form the majority in Indian agriculture. This specific group faces new challenges. Firstly, agricultural growth rates fluctuate due to increased vulnerability to climate change. Secondly, land degradation poses a significant threat to both India's food security and the environment, with extensive farmlands turning infertile due to imbalanced fertilizer use. Thirdly, unsustainable depletion of groundwater levels exacerbates the situation. As farm sizes shrink and productivity declines, many farmers are compelled to seek alternative livelihood options.

Compounding these challenges, are food safety concerns, particularly for the urban poor and migrants. Use of untreated water in food preparation, poor environmental sanitation, poor hygiene, and poor waste management. About half of the cases of child malnutrition are associated with unsafe water, inadequate sanitation, or insufficient hygiene. Improved nutritional status depends upon the improvement in sanitation and hygiene practices along with improved awareness levels in the communities.
Government interventions: The government launched several programs to double farmers' incomes by 2022. These programs aim to remove blocks for greater agricultural productivity, These include:

1. The National Food Security Mission,
2. Rashtriya Krishi Vikas Yojana (RKVY)
3. The Integrated Schemes on Oilseeds, Pulses, Palm oil and Maize (ISOPOM),
4. Pradhan Mantri Fasal Bima Yojana

In addition to that the "Mahatma Gandhi National Rural Employment Guarantee Act" and the "National Rural Livelihoods Mission" have provided support for agriculture and livelihood in rural areas. The government has also taken significant steps to combat under- and malnutrition and address the issue of food insecurity over the past two decades, such as

1. Integrated Child Development Services (ICDS) through Anganwadi systems to provide rations to pregnant and lactating mothers.
2. Through the introduction of "mid-day meals" at schools
3. Subsidised grain for those living below the poverty line through a "Public distribution system".

The primary goal of the "National Food Security Act (NFSA), 2013" is to guarantee food and nutrition security for the most vulnerable populations by implementing linked schemes and initiatives, establishing access to food as a legally entitled right.

In the continued effort the launch of the "POSHAN Abhiyan" (Nutrition Mission) in March 2018 refocused the national agenda on nutrition. "POSHAN Abhiyaan" aims to create a Jan Andolan (people's movement for nutrition) and further intensify regular mass communication on improved nutrition behaviours, especially amongst pregnant women, lactating mothers, adolescent girls and families of SAM/MAM children.

Agri-Nutri Linkage to address the issue of food security:

Agriculture and food security has a common aspect: "food." Food is a key outcome of agricultural activities, and, in turn, is a key input into good nutrition but availability of food from agriculture does not secure good nutrition. Extreme poverty and hunger are largely rural, with smallholder farmers and their families making up a very significant proportion of the poor. Therefore, eliminating poverty and hunger are closely connected to increasing food production, enhancing agricultural productivity, and raising incomes in rural areas.

Agriculture systems need to become more productive with minimum wastage. Adopting holistic and comprehensive approaches to sustainable farming methods and food systems is essential. Vital components such as land, fertile soils, water, and plant genetic resources contribute significantly to food production. Given their increasing scarcity in various regions globally, it's crucial to use and handle these resources sustainably. Enhancing productivity on current agricultural lands, which includes revitalizing depleted lands, by employing sustainable farming practices would also alleviate the need to clear forests for farming purposes.

Improved irrigation and effective storage mechanisms can contribute to sustaining dryland productivity. Reversing and stopping the deterioration of land will play a crucial role to meet the upcoming food requirements. There exist numerous aspects of traditional agricultural wisdom that, when combined with the latest scientific insights, can encourage efficient food production systems. This can be achieved through well-informed and sustainable practices in soil, land, water, nutrient, and pest management, along with the increased adoption of organic fertilizers.

As a large developing country with a growing population, which is dependent on rainfed agriculture, India is particularly vulnerable to climate change. The most significant impact of climate change will be felt through its impact on the country's already stressed water resources. Several studies indicate that climate change will cause significant changes in annual and inter-seasonal variability of the monsoon. The number of dry days and wet days has steadily increased since the 1970s. In such scenario, India needs to increase investment in research, development and demonstration of technologies to improve the sustainability of food systems in the country. Building resilience of the food systems will be critical to averting large-scale future shortages and to ensuring food security and good nutrition for all.

In India, nutrition and food security are critical issues that intersect with the role of farmers in multiple ways:

1. Nutrition Challenges: India faces various nutrition challenges, including undernutrition, micronutrient deficiencies, and diet-related health issues. Many individuals, especially in rural areas, lack access to diverse and nutrient-rich food, leading to malnutrition and stunted growth, particularly among children.

2. Food Security Concerns: Despite being one of the largest food-producing countries globally, India still grapples with food security issues. Access to nutritious food at affordable prices remains a challenge for a significant portion of the population, leading to food insecurity, especially among marginalized communities.
3. Role of Farmers: Indian farmers play a pivotal role in addressing these challenges. They are the primary producers of food and play a crucial role in determining the availability, accessibility, and affordability of nutritious food for the population.
4. Crop Diversity and Nutrition: Farmers can contribute to improving nutrition by diversifying their crops. Growing a variety of crops, including nutrient-rich foods like fruits, vegetables, pulses, and millets, can enhance the availability of diverse nutrients in the local food supply.
5. Sustainable Agricultural Practices: Adopting sustainable agricultural practices among farmers is essential. This includes practices such as organic farming, crop rotation, mixed cropping, and agroecological approaches that enhance soil fertility, preserve biodiversity, and produce nutrient-dense crops.
6. Empowering Farmers: Empowering farmers through education, training, access to resources, and technological advancements is crucial. Providing them with knowledge about improved agricultural practices, better seeds, efficient irrigation techniques, and market access can enhance their capacity to grow and market nutritious crops.
7. Government Support and Policies: The government's role is vital in ensuring food security and nutrition. Policies supporting farmers through subsidies, financial assistance, infrastructure development, and nutrition-focused programs (like Integrated Child Development Services - ICDS and the National Food Security Act) contribute to improving both food availability and accessibility.
8. Creating Market Opportunities: Creating market opportunities for farmers to sell nutritious produce at fair prices incentivizes the cultivation of nutrient-rich crops. Linking farmers directly to consumers through farmer markets, cooperatives, or farm-to-fork initiatives can ensure better returns for their efforts
9. Community Engagement and Raising Awareness: Encouraging community participation and raising awareness about the importance of consuming diverse and nutritious foods can complement farmers' efforts. This helps in fostering a demand for locally grown, nutrient-rich produce.

By recognizing the role of farmers in ensuring nutrition and food security, India can leverage agricultural practices and policies to enhance the availability and accessibility of diverse, nutrient-rich foods, thus addressing the nutritional needs of its population and promoting better health outcomes.

Good Agricultural Practices (GAP) – INM, IPM, ICM, Regenerative Agriculture, IWRM, Local Food System, Indigenous/Traditional Knowledge System

Name of treatment	Use	Ingredients	Application details (frequency etc.) cost per treatment/1 acre	remarks (experiences made etc.)
Vermi wash:	Vermiwash is a highly nutritious solution that carries the enzymes secreted by the earthworms and very rich in nutrients required by the plant. Vermiwash is sprayed on the plants as a foliar spray and provides nutrients to the soil.	Earthworms, bio degradable and water	· To prepare vermiwash, collect the half decomposed organic matter in a pot or drum. Introduce a handful of earthworms. Then they will convert the organic content into fine vermicompost. When water is allowed to enter drop-by-drop into this compost drum or pot, it washes away the enzymes and hormones	We got good results of vermiwash from the cotton crop.

Name of treatment	Use	Ingredients	Application details (frequency etc.) cost per treatment/1 acre	remarks (experiences made etc.)
			secreted by the earthworm. This wash water can be collected from the pot, by making a few holes at the bottom. · The collected Vermi wash is mixed with water in the ratio of 1:10 and sprayed on crops.	
Jeevamruth:	Jeevamruth is a growth promoter made out of cow dung, cow's urine, Jaggery/Molasses, horse gram powder or the powder of any pulses, virgin soil and water. It provides a congenial environment to micro-organisms that help in making available the essential nutrients for plant growth viz., nitrogen, phosphorus and potassium to the plants.	Ingredients required for making Jeeva Jal are cow dung (1 kg), cow urine (1 litter), Jaggery or molasses (200grams), horse gram powder (100 grams), soil from un-disturbed location (500 grams and water (10 litters). Mix all these items well in a mud pot or bucket and keep it in the shade for 5 days. Stir the mixture once a day.	Before using the same in the fields, 10 times more water has to be added. Apply the mixture when the ground is wet for the plants. It can be mixed with canal water, which directly goes to the field. It contains many microbes. This seems to work wonders for the plants due to increased microbial activity.	It only activates the soil ingredients necessary for a plant's healthy growth. This is an excellent culture for enabling the exponential increase of beneficial microbes. The microbes are added through 2-3 handful of local soil.
Fish Amino Acid (FAA):	Fish Amino Acid (FAA) is a liquid made from fish waste. FAA is of great value to both plants and micro-organisms in their growth, because it contains abundant nutrients and various amino acids. It is absorbed directly by the crops and it stimulates the activity of microorganisms.	Ingredients needed are fish (preferably blue or back coloured fish) and Jaggary. Mix it together and put it in a clay pot or plastic jar for 10 days.	After 10 days, dilute the solution at 1litre of solution with 10 litters of water and apply on the crops/soil.	We have applied for wheat crop and got satisfactory results.
Effective Microbial Solution (EM):	Effective microbial solution is a biological preparation; rich in anaerobic microbes that brings back the physio-chemical and biological properties of the soil	Materials required are Papaya (1 kg), Ripened Banana (1 kg), sweet pumpkin (1kg), Egg (1), Jaggery (1 kg) and water (3 liters). Mix all the fruits (after cutting	After 45 days, filter the prepared solution using a thin cloth. 1 litre of solution to be mixed with 10 liters of water and sprayed on the plants.	Very good growth promoters

Name of treatment	Use	Ingredients	Application details (frequency etc.) cost per treatment/1 acre	remarks (experiences made etc.)
	within a shorter duration. This helps in enhancing soil fertility, increasing the microbial population and helps the plant to strengthen the immune system. When it is applied as foliar spray, it increases the vegetative growth and yield of the crop.	them into small pieces), egg, jaggery and water in a plastic container/mud pot/cement container. Close the container airtight for 45 days to facilitate the growth of anaerobial microbes.		
Organic Urea	Organic urea is the alternative option for synthetic urea. It is very useful for all crops to get good production.	Washed sand, cow urine and plastic container. Fill-up 75% plastic container with washed sand and put daily 2.5 lit cow urine in the sand till 25 days,	after 25 days remove the all sand for drying, after drying use for all crops as a manure.	We got satisfactory results of cotton crops after applied organic urea for cotton crop.
Organic NPK	Organic NPK is the alternative option for synthetic NPKThis a pest repellent for controlling pest and insect attack on crop.	Neem cake 250 gm, Cotton cake 250 gm, Soybean or ground nut cake 250 gm, cow urine 5 lit. Ash 50 gm, born powder or Eggs shell.	Mix all the ingredient with cow urine, after 25 days it will be ready for apply. 1 litre of solution to be mixed with 25 litters of water and sprayed on the plants.	All CESSS farmers are using in the last 9 years for good yield.
Dashparni liquid	This a pest repellent for controlling high pest and insect attack on crops.	Ten types of leaves (Bitter test), cow urine and plastic container	Crush the all ten types of leaves and put in the container, put 5 lit cow urines and keep for 15 days in the shadow. After 15 days, dilute the solution at 1litre of solution with 14 liters of water and apply on the crops.	Reduced insect and pest attack on crops
LAMIT (Garlic, Chilly and Tobacco leaves		Garlik 250 gm, green Chilly 250 gm and Tobacco leaves 250 gm. Cow urine and water	Crush and boiled Tobaco leaves in the 5 lit. water, crush the chilly and garlic and put in the water for one day, after one day mix all the three ingredients in the cow urine and dilute the 1 lit solution in 15 lit. water and apply on the crop.	Getting satisfactory results, all our partners is promoting the pest repellent on crop and getting satisfactory results.

Nutrition Garden

As the global population is projected to exceed 9 billion by 2050, to meet the demands producing more food and storing extra supplies remains critical. Given this situation, nations worldwide, particularly countries like India where nutrition and food security are a concern, are employing various approaches to meet rising demands and prevent food insecurity. Recently, there has been a growing emphasis on fortifying and amplifying local food production to alleviate the impact of global food crises and fluctuations in food prices. As a result, there's considerable attention directed toward "Nutrition Gardens" at the household level or at facilities like Schools, AWCs, etc, to improve both food security and nutrition. These nutrition gardens are becoming an integral component of local food systems and the agricultural framework in many developing nations to address the demands and nutrition issues at the local level.

The government of India has launched programs to ensure food security and access to quality food, and addressing issues like malnutrition, anaemia demands multiple strategies. Community and nutrition gardens emerge as crucial players in supporting the nation's food security and diversifying diets to combat the widespread problem of malnutrition. Fruits and vegetables from the Nutrition gardens are good sources of micronutrients especially in poor households. Rural areas have space and involving farming communities to establish a kitchen garden is the best strategy as they are already involved in agricultural activities. Creating and maintaining a nutrition garden is a valuable strategy to address the issues of nutrition and food security. Here's how nutrition gardens can contribute to improving nutrition and food availability:

1. **Diverse Crop Cultivation:** Nutrition gardens focus on growing a variety of fruits, vegetables, herbs, and plants that are rich in essential nutrients. This diversity helps ensure a balanced diet and access to a wide range of vitamins, minerals, and antioxidants.
2. **Local Food Production:** Nutrition gardens are usually small-scale gardens cultivated near homes, schools, or community centers. They promote local food production, reducing reliance on external food sources and ensuring access to fresh, nutritious produce.
3. **Improved Dietary Diversity:** Incorporating a range of crops in a nutrition garden enhances dietary diversity. This is crucial in combating malnutrition and deficiencies by providing a broader spectrum of nutrients to individuals and communities.
4. **Accessibility and Affordability:** Nutrition gardens increase access to fresh, nutrient-rich food, particularly for households with limited resources. They offer a cost-effective way to access nutritious produce and can reduce the financial burden of purchasing expensive fruits and vegetables.
5. **Educational Opportunities:** Nutrition gardens serve as practical learning spaces. They provide opportunities for education on agriculture, nutrition, and healthy eating habits, especially for children, fostering a deeper understanding of food production and its nutritional value.
6. **Community Engagement:** Nutrition gardens often involve community participation, encouraging collaboration and shared responsibility for food production and consumption. This strengthens community ties and empowers individuals to take an active role in improving their own nutrition.
7. **Environmental Sustainability:** These gardens often employ sustainable agricultural practices, such as organic farming, composting, and water conservation, contributing to environmental sustainability by reducing chemical use and promoting biodiversity.
8. **Supplemental Nutrition Programs:** Nutrition gardens can complement existing food programs, such as school feeding programs or community nutrition initiatives, by providing a local and sustainable source of nutritious food.
9. **Supporting Vulnerable Populations:** Nutrition gardens can specifically target vulnerable populations, including women, children, and the elderly, who may be more susceptible to malnutrition. Tailoring the garden's produce to meet the nutritional needs of these groups can have significant health benefits.

Nutrition gardens offer a small-scale and cost-effective method to guarantee wholesome food and well-rounded nutrition. these are successful and enduring approaches to enhancing nutritional levels among low-income rural households by integrating food

production within homes. Micro-gardening stands out as a creative answer to ensuring food security, providing job opportunities for young people, and offering an additional source of income in developing nations. Establishing and maintaining nutrition gardens requires community involvement, knowledge sharing, and ongoing support. When implemented effectively, these gardens can play a vital role in improving nutrition, promoting food security, and enhancing overall well-being within communities.

Method of promoting nutrition gardening in a small area:

Demarcate a rectangular plot of 4 ft width and 8 ft Length. Remove 4-inch soil and put it on both the side. Divide this plot into 4 small plots of 2 ft length. Take out soil from the first plot (0.5 ft) and put it outside and fill dry leaves in the first plot. Take out soil from the second plot and put it in the first plot. Then fill in dry leaves in the second plot. Take out soil from the third plot and put it on the second plot. Then fill dry leaves in the third plot. Take out soil from the fourth plot and put it on the third plot. Then fill dry leaves in the fourth plot and fill the soil which is taken from plot 1. The 4 inches topsoil to be mixed with 50-kilogram dry cow dung, 2-kilogram charcoal, 1 Kg neem cake powder, 1 Kg Pseudomonas, 1 liter Lactic Acid Bacteria (LAB) 1 litre Fermented Fruit Juice (FFJ), and 1 litre Fish Amino Acids (FAA). Many of such models can be developed to ensure household food and nutrition security.

Chapter 5

Different Methods to Restore Integral Ecology

Growth promoters and Organic manures for organic farming and soil health management

Starter Solution

Starter solution is an organic solution, which helps the soil to get back its biological properties faster. It is a microbial solution which converts the dead soil into a living one and thus gradually enriches the soil fertility and makes it as a permanent living medium. This solution also helps in the germination of seeds. Materials requires in making starter solution includes 20-kilogram cow dung 20 litres of cow's urine, 4 kilogram Jaggery, 100 gram turmeric powder and 20 litres of water. Mix all the materials mentioned above in a plastic container/mud pot/cement container. Then cover the mouth with a cotton cloth and keep it for 24 hours. The prepared solution can be stored up to 3 to 4 days with regular stirring in the morning and evening. Filter the solution and add 10 litres of water in 1 litre solution and use. Seeds o be dipped in this solution for 1 hours for better germination. Soil application along with irrigation water will enrich microbial population. Foliar application of this solution will increase the yield and seeds can be kept in the diluted solution for 10 minutes before sowing. This helps for better germination. Metal container is to be strictly avoided as it may react with the solution.

Lactic Acid Bacteria (LAB)

To make LAB, the materials needed are rice washed water, milk and a glass container. Wash the rice grains (organic) and collect the first rinses of cloudy water and fill in a glass bottle. Cover the mouth of the jar with a plain paper and keep it in shade for 3 days. After 3 days, the fermentation takes place and there will be a mat of semi-solid material floating on the top of the plain liquid in the jar. Collect only the plain liquid and add 1.5 litres of fresh milk to it and keep it in shade for another 3 days. After 3 days, a semi-solid white layer will form on the top portion and a yellow colored liquid. The yellow colored liquid is the LAB.

Oriental Herbal Nutrients

The ingredients require for making OHN are 500-gramGinger, 500-gram Jaggery and 1 glass Jar. Chop the ginger into small pieces or crush it well and add jaggery to it. Bottle the mix in the glass jar, cover it with a white paper and keep it for 5 days to ferment.

Fermented Fruit Juice (FFJ)

Making ofFFJ requires 500-gramYellow colored Fruits, 500-gram Jaggery and 1 glass Container. These ingredients need to be mixed well and kept in a container for five days with its mouth covered with a cloth or plain paper. The fruits like organic banana, papaya, mango etc. can be used for making FFJ

Fish Amino Acids (FAA)

FAA to be made with 500 grams of blue or black colored fish, 500 grams of Jaggery, 10-gram charcoal powder and 1 glass Jar. Cut the colored fish into very small pieces and add powdered jaggery and charcoal powder to the chopped fish. Transfer the mix into an airtight glass jar and cover it well. Keep the jar in shade or a cool place for 7 days.

Indigenous Micro Organisms such as IMO 1, IMO 2 and IMO 3

For making IMO 1, put the cooked rice it in a wooden box. Cover the mouth of the wooden box with a plain paper and tie it properly to avoid water or small insects from getting into the box. Dig a small pit under a tree wherever a thick mat of leaves is formed. Bury the three-fourth of the covered wooden box in the pit and leave it on the ground for three days. IMO-1 will be ready in 3 days. IMO 2 requires 1 Kilogram of IMO 1 to be transferred to a glass container. Add 1 kilogram of Jaggery and cover the jar

with a plain paper or cloth. Fasten the cover with a rubber band and keep it under the shade, in a cool place for 6 hours. IMO 3 can be made with 2 Kg of IMO2, 10-kilogram rice bran, 1 Litre OHN, 1 lite LAB and 4 litres of water. Mix well the ingredients and keep it at a height of 30 to 40 cm. After 7 days, there will be fungus being formed which is the IMO 3.

Boron in soil for normal growth of plants

Boron is an essential micronutrient element required for the normal growth of plants. Boron deficiency is of great concern in areas receiving heavy rainfall because of leaching losses. Compared with other micronutrients, the chemistry of Boron in soils is very simple. The primary role of Boron is its involvement in the stabilization of the primary cell walls in plant cells. Adequate Boron nutrition is critical for high yields and quality of crops. Deficiencies of Boron result in many anatomical, biochemical and physiological changes in plants. Boron is also involved in the carbohydrate metabolism in plants, protein synthesis, seed and cell wall formation, germination of pollen grains and growth of pollen tubes and sugar translocation. Presence of Calotropis plants indicates the presence of Boron in the soil. Including Calotropis leaves while making vermicomposting or any other compost adds more Boron to the soil. Spraying of the extract of Calotropis also helps in supplementing Boron.

Vermicomposting for improving soil fertility

Vermicomposting is the method of processing the organic wastes into better plant food by using earthworms. Vermicompost converts the degraded soil into the natural form and accelerates the healthy growth of plants by giving the required micronutrients. Vermicomposting uses earthworms for the decomposition of organic wastes. They churn out the soil and increase the water holding capacity and permeability of the soil. Hence the recharging of groundwater can be improved. The disposal of wastes for the preparation of this manure adds to cleanliness and purity of the environment. Earthworms can consume practically all kinds of organic matter and they can eat their own body weight per day; for example, one kilogram of worms can consume one kilogram of residues every day. The excreta or "castings" of the worms are rich in nitrate, available forms of phosphorus, potassium, calcium and magnesium. The passage of soil through earthworms promotes bacterial and actinomycetes growth; actinomycetes thrive well in the presence of earthworms and their content in earthworm casts is over six times more than in the original soil. The materials needed for preparing vermicompost are organic wastes, cow dung, earthworms and saw dust.

The vermibed made using stone bricks should be filled with saw dust to about 1 centimetre, 30 earth worms per square feet area of the vermibed, 60% of organic wastes mixed with 40% of cow dung to a height of 2 feet and then it should be covered with jute cloth. The vermibed (4 feet breadth and length of any size) should be watered well to maintain moisture throughout. A shed over the vermibed is needed to protect it from sunlight and rain. The compost will be ready in 50 days time. Vermi-compost should be applied on the field once the land levelling and first ploughing is done. Minimum 500 kgs of vermicompost per acre is to be added in the initial stage of organic paddy cultivation. The quantity can be reduced in the next year. Adding vermicompost to the seed bed is also beneficial.

Growth promoter: Panchagavya

Panchagavya is a growth promoter made from five products of the cow -- its dung, urine, milk, ghee and curd. Panchagavya is also a method used to safeguard plants and soil micro-organisms and to increase plant production. Panchagavya is considered to be highly effective liquid organic manure. It has multiple functions and can effectively replace chemical fertilizers and pesticides. It is very nutritious bio-promoter that can be used in farming. "Pancha" means five and "gavya"means– product of cow; five elements derived from a cow such as dung, urine, milk, ghee and curds. The proportion of each of the ingredients for 2.5 acres farm is 5kilogram cow dung, 4 litres of cow urine, 3 litres of fresh milk, 2 litres of curd and 1 litre ghee. For preparing Panchagavya, an earthen pot/plastic drum of 20 litres is required. Mix both cow dung and ghee and cover it with a lid. This should be kept for 10 days, stirring the same every day. On the 11th day, add urine, milk and curd, mix well and leave for 12 days. On 23rd day, it is ready for spraying – mix 3 litres of "Panchagavya" with 100 litres of water and spray it. Since ghee does not dissolve easily, power sprayer is the best option for spraying. One can also add 5 to 10 bananas fruit and 1 litre coconut water and about half a kg of black jaggery or honey to this solution. This can be kept for 2 to 3 months. It can be sprayed 2 to 3 times for a crop of 3 months duration. For plantation and coconuts, it can be sprayed 4 to 5 times.

Growth promoter: Jeevamruth

Jeevamruth is a growth promoter made out of cow dung, cow's urine, Jaggery/Molasses, horse gram powder or the powder of any pulses, virgin soil and water. Jeevamruth encourages microbial activity in the soil. 'Jeeva Jal' is to be provided once in a fortnight or at least once in a month. It promotes immense biological activity in the soil and makes the nutrients available to the crop. Jeeva jal is not to be considered as nutrient for the crop but only a catalytic agent to promote biological activity in the soil. Ingredients required (1 acres) for making Jeevajal are 5 kg cow dung, 5 litres of cow urine, 1 kg Jaggery, 1 kilogram horse gram powder or poweder of any pulse, 5 kilogram soil from un-disturbed location and 50 litres of water. Mix all these items well in a mud pot or bucket and keep it in the shade for 5 days. Stir the mixture once a day. Before using it in the fields, 10 times more water has to be added. Mulching done before the application of growth promoters will have better result.

Pest and Disease Management

Pests and diseases that attack crops cause 20-90 percent loss in yield, when conditions are favourable. Excessive use of synthetic insecticides over the past several decades has resulted in development of resistance in insect pests to commonly used insecticides, resurgence of minor pests to major pests and thereby posing a serious problem in their management. Therefore, the need for adopting Integrated Pest Management (IPM) is gaining importance.

Tonal tonic as pest repellent

Tonal tonic is one of the effective ways of managing pests. The name tone is given due to the fact that pests will disappear in making sound (songs) while spaying this pest repellent. For making tonal tonic, different types of leaves are needed. A handful of each type of leaves should be smashed properly to make a pulp. Take a mud or plastic pot and put the pulp of leaves into it and pour cow's urine into the pot till the mixture is covered fully. Keep the mixture for 10 days. Spray the solution by mixing 1 litre with 10 litres of water. The smell misleads the mother insect and it moves away from the plants. A fist full of ginger, garlic, wild chillies and a pinch of asephoitida could be added to every litre of the same solution and sprayed over the plants to give more powerful results.

Light Trap for pest control

Light traps can be used to monitor and trap the adult moths, thereby reducing the population. Some common light traps that could be used are hurricane lamps, traps with electrical bulbs etc. The adult moths have an inherent capacity to get attracted to the light. Lights are hung at a certain height above the crop. A large plate or vessel filled with kerosene mixed with water is kept near the light trap. Insects are attracted towards the light and fall into the vessel and die. Lights should be set up in the field after 5.30 p.m.

To control Stem Borer

The stem borer larvae bore at the base of the plants during the vegetative to flowering stage. On older plants, they bore through the base stem part and feed on internal soft part of stem. Late infestation causes whiteheads. To control stem borer, select improved rice varieties with greater resistance, destroy egg masses seen in nursery by handpicking, transplant rice widely apart with less number of plants per location, and provide extensive irrigation at least for 3 days at 7 cms of water. Promote control of pests by predators such as Spiders, Dragonflies, Wasps, Lady Bird Beetles, and even some birds that are natural enemies of the stem borer.

Leaf folder: Rice leaf folder is very common and can be found in all stages of rice growth. The damage is seen as it affects more than half of the flag leaf and the next two youngest leaves in each tiller. Farmers used to scrub away insect larvae from rice leaf with the help of a thorny branch. Once the larvae falls to the ground, ponding of water is done in the rice field (for about 2 days) and this drowns the insects. Organic spray (a fermented mixture of Neem with water and cow's urine) is sprayed to kill larvae and to keep away adult insects. There are many predators of Leaf Folder in Rice Field including Crickets, Spiders, Ground Beetles, Ladybird Beetles, Wasps and Ants.

Rice bug: The rice bug is an insect pest during the milky stage of the rice plant. Both the nymphs and adults prefer the endosperm of the rice grain resulting in production of smaller grains. They also feed during the soft or dough stages and can cause grain discolouration. Use dirty (smelly) trap to attract adult rice bugs away from the field. Pick and throw away eggs of the insect (present on leaf of the rice plant). The natural enemy of insect is the Tiger Beetle, Spider, Dragonfly, etc. Wasps prey on eggs.

Organic System of Rice Intensification (OSRI)

Organic System of Rice Intensification (OSRI) is an easy method to learn and practice. OSRI helped in reducing input costs and improving fertility and productivity of land. Selecting high quality seeds has critical importance because germination, growth rate and grain quality depend on the quality of the seeds. Seeds are collected very selectively and store in a jute bag for three days. Small quantity of water is sprinkled at regular intervals for maintaining a constant moisture level that is required for germination. On the fourth day when seeds start germinating, they are transferred from the jute bag to the seed bed. Seed bed is prepared on a plastic sheet with an inch-thick mixture consisting equal quantities of soil, sand and dry cow dung. After the seeds are spread on to the seed bed, another thin layer of the mixture is spread over the seeds so that they remain covered and protected. In the meantime, the field is ploughed and levelled for transplantation. Normally, the seeds are transplanted 8-12 days after they were laid on the seed bed. Weeding needs to be done after ten days of transplantation and is repeated twice more in the intervals of ten days.

No chemical inputs are administered on these plants at any point of plant growth. Instead organic manure and growth promoters are administered at regular intervals to increase the soil health and nutrient availability for the plants. Once the plants start flowering, pest repellent solution constituted of garlic, green chili, tobacco leaves and seeds of neem is administered every fifth day. OSRI requires 40% less water by maintaining non-flooded aerobic soil conditions with intermittent irrigation. Such irrigation pattern is found to be beneficial for root growth of paddy plants. Minimum moisture is maintained by alternate wetting and drying during the growth period while in the flowering season the fields require only 1-2 cms of water level.

Although the yield from organic paddy cultivation is often not as large as compared with the intensive, chemically treated mode of cultivation, the lower cost or production with reduced costs of treatments can make organic paddy cultivation as profitable, and sometimes even more profitable. Systematic process of cultivation by adopting proper seed selection and use of good seeds, manure application, use of growth promoters in regular intervals, adoption of water and pest management practices will help farmers to spend less on cultivation and to gain more profit. Systematic process of research and documentation needs to be done by selecting plots of same size in control plot system for experimentation. Organic rice cultivation is found to be effective. It is important that farmers are made aware of the significance and relevance of promoting organic rice cultivation.

PoP of Transplanted Rice Cultivation

No	Method	Process (for 1 acre)
1	**Land preparation**	This involves ploughing/ land leveling, and application of neem cake (10 Kg), pseudomonas (5 Kg), Farmyard Manure/leaves (4000 Kg), Cow dung (1000 kg) EM solution (10 litres), Jeevamruth (200 litres), while preparing the land.
2	**Seed selection**	In order to select the best seeds, take a fresh egg and add it to the vessel containing plain water. Salt or salt solution to be added to the water till the egg comes up. Remove the egg and put the paddy seeds into the salt solution. Select the seed that settles down and discard the floating seeds. The selected seeds should be rinsed well in fresh water and soak in starter solution for one hour for better germination. Starter solution to be made with Cow dung (1 Kg), Cow's urine (1 litres), Jaggery (200 gram), Turmeric powder (200 Gram) and water (5 litres). Mix all these well in a plastic container, cover the mouth with a cotton cloth and keep it for 24 hours. Add 10 litres of water and seeds can be kept for 30 minutes before keeping it for sprouting. Seeds required per acre is 10kg.
3	**Bed Preparation**	Bed will be made on the side of the field. Single bed or several small beds (say, 4 beds measuring 4x40 feet each) will be prepared. To prepare the bed, spread a polythene sheet on the bottom followed by the filling of Farmyard Manure/vermicompost and soil alternately in 4 layers. The bed on all sides will be made secure with wooden reapers/ planks. Channels will be provided on all sides to drain excess water.

No	Method	Process (for 1 acre)
4	**Transplantation**	Once the seedlings are grown in a healthy situation the transplantation to be done in 12 or 15th day when the seedlings are still having the seeds in it. 2 seedlings to be planted per hill carefully in 5 Cm width and 25 Cm length.
5	**Irrigation**	Wetting and drying will be practiced in this method
6	**Mary Gold**	Plant Mary gold on the bund (1-meter distance)
7	**Weeding**	Weeding should start about 15 days after planting and 3 times weeding will be done (15th, 30th, 45th)
8	**Harithakashayam**	Harithakashayam made of different types of leaves, Jaggery, Pulses powder, and Cow dung will be applied (20th,45th,60th)
9	**Jeevamruth**	Jeevamruth made of Cow dung, Cow urine, Jaggery, Horse gram powder, soil from un-disturbed location will be applied on the 15th day and 45th day.
10	**Beauveria Bassiana**	5 Kg of Beauveria Bassiana to be diluted in 50 litres of water and apply 20th day, 40th days, 60th day, 75th day.
11	**Trico Card**	5 Trico cards to be placed in the rice field on 20th day
12	**Fish Amino Acids**	Fish Amino Acids made of Fish and Jaggery will be applied on 30th day and 60th day
13	**Yellow Card/ Bird Percher**	Yellow card and bird percher will be used for controlling pest.

Bee keeping for honey, money and pollination

Bee keeping is an ancient, age old tradition and practice in India to collect honey, a natural product known for its therapeutic, health, cosmetic benefits and values. Its popular demand at the national and international level renders it as a sustainable livelihood. Bees not only produce honey but also provide several other hive products including bee wax, royal jelly, propolis, apitoxin etc. In addition to increase dividends, bee farming contributes to increase in crop yields through pollination. Bee pollination is vital for life on earth in terms of bio-diversity conservation.Bee farming also provides an array of employment opportunities for those who may be facing challenges with agriculture farming and/or those who intend to earn a living through farming. Advantages of Bee farming include but are not limited to provide food and cash income, providing opportunities for small, medium farmers, a spare time, part time, and full time occupation, requiring little investment and infrastructure, diversifying the economic base and providing effective linkages to other farming system with positive ecological consequences.

Waste Management

The disposal of solid waste is a problem, and it will continue with the growing population. The dumping of waste in open places, huge garbage lying down uncollected beside the roads, streets dustbins and on the ground and improper handling and management of Waste from households are causing adverse effect on the public health at large and is causing threat to the environment. To get rid of the problems with wastes, many possibilities have been experimented in many places. Home-based garbage processing is possible within the compound. It has multiple advantages such as keeping the surroundings clean by removing wastes on time, making composts from the domestic wastes, and promoting nutrition gardening in the backyard with the compost that is made, make some income from selling compost.

The primary focus is to bring back the reusable culture from use and throw culture. The scientific management of waste lead to reduction in the pollution level of wastes. Efforts to be made in promoting eco-friendly and reusable products such as cloth bags, plates, tumblers and other utensils made of eco-friendly materials thereby reduce the quantum of solid waste generation. With the implementation and practice of green protocol, the use of non-biodegradable articles such as disposable Plastic, Paper and Thermocol plates and cups to be replaced with biodegradable and eco-friendly materials in all the offices and institutions, official and unofficial functions and celebrations.

Challenges:-

Waste management presents significant challenges that intersect with the larger goal of restoring integral ecology, which entails considering the interconnectedness of our world's environmental, social, economic, and cultural components. Some issues in waste management that affect integral ecology include:

Environmental Impact: Improper waste disposal pollutes the land, water, and air. Waste dumped in landfills or oceans can have a negative impact on ecosystems, soil quality, and water sources, affecting biodiversity and ecological balance.

Inadequate waste management leads to inefficient use of resources. Recycling and proper waste treatment are critical in recovering valuable materials and reducing the need for raw material extraction, thereby conserving natural resources.

Climate Change: Improper waste disposal, particularly the decay of organic waste in landfills, produces methane, a potent Greenhouse gas. Composting and anaerobic digestion are examples of effective waste management practices that can help to reduce emissions.

Public health risk: Poor waste management can pose public health risks, such as disease transmission through contaminated water or air. Waste-related health risks are reduced through proper disposal, treatment, and recycling.

Social Equity: Environmental injustice frequently causes social and economic challenges for communities living near waste disposal facilities. Effective waste management should consider equitable distribution of waste disposal facilities, as well as the participation of affected communities in decision-making processes.

Technological and infrastructural gaps: Developing countries frequently lack the necessary infrastructure and technology for efficient waste management. Investment in infrastructure, education, and technology transfer is critical for these areas.

Consumer Behavior: Promoting Responsible Consumption and a Circular Economy Waste management relies heavily on practices such as reduction, reuse, and recycling. Educating the public about proper waste disposal and recycling is essential for changing consumer behaviour.

To restore integral ecology, it is critical to take a comprehensive approach that includes not only waste disposal but also resource conservation, pollution prevention, community engagement, and policy development. Collaboration among governments, businesses, communities, and individuals is critical to addressing these challenges and implementing sustainable waste management practices that restore environmental balance and promote the well-being of all life forms in our ecosystems.

Pollution Free Poultry Farm (PFPF)
Natural...Economical...Healthy

Pollution Free Poultry Farm (PFPF) is a natural farming method of rearing chicken in an organic system. One of the distinct advantages of this innovative system is that it does away with the pesky smell that normally surrounds poultry farms. The floor of the shed is filled with soil, rice husk, rice bran, anthill soil, charcoal, Oriental Herbal Nutrients (OHN), Fish Amino Acids (FAA), Fermented Fruit Juice (FFJ), Indigenous Micro Organisms (IMO) and Lactic Acid Bacteria (LAB). The organic floor

composition ensures that birds get part of their feed from the floor itself. The composite floor bed is designed to absorb bird droppings and thus stop formation of foul smell on the floor. The organic floor bed eventually becomes very good manure. This method on one hand, ensures healthy growth of birds and on the other, provides quality compost from the bed. With this method, landless and smallholders can earn incomes from poultry activities and compost sale.

The floor of chicken housing should be soil as birds more comfortable living on soil. They do great with very little soil. Temperature should not be artificially controlled. Heat from fermenting compost will help even for small chicks. Feed for hatchlings should consist of whole brown rice grains and bamboo leaves to strengthen the intestines. Chicken shed needs to be designed in such a way that there is no bad smell, no emission, no cleaning needed, and no disease. The shed is constructed to suit their habits, instincts, and behaviours. It is important to enrich the population of microorganisms on the floor in order to break down chicken feces. This contributes to the absence of smell in the chicken house. The feces do not need to be removed unless needed for compost. The chickens feed on the fermented products of their feces, so taking out all the feces may affect the chickens negatively. The floor serves as feed producer, fertilizer factory, and waste treatment plant all in one.

In PFPF, birds are kept in houses which have sufficient spaces and natural heating, fresh water, and natural feeds. The unique design does not require frequent cleaning and wastewater disposal as conventional poultry unites require. Apart from these advantages, PFPF units require no treatment with chemicals and with minimal labour, can increase profitability of poultry activities. For the poor households, PFPF can be very useful in terms of supply of chicken and manure for crops. The agricultural byproducts can be used as chicken feed in order to have inter-dependency in humans, animals and crops. A family working together to take care of chickens and perform other tasks will form a close relationship between humans, animals and crops. This can also be an occupational therapy for family members. The compost generated from the shed will help enriching land, put healthier food on the platter and boost the local economy.

Chicken housing should have a soil bed as the first layer as birds normally prefer soil surfaces. Soil bed, which has great temperature control properties, will ensure that no artificial temperature control will be needed. Fermentation of compost which will occur on the floor will help in the development of chicks. Feed for the hatchlings should consist of whole brown rice grains and bamboo leaves to strengthen the intestines of birds. Chicken shed needs to be designed in such a way that there is sufficient ventilation and ease in cleaning so that the birds do not get any infection. Sheds are constructed to suit their habits of birds. Galvanized zinc sheets need to be used for roofing, steel wire mesh for partition walls/curtains and the soil-based floor must be carpeted with 3-7 cm thick shredded rice straw. Fermented plant juice (FPJ), LAB and Indigenous Micro Organism (IMO) are added to the mixture for soil floor, enzymes from straw carpet and bird droppings. Water needs to be sprayed 1-2 times a week. Home-made chicken feed to be given once daily. The newly-hatched chicks are fed whole brown rice grains along with bamboo leaves. The feed should be prepared in such a way that rice husk and fresh green grass constitute 1/3 of the total feed for adult chickens. This type of feed toughens the intestines of the birds and makes them healthier.

Microorganisms to reduce the smell in the bed: It is important to intensify microorganisms on the floor for ensuring that the bird droppings are broken down quickly. The primary reason for the smell is droppings of birds. When the droppings are composted quickly, the smell in the chicken house also reduces. The droppings need not be removed unless for the purpose of making compost. The chicken feed on the fermented products off their droppings, so taking out all droppings may affect birds negatively as it will lead to feed shortage. The floor of the shed for birds serves as feed producer, fertilizer factory and waste treatment plant, all rolled into one. Drinking water needs to be supplied to the birds with perforated pipes. The perforations have to be made in such a way that the holes are slightly tilted back from the position of birds. It is necessary to ensure constant supply of fresh water in the shed.
Different ingredients required for a 450-square feet bed are as follows:

Red soil	:	4500 Kg (10 Kg per square feet)
Chicks	:	100 numbers
Rice husk	:	90 Kilogram (200 gram per square feet)
Charcoal	:	4.5 Kilogram (10 gram per square feet)

Anthill soil	:	90 Kilogram (200 gram per square feet)
Rice bran	:	45 Kilogram (100 gram per square feet)
Paddy straw	:	45 Kilogram (100 gram per square feet)
Milk	:	500 millilitres
Rice washed water	:	1.5 litres
Fruits	:	500 gram
Jaggery	:	1.5 Kilogram
Ginger	:	500 gram
Fish	:	500 gram
Half cooked rice	:	1 Kilogram

This method works on Indigenous Micro-organisms (IMO) which has been successfully tried by agriculturists, academic researchers, non-profit organizations and farmers alike. IMO has been found very useful in removing bad odour from animal wastes, hastening composting and contributing to crops' general health. In PFPF, IMO 1, IMO 2 and IMO 3 need to be made in addition to Lactic Acid bacteria, Fish Amino Acids, Fermented Fruit juice, Oriental Herbal Nutrients (OHN). This will give the base for poultry bed and procedures of making, mixing and application are narrated below

Preparing the Poultry Bed

Steps to preparing a poultry bed: The dimension of the poultry bed is 30 ft (length), 15 ft (width) and 10 ft (height) with the longer part facing East or West direction. This positioning helps in the easy entry of sunlight. Boundary walls of 10 feet height need to be constructed on north and south boundaries. The height of the boundary wall should be 1.5 feet on the east and west side of the bed and a wire mesh (chicken mesh) to be placed on the boundary of the bed for better protection of the bed.

Preparing the floor for poultry rearing

Stept 1: On completing the bed, the floor of the bed has to be filled with soil and other ingredients. The first step is to mix well 500 ml of Lactic Acid Bacteria (LAB), 300 milliliteres of Fermented Fruit Juice (FFJ), and 200 liters of water into 4500 kilograms of soil. Keep it on one side of the bed and leave it for 7 days on a small heap.

Step 2: After 2 days, the next part of the floor material needs to be prepared with 90 kilograms of paddy husk, 4.5 kilograms of charcoal, 90 kilograms of Ant Hill Soil (AHS), 45 kilograms of IMO-3 and 300 millilitres of IMO-1, 300 millilitres of FAA and 300 millilitres of OHN. Mix these ingredients well and leave it as a small heap on the bed for 5 days.

Step 3: On the seventh day, mix preparations of step 1 and step 2, and spread on the floor to the level of ground. Then spread 3 inched 45 kilograms of paddy straw onto the floor. After 10 days of leveling the floor, chicks can be incorporated for rearing. When paddy straws are no more be visible on the bed, which happens over 20 days, add more paddy straw to the bed.

Feed for the chicks: Water has to be sprayed at least 1-2 times a week and the chicken could be given homemade chicken feed. Rice husk and fresh green grass are good for poultry birds and it makes up for 1/3 of the total feed for adult chickens. This type of feed toughens the intestines and makes the chicken healthy.

Broken wheat, green fodder, remains of vegetables, balance rice and fish waste etc. can also be given to chicks as feed. For solving calcium deficiency of birds, it is advisable to give egg-vinegar solution, which can be prepared by sun dried crushed shells in vinegar solution for two days. One teaspoon of this solution can be diluted in 1 litre of water to be given to the chicks. It is also advisable to give it to the chicksthe solution prepared by mixing the juices of garlic and ginger with jaggary, kept over 5 days, once in 20 days for disease control.

Water pipes need to be made with holes for providing drinking water to the chicken. The hole on the water pipe needs to be made in such a way that it is slightly tilted back from the chicken's position. Water should always flow in the pipe to ensure that sufficient water available is always for the chicken.

Time schedule for setting up of PFPF

Days	Item	No. of days
Day 1	Fish Amino Acids (**FAA**)	15 days
Day 7	Indigenous Micro Organism 1 (**IMO1**)	4 days
Day 10	Indigenous Micro Organism 2 (**IMO2**)	6 hours
	Fermented Fruit Juice (**FFJ**)	5 days
Day 11	Lactic Acid Bacteria (**LAB**)	5 days
	Indigenous Micro Organism 3 (**IMO3**)	
	Oriental Herbal Nutrients (**OHN**)	
Day 12	Indigenous Micro Organism **1** (**IMO1**)	4 days
Day 14	Mixing of Step 1 solution: **Soil + FFJ + LAB** and keep it on one side of the bed	7 days
Day 16	Mixing of Step 2 solution: **FAA + IMO1 + IMO3 + OHN + Charcoal + Paddy Husk + Anthill soil** and keeping it on the other side of the bed	5 days
Day 17	Spreading of solution by mixing Steps 1 and 2 on to the bed and level it	

Indigenous Wisdom for Sustainable Futures: Harnessing Traditional Knowledge for Global Development

Indigenous Knowledge Systems (IKS) embody the collective wisdom of indigenous communities, offering insights nurtured and passed down through generations. This article explores the intrinsic value of IKS, emphasizing their pivotal role in sustainable development, environmental conservation, and cultural preservation. Respecting and integrating these knowledge systems is imperative for fostering inclusive, resilient, and equitable societies. Indigenous Knowledge Systems stand as invaluable reservoirs of wisdom that contribute not only to the well-being of indigenous communities but also to global sustainable development goals. Recognizing the importance of IKS is not only a matter of cultural respect but a practical imperative for addressing contemporary challenges. NGOs, governments, and the international community must work hand in hand with indigenous communities to ensure the preservation and promotion of these vital knowledge systems for the benefit of present and future generations. By valuing and incorporating Indigenous Knowledge Systems into broader development agendas, we foster a more inclusive, resilient, and sustainable future for all.

Defining Indigenous Knowledge Systems: IKS encompasses a diverse array of traditional knowledge, skills, and practices developed by indigenous communities over centuries. Rooted in a profound connection with the land, ecosystems, and cultural identity, IKS provide holistic perspectives on sustainable living, resource management, and community well-being. The dynamic nature of IKS reflects the adaptability of indigenous communities to changing environments.

Key Components of Indigenous Knowledge Systems: Foundational elements of IKS include traditional ecological knowledge, medicinal practices, agricultural techniques, and sustainable resource management strategies. The intergenerational transmission of knowledge through oral traditions, storytelling, and experiential learning is emphasized as a central aspect of preserving and perpetuating IKS.

Sustainable Resource Management: Indigenous communities have developed intricate resource management practices ensuring environmental sustainability. IKS fosters a profound understanding of ecosystems, leading to practices such as rotational farming, community-based fisheries management, and agroforestry. These sustainable approaches contribute to biodiversity conservation, soil health, and water resource management.

Climate Resilience and Adaptation: IKS exhibits a deep understanding of local climates and weather patterns, providing indigenous communities with adaptive strategies to cope with climate change impacts. Seasonal calendars, indigenous forecasting methods, and traditional ecological indicators are essential components of IKS that contribute to building resilience and mitigating the adverse effects of a changing climate.

Medicinal Plants and Traditional Healing Practices: IKS encompasses a vast repository of knowledge about medicinal plants and traditional healing practices. Indigenous communities leverage their understanding of local flora to address health challenges. Traditional healing practices, often intertwined with cultural and spiritual elements, contribute not only to physical well-being but also to the overall harmony of individuals within their communities.

Cultural Heritage and Identity: IKS is intricately woven into the cultural fabric of indigenous communities, shaping identities, values, and worldviews. Preservation of linguistic diversity, traditional ceremonies, and cultural practices is emphasized as central to maintaining cultural heritage, promoting self-determination, and strengthening community resilience. IKS serves as a means of sustaining cultural identity and fostering a sense of belonging.

Challenges and Threats: Despite their resilience, IKS faces challenges such as globalization, cultural assimilation, and the encroachment of modern technologies. This section explores the threats to IKS, emphasizing the need for proactive measures to protect and revitalize these knowledge systems.

Collaborative Approaches for Preserving Indigenous Knowledge Systems: Preserving and revitalizing IKS requires collaborative efforts involving indigenous communities, governments, NGOs, and the broader international community. This section discusses the importance of respecting indigenous rights, fostering community-led initiatives, and integrating traditional knowledge into mainstream education and research agendas.

The Role of NGOs in Safeguarding Indigenous Knowledge Systems: NGOs play a crucial role in safeguarding and promoting Indigenous Knowledge Systems. This section explores the various ways in which NGOs can support indigenous communities, including funding community-led initiatives, facilitating knowledge exchange platforms, advocating for indigenous rights, and promoting inclusive policies that respect and integrate IKS.

Farmer Field Schools

What is a Farmer Field School? Farmer field schools (FFS) is described as a Platform and "School without walls" for improving decision making capacity of farming communities and stimulating local innovation for sustainable agriculture. It is a participatory approach to extension, whereby farmers are given opportunity to make a choice in the methods of production through discovery based approach. A Field School is a Group Extension Method based on adult education methods. It is a "school without walls" that teaches basic agro-ecology and management skills that make farmers experts in their own farms.

It is composed of groups of farmers who meet regularly during the course of the growing seasons to experiment as a group with new production options. Typically FFS groups have 25-30 farmers. After the training period, farmers continue to meet and share information, with less contact with extensionist. FFS aims to increase the capacity of groups of farmers to test new technologies in their own fields, assess results and their relevance to their particular circumstances, and interact on a more demand driven basis with the researchers and extensionists looking to these for help where they are unable to solve a specific problem amongst themselves. FFS is a forum where farmers and trainers debate observations, apply their previous experiences and present new information from outside the community. The results of the meetings are management decisions on what action to take. Thus FFS as an extension methodology is a dynamic process that is practiced and controlled by the farmers to transform their observations to create a more scientific understanding of the crop / livestock agro-ecosystem. A field school therefore is a process and not a goal.

Objectives of Field Schools: To bring farmers together to carry out collective and collaborative inquiry with the purpose of initiating community action in solving community problems

Specific Objectives

- To empower farmers with knowledge &skills to make them experts in their own fields.
- To sharpen the farmers ability to make critical and informed decisions that render their farming profitable and sustainable.
- To sensitize farmers in new ways of thinking and problem solving
- Help farmers learn how to organize themselves and their communities.

FFS also contribute to the following objective;

- Shorten the time it takes to get research results from the stations to adoption in farmers' field by involving farmers experimentation early in the technology development process.
- Enhance the capacity of extension staff, working in collaboration with researchers, to serve as facilitators of farmers' experiential learning. Rather than prescribing blanket recommendation that cover a wide geographic area but may not be relevant to all farms within it, the methods train extensionist and researchers to work with farmers in testing, assessing and adapting a variety of options within specific local conditions.
- Increase the expertise of farmers to make informed decisions on what works best for them, based on their own observations of experimental plots in their Field schools and to explain their reasoning. No matter how good the researchers and extensions, recommendations must be tailored and adapted to local conditions, for which local expertise and involvement is required that only farmers themselves can supply.
- Establish coherent farmer groups that facilitate the work of research and extension workers, providing the demand of a demand driven system.

Principles of Farmer Field Schools: In the field school, emphasis is laid on growing crops or raising livestock with the least disruption on the agro-ecosystem. The training methodology is based on learning by doing, through discovery, comparison and a non-hierarchical relationship among the learners and trainers and is carried out almost entirely in the field.

The four major principles within the FFS process are:

- Grow a healthy crop
- Observe fields regularly
- Conserve natural enemies of crop pests
- Farmers understand ecology and become experts in their own field

Characteristics of the Farmer Field School Approach

Farmers as Experts. Farmers 'learn-by-doing' i.e. they carry out for themselves the various activities related to the particular farming/forestry practice they want to study and learn about. This could be related to annual crops, or livestock/fodder production. The key thing is that farmers conduct their own field studies. Their training is based on comparison studies (of different treatments) and field studies that they, not the extension/research staff conduct. In so doing they become experts on the particular practice they are investigating.

The Field is the Learning Place. All learning is based in the field. Working in small subgroups they collect data in the field, analyse the data, make action decisions based on they analyses of the data, and present their decisions to the other farmers in the field school for discussion, questioning and refinement.

Extension Workers as Facilitators not Teachers. The role of the extension worker is very much that of a facilitator rather than a conventional teacher. Once the farmers know what it is they have to do, and what it is that they can observe in the field, the extension worker takes a back seat role, only offering help and guidance when asked to do so. Presentations during group meetings are the work of the farmers not the extension worker, with the members of each working group assuming responsibility for presenting their findings in turn to their fellow farmers. The extension worker may take part in the subsequent discussion sessions but as a contributor, rather than leaders, in arriving at an agreed consensus on what action needs to be taken at that time.

Scientists/Subject matter Specialists work with rather than lecture Farmers: The role of scientists and subject matter specialists is to provide backstopping support to the members of the FFS and in so doing to learn to work in a consultative capacity with farmers. Instead of lecturing farmers their role is that of colleagues and advisers who can be consulted for advice on solving specific problems, and who can serve as a source of new ideas and/or information on locally unknown technologies.

The Curriculum is integrated. The curriculum is integrated. Crop husbandry, animal husbandry, horticulture, land husbandry are considered together with ecology, economics, sociology and education to form a holistic approach. Problems confronted in the field are the integrating principle.

Training Follows the Seasonal Cycle. Training is related to the seasonal cycle of the practice being investigated. For annual crops this would extend from land preparation to harvesting. For fodder production would include the dry season to evaluate the quantity and quality at a time of year when livestock feeds are commonly in short supply. For tree production, and conservation measures such as hedgerows and grass strips, training would need to continue over several years for farmers to see for themselves the full range of costs and benefits.

Regular Group Meetings. Farmers meet at agreed regular intervals. For annual crops such meetings may be every 1 or 2 weeks during the cropping season. For other farm/forestry management practices the time between each meeting would depend on what specific activities need to be done, or be related to critical periods of the year when there are key issues to observe and discuss in the field.

Learning Materials are Learner Generated. Farmers generate their own learning materials, from drawings of what they observe, to the field trials themselves. These materials are always consistent with local conditions, are less expensive to develop, are controlled by the learners and can thus be discussed by the learners with others. Learners know the meaning of the materials because they have created the materials. Even illiterate farmers can prepare and fuse simple diagrams to illustrate the points they want to make.

Group Dynamics/Team Building. Training includes communication skills building, problem solving, leadership and discussion methods. Farmers require these skills. Successful activities at the community level require that farmers can apply effective leadership skills and have the ability to communicate their findings to others. Farmer Field Schools are conducted for the purpose of creating a learning environment in which farmers can master and apply specific land management skills. The emphasis is on empowering farmers to implement their own decisions in their own fields.

Steps In Conducting FFS: There are 8 key classical steps in conducting FFS

- Follow up by facilitators
- Farmer run FFS
- Graduations
- Field days
- Evaluating PTDs
- Establishment and running of FFS
- Training of Facilitators

Ground working activities: Conduct ground working activities

- Identify focus enterprises
- Identify priority problems
- Identify solutions to identified problems
- Establish farmers' practices
- Identify field school participants
- Identify field school sites

Training of Facilitators on:

- Crop/livestock production and protection technologies
- Field guides on how to effectively deliver crop/livestock production and protection topics using non-formal education methods (NFE)
- Participatory technology development (PTD) with emphasis on the approaches and developing guidelines on conducting PTD
- Non-formal educationwith emphasis on what, when and how to use NFE in FFS
- Group dynamics
- Special topics to be addressed at every stage of training.

Field days

- During the period of running the FFS, field days are organized where the rest of the farming community is invited to share what the group has learned in the FFS.
- 1or 2 per season
- Farmers themselves facilitate during this day

Graduations

- This activity marks the end of the season-long FFS. The farmers, facilitators and the coordinating office usually organize it.
- Farmers are awarded certificates

Farmer run FFS: FFS farmer graduates now have the knowledge and confidence to run their own FFS. Occasionally the core facilitators will follow-up on schools that have graduated preferably on monthly basis. The core facilitators also backstop on-going farmer run FFS.

Organization And Management Of Farmers Field School

Facilitators

- Accept farmers as equal partners
- Familiarity with the concept &Procedure
- Desired technical skills/ Facilitation skills/ Communication skills

Conditions of successful FFS

- Well trained facilitators
- Well defined priority problem
- Organized community that is dedicated/committed and willing
- Clear understanding of the concept and procedure by all stakeholders
- Support and goodwill of the authorities at various levels
- Availability of appropriate technology
- Adequate resources and logical support
- Proper identification of site/area and selection of participants
- Flexible and dynamic farmer group that is well Organized and structured
- Farmers with common interest
- Proper and guaranteed supervision, monitoring and evaluation of the activities.

Ground working: A collective term for all activities carried out in an area with a view of preparing/paving way for introduction of FFS activities. Note: the activities should begin a season before or at least a month prior to a planned FFS.

Selection of participants

- Active and practicing farmer
- Willingness to participate (Volunteer)
- Ready to work in a group
- Socially acceptable
- Must have good relationship with others
- Willing to learn for their own development
- Farmers must have a common interest.
- Must come from same locality (area)
- Willing to follow the norms set by the group
- Must be willing to share experiences

Criteria for site selection

- Accessible
- Suitable for the particular activities to be done.
- Within or next to the community
- Should be acceptable to all the farmers.
- Should be centrally located among the farmers
- Should have a data processing site
- Security

Participant grouping and class

- All learning is done in sub-group
- Each group is responsible for a treatment or a series of treatments for comparison studies Treatments are at the learning site.
- There are no replications in the same school.
- Each group plays host on the day of FFS activities.
- Each sub-group has officials therefore FFS has several leaders at different levels.

FFS curriculum: Activities to be undertaken during the learning period. The FFS are based on a solid tested curriculum, which covers the entire crop/livestock cycle. The field guides, study fields plus a collection of group dynamic exercises provide the basis for the field school curriculum. These materials are used according to their appropriateness. Training in the farmer field school is experiential and discovery based. The training activities are designed to have participants learn by doing. Most of the training time is spent in the field. Exchange of information and generation of knowledge is facilitated through sharing observations, brainstorming and long discussions. A corner stone of the FFS methodology is agro-ecosystems analysis (AESA) which is the establishment by observation of the interaction between a crop/Livestock and other biotic and abiotic factors co-existing in the field. This involves regular (usually weekly) observations of the crop. Participants work in sub groups of 4 or 5, and learn how to make and record detailed observations including:

- Growth stage of the crop
- Insect pest and beneficial numbers and weeds and disease levels.
- Weeds and disease levels
- Weather conditions
- Soil condition
- Overall plant health.

The farmers then take management decisions based on these observations. An important aspect of FFS is helping and encouraging farmers conduct their own experiments, to test out ecological crop management methods. There are no standard

recommendations or packages of technology offered. Farmer groups collectively decide which methods or aspects of crop management should be studied, and undertake action based on their own findings. In this way, farmers become active learners and independent decision-makers through a process of learning by doing. These together with a group dynamic activity and a special topic, which concerns what is happening in the field, form the core of the field school curriculum.

Group Dynamics : These are a variety of team building exercises employed during the training. There are many games and exercises that can be used to enhance group dynamics. The principal emphasis is on creating an environment in which individuals and the group feel free to experience, reflect and change. In particular games and exercises are valuable for;

- Relaxing the participants
- Illustrating a lesson
- Rejuvenating the group
- Making people alert
- Stimulating the flow of communication between strangers
- Bringing private expectations and group reality closer
- Encouraging everyone to participate and learn
- Rounding off or introducing a session
- Developing new skills
- Exposing participants to new ways of judging their own actions, particularly in relation to the impact on group work
- Developing participants into a closer knit team
- Establishing a learning climate that is enjoyable as well as fruitful.
- Helping participant's experience what can be accomplished by working together

Field Days : Given that the FFS participants are usually a small group of 25 – 30 farmers, the need to share with other members of the community arises. During the period of visiting the FFS field days are organized, utmost two. Sometimes combined with graduation. Key aspect is that farmers themselves facilitate during the field days.

What is a Field Day? An Occasion when farmers and facilitator show other people or the community what they have learned and the results from their PTD activities.

When is it best to hold it.

- When there is still a standing crop, nearing maturity
- Sometimes combined with graduation (If two)

List activities carried out during the field day

FFS perspective

1. Assembling of field day attendants
2. Registration
3. Objectives of both the group and FFS
4. Problems being addressed by FFS
5. Layout
6. Visitations to various plots/stations

Gathering

- prayer
- introduction
- folk media
- farmer impressions

- speeches
- guest of honour
- disperse Facilitators for the day are the farmer participants.

Graduation

- This activity marks the end of the session with FFS
- The farmers, facilitators and the co-ordinating office usually organize it.
- The occasion is used to recognize the time put in the FFS by the farmers and facilitators.
- It is also a forum to pass on the lessons learnt at the FFS to the public, administrators, and create interest to more farmers to join the next planned FFS in the locality.
- The harvest results of field PTDs are displayed, FFS participants dramatize (using folk media), all lessons learnt at the FFS.
- Certificates are awarded to participants of FFS.

Participatory Technology Development (PTD):

Participatory Technology Development (PTD) is a process of collective and collaborative inquiry with the purpose of initiating community action on solving local problems. PTDs in farmers field schools are implemented to empower participants (both farmers and facilitators) with analytical skills to investigate into cause - effect relationship of problems in farming practices and thereby stimulate them to design a set of actions for participants learn from other farmers response at each stage of intervention and draw lessons for future field school programs implementation strategies. In addition, the participants develop analytical skills and attitudes in working within participatory framework in planning, organizing and evaluating development activities.

Participatory Technology Development (PTD) means all relevant stakeholder do what only researchers usually do. It can be seen primarily as a learning strategy for empowering participants and secondarily as producing research results in conventional sense. PTD as a learning process empower in three ways:

- It empowers because of the specific insight, new understandings and new possibilities that participants discover in creating better explanations about their social world
- Participants learn how to learn;
- It liberates when participants learn how to create new possibilities for action.

Green audit towards promoting green protocol:

Green audits are tools that companies, NGO's and other organizations use to identify or define their full range of environmental impacts and assess their operations compliance with applicable laws and regulations, as well as with the expectations of their various stakeholders. It serve as a means to save money, enhance work quality, improve employee health and safety, reduce use of resources, and achieve accreditations. The institution/organisation can undertake green audits to follow Green Protocol and to show that the management has created efficient environmental policy and provided for acceptable environmental attitude. The purpose is to prove the report of the green audit done in the organisation (green audit statement), to prove that the company follow Green Protocol after conducting green audit, to ensure that their environmental performance follows applicable laws and regulations, to improve environmental performance and saving money. Considering the responsibility of the organisation towards managing resource judiciously, the team members of can undergo a training on various processes of green audit and green protocol.

Green audits are to identify or define their full range of environmental impacts and assess their operations compliance with applicable laws and regulations, as well as with the expectations of their various stakeholders. It serves to save money, enhance work quality, improve employee health and safety, reduce use of resources, and achieve accreditations. Caritas India decides to undertake green audits to follow Green Protocol and to show that the management has created efficient environmental policy and for acceptable environmental attitude. Considering the responsibility of every institutions towards managing resource judiciously, it

is important to conduct green audit such as waste audit, water audit and energy audit prior to the implementation of green protocol. Green audits are conducted for the following reasons:

- To prove the report of the green audit done in the organisation
- To prove that they follow Green Protocol after conducting green audit
- To ensure that the performance follows applicable laws and regulations
- To ensure the ability of organizations to demonstrate their environmental responsibility and implementation of environmental policy
- To Improve environmental performance and saving money
- To identify potential liabilities and identify opportunities
- To reduce costs or increase revenue and to Improve resource efficiency

Waste Audit: Know where you throw:

We need to be concerned about the disposal of large quantity of waste which are both biodegradable and non-biodegradable which are causing environmental degradations. The disposal of solid waste is a problem, and it will continue with the growing population. Disposal of waste in open pits has become routine in majority of places. The dumping of waste in open places, huge garbage lying down uncollected beside the roads, streets dustbins and on the ground and improper handling and management of waste are causing adverse effect on the public health at large and is causing threat to the surrounding environment. As part of the social and ecological responsivity of the organization, it is very important to conduct waste audits to assess the quantity of waste being generated and the Present Waste Segregation method (Know where you throw). Waste Audit is the process to measure/ calculate the types and quantity of waste being generated by an organization in a day, month and year. Waste audit help to identify the types and quantity of wastes produced by the organization and how the organization manages this waste.

Conducting waste audit help to minimize the organization's waste impact on environment. Waste audit can also make the organization more effective in reducing waste management costs by educating staff about proper waste disposal and making better use of the waste. The organization should not inform staff about waste audit prior to the completion of the audit as informing staff on waste audit in advance lead to alter their waste disposal habits resulting an inaccurate waste audit. Successful waste audits help to ensure a safe and healthy environment for the organization and everyone in the surrounding area.

Waste Assessment: Waste Assessment is to know the baseline conditions of the waste generated in the offices. The waste assessment help in providing starting point for setting waste minimization measures. The assessment includes the following components:

- Quantity of waste being generated in a month
- Discussion with the team on waste management process to identify scope/opportunities for waste minimization and recycling.
- Work out a plan for Waste reduction strategies.

How much waste does the organisation produce?

- Weigh the trash generated by the organization at the end of each day for one month.
- Average the weight of the trash over the five days.

What is the composition of school waste before recycling?

- Separate the waste generated in the organization into the following categories.
- Weigh the separated waste
- average the weight of each trash category, convert to a percentage.
- record the data on a chart and graph the results.

- Paper: newspaper, notebook paper, magazines, boxes, wrappers
- Plastic: disposable food service products (plastic cups, cutlery, product wrappers, food and beverage containers, markers, disposable pen)
- Paper cup/plates
- Glass: Beverage containers
- Metal: paper clips, staples, aluminum foil, food and beverage containers
- Food waste
- Wood: toothpicks, pencils
- Other: rubber bands, fabric, balloons, mixed material

How much of the Organization's waste can be recycled?

- Weigh the quantity of each category of waste and measure it for the month.
- Segregate the recyclable waste and weigh it
- Display the recycling process involved in the center
- The recycling team should collect all the results and set a goal for waste management and recycling based on the result of the audit.

Water Audit

Water is vital to the survival of everything on the earth and is limited in supply while the demand is increasing. Managing water is a growing concern everywhere. Water auditing is the process of measuring the quantity of water being used in an organization/institution/household and how much water can be saved. Excessive use of water is common due easy availability of water in the connecting taps and pipes, ignorance on the excessive use and water leakages etc. A water audit is a systematic review of a site to identify opportunities to improve its water use efficiency. Water audit involves tracking, assessing and validating all components of flow from the site of withdrawal or treatment through the water distribution system and into the consumer's properties. Institutions/organisationsuse a significant amount of water in its daily operations. It is important to count the amount of water being used daily and to come out with an operating system of saving water use and hence the operational cost. We are aware of the excessive use of water and the need to use water more efficiently to reduce water shortage and operational cost.

Water audit and systematic planning is required for effective water management for which a water management team is required at the organization level to review the water use and develop a water management plan for the institution. The implementation plan should have a monitoring system to quickly find and fix water leakages and other unwanted water use. Water leaks are the unintended waste of water with no use or purpose. Hence a leak detection and repair plan are very important to save water, money and time. Subsequently the organization can also identify cost effective reduction of water use

Water audit is a quantitative and qualitative assessment of water consumption in the institutions, households. Conducting water audit help in developing various ways and means of reducing and recycling of water. Water audit is important to know the facility's water use and what can be done to reduce it. The auditor needs to trace the water use from the point of entry into the facility through its discharge into the underground channel that carries the wastewater. Identify each point of water use within the system. Start with a walk through and identifying every point in which water is used. For items such as toilets and faucets, the inventory should include the item, its location and its flow rate.

- Water audit help in realizing the amount of water being used and misused
- It helps in reducing the consumption of electricity and hence the electricity bills
- It helps in reducing the water bills
- It helps in reducing the wastage and unnecessary use of water
- Water audits make the community more aware and responsible on water use.

Steps of measurements:

Sources of water for the organization

- Municipal Water supply
- Bore well
- Dug well
- Tanker water supply
- Other sources

Estimate the quantity of water supply from each source

Bore well and dug well supply

- Measure the flow rate: Time taken to fill a 10liter bucket at the outlet of the pump
- Keep a track on the pump is on in a day
- Use these two to calculate the quantity of water withdrawn

Process of Water Audit:

- Measurement of water usage of each collecting points of an institution
- Calculation of water usage of each point to know the total quantity being used
- Water Audit observations on the quantity, use, leakage, improvement measures
- Audit report with observations and recommendation
- Discussion with the Management/team of actions based on the audit report
- Planning & process of water Management/Conservation measures
- Implementation of Water Management & conservation measures.

Water Management Plan (WMP): In order to work out a long term sustainable water saving practice of an organization, it is important to have a comprehensive water management plan, with a focus on reducing the water use such as loss of water through leaks, improving the efficiency equipment, system, create awareness among the employees on water saving practices and reuse of the discharged water through using graywater for gardening etc.

Energy Audit:

Energy audit is the process of evaluating the existing energy consumption of the household/organization/institutions. This helps in realizing energy use from different energy sources like electric motor, lights, fan, refrigerator, heater etc. and to identify potential energy saving and to report the findings of the present energy use. Conducting energy audit led to the reduction in electricity bills and fuel wastage. The cost of electricity is high and if we use energy consumption judiciously, the cost can be reduced. Institutions/households can reduce their electric consumption and energy wastage and consequently reduce expenditure by adopting energy efficient measures. Energy audit help in the following aspects:

- It identifies energy use among various services
- Identify opportunities for energy conservation
- The study should reveal the options available for reducing energy and costs involved

Average Daily Power consumption per Electrical Appliances

Power consuming Appliances	Wattage	Usage hours	Daily Units
CFL 1			
CFL 2			
CFL 3			
LED 1			
LED 2			
Fan 1			
Fan 2			
AC			
AC			
Fridge			
Water Filter			

Electricity meter shows the amount of electricity that is used. So a 100-Watt bulb if kept on for 10 hours will consume: 100x10=1000 Watt per Hour=1 Kilowatt-Hour (kWH) = 1 units (on the meter).

Our Carbon Footprints:

Our daily actions lead to the release of greenhouse gases. The average footprint of a person living in town/cities is 10 tons while the average is only 2 tons. The global average is 4 tons. The average carbon footprint of a person in USA is 16 tons, one of the highest in the world. Air travel is responsible for higher emission followed by gas consumption, car travel and electricity use. Lowering the carbon footprint requires special efforts from each one of us. The carbon releasing by some of our actions are as follows:

- 1 litre of diesel emits 2.68 Kilogram of Carbon dioxide
- 1 litre of Petrol emits 2.31 Kilogram of Carbon dioxide
- 1 litre of LPG produces around 1.51 Kilogram of Carbon dioxide
- 1 unit of electricity produces 0.8 Kg Carbon dioxide
- 1 kilogram of wood by burning produces 1.65 to 1.80 Kilogram of Carbon dioxide
- Carbon footprint of 1-kilogram plastic is 6 Kilogram Carbon dioxide

Soil carbon is the largest terrestrial carbon pool and along with biotic or vegetation pool, is critical in stabilizing the atmospheric CO2 concentration. Organic matter is one of the significant constituents of soils. It improves soil structure, soil aggregate stability and enhances the ecosystem services. We need to be instrumental in conservation and restoration of natural resources particularly land (soil), water and forest (trees) through various measures and environment friendly (climate adaptive farming approaches) cultivation practices. Encourage mass plantation and afforestation under natural resource management with agro-based livelihood activities for sustainable management of natural resource base. Considering the emission, **Community Carbon Collective approach** would be a sustainable solution where, We need to take concerted efforts in engaging small and marginal farmers by **exploring the role of smallholders and smallholder farming systems in climate change impacts, adaptation, emissions, and mitigation** as compared to farming systems of other regions.

Carbon Sequestration: We should commit ourselves to live simple by having simple food, less travel and sharing resources with others in need. Plant saplings (multispecies) and nurture them since trees can directly remove carbon dioxide. 1 mature tree of 15 years will absorb 21 Kg carbon per year and give 118 kg of oxygen. Grow your food and eat...to avoid transportation of food and hence reduce pollution. We should conserve, preserve, and protect water, to be shared with all creations, to be protected for future generations too. Improve soil health through promoting Natural Farming/Organic Farming. We need to engage our team efforts to establish climate justice. We should have an extra burden to come together, pray together and act together for climate justice and to solve the climate crisis. Turn off lights and unplug devices when you're not using them. Eat more food that is grown or made locally and less red meat. Taste the difference, feel better and support the Austin economy!

Green Protocol

Green Protocol is a set of measures or recommendations which when implemented, result in wise use of resources and significantly reduce their misuse and over use. **Following Green Protocol, reduce the habit of generating waste.** Thus Green Protocol take us one step forward towards achieving sustainable development. Whereas, Green Audit is the widely accepted tool for achieving Green Protocol. Efforts to be sincerely made to green protocol as much as possible through adopting appropriate measures and mechanisms. It is the high time to stop the use of disposable (use and throw) products such as those made of plastics, paper and thermocols. Keep the surroundings and water sources clean and steady and follow the judicious use of resources.

Do's	Don'ts
Steel/glass plates, cups, tumblers, spoon	Disposable plate, glass, spoon and straw
Cloth bags, covers, cloth handkerchief	Plastic bottles/tiffin boxes/carry bags
Ink Pen	Flex banner
Banner made of cloth or biodegradable materials	Bouquets made of plastic
Eco-friendly decorations	Decorative materials in plastics
Recycle water at the source	Plastic pen/disposable pen
Waste to Wealth: Composting from waste	Tissue paper/table cover in paper
Eco-friendly products	Burning of wastes
Seeds, seedlings as gift	Burning of plastics
Steel plates to get food parcel	Plastics used in parcel food

Office and Premises

- Conduct waste audit
- **Reduce** the use of Plastic
- Declare the campus as **Plastic neutral**
- **Avoid using plastic** bottles, covers
- Avoid single use and throw pens.
- Reduce the use of paper and printouts. Promote the reuse of one side paper.
- Proper disposal of all kind of waste
- Stop burning waste (burning of plastics produces dioxane)
- Keep separate baskets for keeping Plastic / Paper / and Food Waste
- Manage the waste in proper intervals
- Avoid plastic wrappers and covers during the purchase itself.
- Make RRRRR (5R) policy towards plastic waste.

- Start an organic farm/garden in the office premise. If there is no space available, use methods including terrace farming, grow bag cultivation and upright garden.
- Find one agency (Governmental/Non-Governmental) for collecting and recycling the plastic waste from the office
- Reduce the use of Electricity/ switch to LED light bulbs/ conduct energy audit
- Take steps to save water/conduct water audit/create water literacy awareness
- Use awareness materials on green protocol (Sticker, Poster) in the office.
- Give extra duty to one staff (rotating) as the green protocol maintaining officer.

Public Programs

- Avoid plastic banners
- Avoid note-pads with plastic coating
- Distribute paper pen to the participants
- Distribute paper/echo friendly files to the participants
- Distribute Eco - Friendly materials for welcoming guest/token of gratitude
- Do not distribute bottled water in the programs
- Keep drinking water in common points
- Use steel glasses / reusable glasses for distributing Tea and water
- Aware participants on Green policies practicing in the program.
- Promote eco-friendly activities in the field, link them with existing programs

Procurement

- Ask the vendor to supply materials in Echo friendly wraps.
- Find local vendors supplying Original Cloth bags instead of using polypropylene bags (They feel like cloth, But not biodegradable)
- Ensure the proper disposal and recycling of non-biodegradable waste before winding up the program.

Bio Resource Flow

Bio resources as the name suggest is the biological waste of a farming system component. Bio Resource Flow is a crucial function in an integrated farming system model. The waste from one component serves as a valuable input for another or many. This is essentially a process of upcycling where the waste / product of one process esteem higher value for another process of another component. In simple words, one can reduce the external dependency of inputs for managing a farm component by using the locally available inputs from another one. The performance of the overall farming system also depends on the efficiency and effectiveness of the processes and functions of each farm components. This makes it important to understand various bio resources produced from each of the farm component and optimize the connection between each product/water and the remaining components of a farm. A bio resource flow diagram is prepared for each farm to understand the present use of product/by-product/waste as input for another component within the farm. This process helps a farmer / a facilitator to understand the potential optimisations to improve the efficiency and effectiveness of each component.

Steps involved in preparing a Bio Resource Flow Diagram:

- Step 1: Identify the Farm Components and prepare a diagram placing these components in a farm.
- Step 2: Map the present connection between each of them with lines and note them carefully below each line.
- Step 3: Explore potential improvements by adding new connections / components which can improve the effectiveness / performance of the components.
- Step 4: Map the changes in the connection after each interval and follow step 3 till the system is completely optimised.

Figure 1: Bio Resource Flow Diagram prepared in SAFBIN Programme

Discussion points : What are the components you can identify in the diagram?
What are the connections between each components?
Identify the components with multiple connections?
Can you identify any improvements in the components / connection?

A bio resource flow diagram can be very helpful in clearly understanding the various potential of recycling and upcycling the biological waste / by-products available in a farm.

Exercise:

Task : Prepare a bio resource flow diagram for a farm you know

Materials required : Chart paper, pencil, colour pens / marker, rubber

Carbon Sequestration

Carbon sequestration is the process of storing carbon in a carbon pool. Carbon sequestration involves the removal of carbon dioxide from the atmosphere in the form of soil organic carbon (SOC), with the capture of CO2 in the soil seen as an effective way of reducing greenhouse gases. Because soil rich in carbon is also healthier and more fertile, it can benefit farmers while helping meet the targets of the Paris Agreement on climate change and the Sustainable Development Goals. (FAO, 2021)

Carbon sequestration entails additionality and permanence of new carbon beyond original carbon levels at a given location. It is considered as the process by which atmospheric carbon dioxide is taken up by plants through photosynthesis and stored as carbon in biomass and soils at a given location, but sometimes, it is associated by the soil carbon increases resulting from the importation of external organic matter to a given plot (for example, manures, biochar, etc.). In the first case, the SOC increases are mainly visible after some years (usually more than four), while increases resulting from imported carbon maybe visible shortly after its addition as it is incorporated in the soil. The SOC sequestration values associated to the addition of external sources of carbon may be higher in the short term when compared to the SOC sequestration values associated to an increased organic matter (plant litter) input due to improved soil health and hence crop productivity.

Terrestrial Ecosystems:

- Forests: Forests are significant carbon sinks, sequestering carbon through the process of photosynthesis. Trees absorb CO2 and store carbon in their biomass, including roots, stems, and leaves.
- Soils: Soil organic matter, derived from decomposed plant and animal residues, is a substantial reservoir of carbon. Practices such as agroforestry and sustainable land management can enhance carbon sequestration in soils.

Oceanic Ecosystems:

- **Phytoplankton:** Marine algae, particularly phytoplankton, play a crucial role in carbon sequestration through photosynthesis. They absorb CO2 from the atmosphere and form the base of the marine food web.
- **Deep Ocean Storage:** The oceans act as a significant sink for atmospheric carbon. Carbon dioxide dissolves in seawater and can be transported to the deep ocean through various processes.

Wetlands:

- **Peatlands:** Wetlands, especially peatlands, store large amounts of carbon. Peat is formed from partially decomposed plant material in waterlogged conditions, and its preservation prevents the release of stored carbon.

Grasslands:

- **Root Systems:** Grasses and other vegetation in natural and managed grasslands contribute to carbon sequestration through the accumulation of carbon in their root systems.

Agricultural Practices:

- **Agroforestry:** Integrating trees into agricultural landscapes enhances carbon sequestration by storing carbon in tree biomass and improving soil organic matter.
- **Conservation Agriculture:** Practices such as minimal tillage and cover cropping contribute to carbon sequestration in agricultural soils.

Carbon Capture and Storage (CCS):

- **Direct Air Capture (DAC):** Artificial technologies like DAC involve capturing CO2 directly from the atmosphere for storage or utilization.
- **Carbon Capture from Industrial Sources:** Capturing and storing carbon emissions from industrial processes, such as power plants and factories, can contribute to reducing atmospheric CO2 concentrations.

Urban and Peri-Urban Green Spaces:

- **Urban Forests and Green Infrastructure:** Planting trees and establishing green spaces in urban areas can contribute to carbon sequestration, providing additional benefits for local communities.

Land Use Change:

- **Reforestation and Afforestation:** Planting trees in deforested or unused areas (afforestation) or restoring previously forested areas (reforestation) can sequester carbon and enhance biodiversity.

Carbon Finance

Carbon Finance: Carbon finance refers to financial mechanisms and instruments designed to support projects, activities, or initiatives that contribute to the reduction of greenhouse gas emissions and address climate change. The goal of carbon finance is to provide economic incentives for individuals, businesses, and governments to adopt environmentally friendly practices and invest in projects that lead to emissions reductions or removals. This field has evolved as part of broader efforts to transition to a low-carbon economy and mitigate the impacts of climate change. Key elements and components of carbon finance include:

Carbon Credits and Offsetting:

- **Emission Reduction Projects:** Carbon finance often involves the generation and trading of carbon credits. Projects that reduce or remove greenhouse gas emissions, such as renewable energy projects or reforestation initiatives, can earn carbon credits. These credits can be sold to entities seeking to offset their own emissions or meet compliance targets.
- **Voluntary Offset Programs:** Individuals, companies, and organizations may voluntarily purchase carbon credits to offset their carbon footprint. This involves investing in projects that result in emissions reductions equivalent to the buyer's own emissions.

Carbon Markets:

- **Cap-and-Trade Systems:** Some regions or countries have implemented cap-and-trade systems, where a cap is set on total allowable emissions, and entities are issued permits (allowances) representing the right to emit a certain amount. Entities can buy and sell these allowances based on their emissions needs.
- **Carbon Trading Platforms:** Carbon credits can be traded on specialized exchanges or trading platforms. These markets facilitate the buying and selling of carbon credits among participants, allowing for price discovery and liquidity.

Climate Finance:

- **Investment in Low-Carbon Projects:** Carbon finance is often part of broader climate finance initiatives. Funds are directed toward projects and activities that promote renewable energy, energy efficiency, sustainable land use, and other measures that contribute to climate change mitigation and adaptation.

- **International Climate Finance:** Developed countries may provide financial support to developing countries through international climate finance mechanisms. This assistance helps developing nations implement climate-related projects and adapt to the impacts of climate change.

Green Bonds and Sustainable Finance:

- **Green Financing Instruments:** Financial instruments, such as green bonds, are used to raise capital for projects with environmental benefits, including those aimed at reducing greenhouse gas emissions. Investors purchase these bonds, and the proceeds are directed toward qualifying green project

Corporate Social Responsibility (CSR):

- **Corporate Emission Reduction Commitments:** Some companies incorporate carbon finance into their CSR initiatives by committing to reduce their carbon footprint and investing in projects that contribute to sustainability and emissions reduction goals.

Carbon finance plays a crucial role in mobilizing resources and driving investment toward climate-friendly activities. By creating financial incentives for emission reduction projects, it helps bridge the gap between economic interests and environmental goals, encouraging the transition to a more sustainable and low-carbon future.

As explained above, carbon credit is a tradable permit or certificate that represents the right to emit one ton of carbon dioxide (CO2) or its equivalent in other greenhouse gases. It is a key component of emissions trading programs, which are designed to incentivize the reduction of greenhouse gas emissions. The concept is based on the idea that entities that reduce their emissions below a certain level are awarded carbon credits, which can then be sold or traded to other entities that exceed their emissions limit. Carbon credits serve as a market-based mechanism to encourage emission reductions in a cost-effective manner. They provide financial incentives for businesses and projects to invest in cleaner technologies and sustainable practices. The overall goal is to create a financial mechanism that helps shift economic activities toward a low-carbon and more sustainable trajectory.

Carbon credit process works generally in the following manner:

Emission Reduction Projects: Organizations or projects that reduce or remove greenhouse gas emissions can be eligible for carbon credits. These projects can take various forms, such as renewable energy projects, afforestation initiatives, energy efficiency programs, or methane capture from landfills.

Verification and Certification: To receive carbon credits, the emission reduction projects must be rigorously verified and certified by an accredited third-party organization. The verification process ensures that the claimed emission reductions are real, measurable, and additional to what would have occurred without the project.

Issuance of Carbon Credits: Once the emission reductions are verified, carbon credits are issued to the project or entity responsible for the reduction. Each credit represents one ton of CO2 equivalent that has been prevented or removed from the atmosphere.

Trading and Transactions: Carbon credits can be traded on the carbon market. Entities that are unable to meet their emissions targets can purchase carbon credits to offset their excess emissions. Alternatively, entities with surplus credits can sell them to those in need of additional allowances.

Compliance and Offsetting: In some cases, carbon credits are used for compliance with government-mandated emission reduction targets. Additionally, individuals or organizations may voluntarily purchase carbon credits to offset their own carbon footprint, contributing to climate change mitigation efforts.

It's worth noting that the effectiveness of carbon credits in addressing climate change depends on the integrity of the measurement, reporting, and verification processes associated with the projects generating the credits. If properly regulated and monitored, carbon credits can play a role in the broader effort to combat climate change.

Carbon Fast: Our daily actions lead to the release of greenhouse gases. The average footprint of a person living in town/cities is 10 tons while the average is only 2 tons. The global average is 4 tons. Air travel is responsible for higher emission followed by gas consumption, car travel and electricity use. Lowering the carbon footprint requires special efforts from each one of us. The carbon fast shall provide myriad ways for the us to get involved in enhancing climate justice. Join the carbon fast because we can change the world a little in 40 days. But more importantly, we could change ourself a lot. Look back over the year and see how much fuel (petrol/diesel) did we use? How much did we spend? Reflect on how we have treated the environment.' People should commit themselves to living simple, besides having simple food, less travel and sharing resources with others in need. We should plant saplings and nurture them since trees can directly remove carbon dioxide and store it as wood and foliage. "We have to build an economy that will support, not undermine, future generations. It is not only the responsibility of the governments, but also of the citizens to engage in efforts to establish climate justice

Root Zone Fertigation of multiple fruit trees:

Usually, trees are grown through providing surface irrigation practices such as drip irrigation, sprinkler irrigation, pitcher pot irrigation systems which absorbs water to a depth of maximum one feet. This innovation of root zone-based fertigation provides water and manure to a depth of 1.5 to 2 feet which is difficult in surface irrigation methods. This technique involves creating permeable zone around root zone of the plant providing a favourable environment in the Rhizosphere (the plant- root interface) by facilitating fertigation (water and nutrients) to the root zones at different levels. Rhizosphere part of the plants are the hot spots for microbial diversity. Water use efficiency will be ensured through this technique and helps in reducing evaporation as the water and nutrients are given directly to the sub surface root zones. This innovation helps in improving the soil texture and structure of the rhizosphere. The growing roots will get nutrients and water in this process and hence the fast and healthy growth of the plants. The methods involved in this technique is as follows:

- Dig a pit of 2 feet length, 2 feet width and 1.5 feet depth
- Mix all the ingredients with topsoil such as organic compost (10 Kilogram), dry cow dung (25 Kg), coir pith/husk 15 Kg), Bone Meal (2 Kg), pseudomonas (1 Kg), neem cake powder (1.5 Kg), Charcoal (1 Kg) along and fill in the pit.
- Plant the sapling and provide fertigation (water and liquid manure) through the pipes.
- Add mulching martials (dry leaves) beneath the plant for maintaining soil moisture.
- Water your plants by filling the pipe. This channel water directly to the root system.

Mulching should be maintained throughout the year. The soil should be re-mulched with time since dry soil is detrimental to plant health. Also, never remove organic matter like fallen leaves as it will kill good soil microbes.

Chapter 6

Caritas India Approaches on Integral Ecology

Caritas Interventions in Climate Justie

Caritas India's work in the Past: Supporting marginalized rural and tribal communities to manage their natural resources, has been a long-standing commitment for Caritas. We have had successes in NRM projects all around the country. The marginalized farmer must have a control over what they grow and how they grow. Similarly, control over individual and community resources such as the land and water has to be wrested and the struggle for these resources at the grassroots will continue. Caritas and its partner communities have for long worked on sustainable agriculture techniques and this emphasis will continue. Caritas will intensify its work in the Climate Change mitigation and adaptation fields. The existing programmes are focusing towards improving the environment in an area through participatory and integrated approach while ensuring sustainable development of the communities. This is achieved through focusing on the right based approach and ensuring equity, equality, transparency and accountability at community levels. Caritas India has established a Centre for Environmental Studies in Social Sector (CESSS) in Amravati. The centre will initiate replicable models of Integrated and Sustainable Natural Resource Management with specific focus on Agriculture, Food Security, Livelihoods and Poverty Reduction with the view to assist the communities in their socio-economic empowerment.

Caritas India along with its partners are promoting Integrated Natural Resource Management programmes through building the capacity of its partners, supporting in the promotion of models of soil and water conservation, eco-farming and linking with governmental agencies for the replication of models. The priority of the programme is to improve the socio-economic situation and quality of life of the people in addition to the regeneration of natural resources through an integrated environment management approach. The focus of this proposed project will be the overall development of the target area through an integrated Natural Resource management programme. The sustainable and replicable models are created through various actions with the active participation of the people

Objectives of NRM Division: Following are the main objectives of the NRM division of Caritas India:

- NRM division of Caritas India is to provide technical expertise on Water Management, Soil and Water Conservation, Sustainable Agriculture, and Climate Change adaptive actions.
- To empower the community to take control of their environment through preservation and promotion of eco-friendly measures and practices for sustainable social, cultural, and economic development. This integrated approach involves the conservation and management of soil and water, improving the quality of crop production through sustainable farming. The entire process will be strengthened through active involvement of local community based organizations.

For the last 60 years Caritas India could support more the 1100 NRM projects through its partners. Some of the models created are replicated by Governmental agencies such as:

- The Roof Water Harvesting (RWH) project in Kerala replicated by Kerala Government as "VARSHA" project.
- 3 Partners in Karnataka has mobilized projects of World Bank as the follow up of the NRM programme of Caritas India
- NRM programme in Imphal, North East supported by Caritas India helped them to upscale NRM initiatives (several Good models are developed there)
- Harith Asha project of Chattisgarh improved the confidence of partners in Chattisgargh. Caritas Australia selected this project for their project compassion for the year 2009.

- The Organic System of Rice Intensification promoted as part of the support of Caritas India is being replicated by many farmers in India (more than 5000 farmers are into OSRI now)
- Caritas India became the working group member for the formulation of 12th 5-year plan of planning commission.
- Caritas India became the LEAD AGENCY for promoting sustainable agriculture among the partners of Caritas Asia (23 Member organizations in Asia) due to its expertise in Sustainable Agriculture.

Save Farmers. Save India Campaign:
As part of the save farmers. Save India Campaign in the year 2014, Caritas India could effectively intervene in the areas where Farmers commit Suicide. FARM project of Vidharbha, Andhra Pradesh and Wayanad District of Kerala helped in mobilizing more than 40000 farmers in promoting sustainable Integrated Farming. The implementation of FARM program in Wayanad has helped 2559 small holder families in promoting chemical free system of farming practices. Organic System of Rice Intensification also has been adopted by 378 farmers. Strong linkages have been developed with 16 Governmental Institutions starting from Agriculture University to Commodity Boards. Resource mobilization from various Governmental Agencies in the last three years is Rs. 12639704.

Water and Agriculture Resilience Mission (WARM) of the drought affected Vidarbha, Marathwada and Bundelkhand region: Caritas India have started WARM program with six partners currently working in Vidarbha, Marathwada and Bundelkhand regions. The six partners have worked intensively in 4-5 villages to create replicable and drought-resilient management practices in the sectors of agriculture and water. The pilot project seeks to initiate/develop models that could be scaled-up as larger interventions - in terms of both area and intervention period - which will follow the pilot project.

Saksham Program in Madhya Pradesh, Bihar, U.P & Rajastan: The integrated approach of ensuring food sovereignty has been initiated through a cluster program called "Saksham". The proposed intervention is intended to strengthen livelihood, food and nutrition security of smallholder farmers who have been suffering badly because of climate change, including droughts.

Ujivana, Ujjwala & Uttoran (U3): CARITAS India in 2014 March initiated a program to strengthen livelihood of poor and marginalized people in the state of West Bengal, Karnataka and Telangana. The U3 cluster intervention spread out to 9680 households in 193 villages of 21 blocks in 17 districts through 16 partners in 3 states namely West Bengal, Karnataka and Telangana. The program aimed to strengthen demand for improved delivery of basic services/amenities and make service providers more responsive and accountable (local administration). This project facilitated the Livelihood improvement of 9680 Marginalized households who will increase income through sustainable agriculture production and management system and consumption at community level.

SAFBIN: The Europium Union supported SAFBIN cluster project is a cluster program of Caritas India, Nepal and Bangladesh to promote local food and nutritional security through adaptive small-scale farming in 4 rainfed Agro Ecological Zones of South Asia in the context of climate change. This innovative project has developed and documented innovations in traditional food production, distribution and consumption system of Small Holder Farmers with respect to climate change adaptations. mitigation and around nutritional security and influenced national research and policy agenda for promotion of collectivized Food Production Distribution and Consumption System to adapt to and mitigate climate change and nutritional security

Udhayam - Eco DRR: The Eco-DRR cluster program of 8 partners in Tamil Nadu is an effort of Inclusive restoration of Shelter, Livelihood, and reduction of disaster risk of selected most vulnerable families in worst flood affected villages in 8 districts of Tamil Nadu.

Centre for Environmental Studies in Social Sector (CESSS): Centre for Environmental Studies in Social Sector (CESSS) is Caritas India's innovative new initiative in the field of Natural Resource Management. Caritas India took the decision to set up CESSS in Central India and started its intervention from 2009 to promote sustainable management of natural resources and to create replicable models in sustainable Agriculture with the view to assist the farming communities in their socio-economic empowerment processes.

Technical Support from NRM Desk of Caritas India: The NRM team of Caritas India consists of 5 technical experts including the Team leader. This team provides technical expertise on the following aspects:

- Integrated Watershed Development and Management/Soil and Water Conservation.
- Groundwater Recharging and Harvesting
- Action Research on Integrated Water Management
- Permaculture/Sustainable Agriculture
- Climate Change Resilience & Adaptation
- Organic System of Rice Intensification (OSRI)

Caritas India has been instrumental in conservation and restoration of natural resources particularly land (soil), water and forest (trees) through various conservation measures and environment friendly (climate adaptive farming approaches) of cultivation. Encourage plantation and afforestation under natural resource management with agro-based livelihood activities for sustainable management of local resources. The primary focus is to contribute to the United Nations Sustainable Development Goals 2: End Hunger, achieve food security, improve nutrition, and promote sustainable agriculture. Caritas India has its presence in almost 11 agro climatic zones across India by serving the most vulnerable households with a **twofold purpose of promoting local and food and nutritional security through climate adaptive farming approach.** The major focus is around reuse and recycle of farm wastes and resources through empowering community institutions and smallholders to integrate various farm components for their resilience while maintaining the ecological integrity of the creation. Caritas India works in proximity with the communities, creating a contiguous coverage of intervention areas, facilitate alliances with the government and conduct research and establish market actors to build an enabling ecosystem for their sustainability.

Smallholder farmers have journeyed and achieved major milestones by successfully demonstrating to adapt to climate change, to integrated farming systems and agroecology for farm production and income and later showcasing their potential to achieve SDGs (especially 1 and 2), they are well prepared to help their farming and their governments to achieve the new global target of net-zero by 2050. As the world seeks to move towards **nature-based solutions (NBS) as carbon-absorbing and low-carbon pathways,** our small farmers are well poised to swiftly move to **practice 'regenerative agriculture through community carbon collective** that is being seen as a resilient and innovative pathway of Nature Based Solutions (NBS). With their collectives, capacities, and past transitions already in place, additional investments to support their move to **nature-based solutions that also helps measure carbon offset and reward them with credit,** can be highly impactful. While donors can achieve higher investment efficiency, this can help farmers to make their small farms resilient and also earn additional carbon money while contributing to the local global net-zero targets.

As a stewards of the Indian agro-mass, our key intervention would be:

- Journeying with the **smallholder famers towards regenerative agriculture** and measure the carbon sequestration preparing institutional mechanism to earn carbon credit
- **Research and development into innovative systems** and technologies to enable farm business to reduce greenhouse gas emissions
- **Alliance building for systemic change** in farming practices and agri-food supply chain.
- **Farmer Engagement** to collaborate and collectively deliver landscape benefits for water and soil - with the additional benefits of knowledge exchange, demonstrations, and networks.
- Support farmers in **securing tenure** through documentation required for trading carbon
- Assist in connecting them to sensitive and **non-exploitative carbon market** that can increase their income.

Caritas India Environment Justice Policy

Environment Management@Caritas India

During the six decades of its humanitarian and development efforts, Caritas India has served the poor and marginalized without any discrimination based on caste, creed and ethnicity. It is associated with more than 350 partner organizations through its State offices covering twelve regional and 173 DSSS partners. It works on different thematic sectors namely, ECOSIDE (Climate

Justice), Climate Adaptive Agriculture and Food Sovereignty (CAFFS), Disaster Risk Reduction (DRR), Child Protection and Development (CPD), Anti Human Trafficking (AHT), Dalit and Tribal Development.

Premise: Caritas India intends to adopt an environmental policy to reiterate its commitment of continuous upgradation in its practice of ethical and sustainable development. A clearly defined and commonly understood Environmental Policy Framework will help in establishing the blueprint for how environmental issues will be ethically managed by Caritas India. It would serve as a guide of best practice environmental management in line with Caritas's ethical principles, catholic social teaching and environment concerns of the church and goals for the management of its organizations, partners as well as its developmental initiatives. This will be achieved by addressing issues systematically, consistent with globally and legally prescribed/accepted as well as self-defined ethical standards. An important element of this systematic approach will be the development of detailed environmental management procedures to guide its team, partners and as well as development project stakeholders in adhering to the ethical environmental behaviour and practice.

Three main issues are key to environmental management: politics (networking), programs (projects), and resources (money, facilities, etc.). The Environmental Management Framework (EMF) provides general policies, guidelines, codes of practice and procedures for the management of environmental issues to be integrated into the implementation of the projects. More specifically, the objectives of the EMF are:

- To establish clear procedures and methodologies for the environmental and ethical review, approval and implementation of projects to be supported by Caritas India;
- To establish possible ways for networking and Lobbying for Environmental issues.
- To determine the training and capacity building
- To establish the project funding areas required to implement the EMF requirements;
- To provide practical resource materials for implementing the EMF.

The Policy Statement

Caritas India is committed to ensuring that "care for the environment" or "environmental justice" or "climate justice" embodied in Church teaching, which is intimately connected to human dignity and sustainable development. Caritas India is committed to ethics-based and sustainable development.

Towards this, a clearly articulated and commonly understood Policy on climate Justice will establish a blueprint on how environmental issues will be addressed in solidarity with focus communities and partners across India. Drawing upon CST, global and national policies and agreements, and considering the increasing environmental injustice to the focus communities, this policy document will serve as a guide of best practice in promoting environmental justice. This policy document is a reflection of Caritas India's continued commitment to the cause of Environment and Climate Justice.

The Context: Environmental degradations have adversely affected the vulnerable communities in the country. In the recent past, India has witnessed an increasing number of disasters and calamities like drought, flood, cloudburst, heat and cold waves, cyclone, etc. Parts of the country arefacing significant variations in climate, extreme seasons, land salination, increased crop failures, new vector and pest infestations, seawater intrusion, increased desertification, and a notable diminution in the diversity and population of flora and fauna. The coping mechanism of the poor and marginalized people crumbles with the extreme change in the climate leading to the loss of lives and livelihoods. Hence it is high time to have initiatives that support the communities in coping with the climate consequences through climate resilient & adaptive measures which are ecologically sensitive, economically viable, socially adaptive, traditionally practiced and culturally acceptable. Caritas India plan is aligned with International agreements such as 2015 Paris Agreement to limit climate change, agenda 2020 and Goal No. 13 of Sustainable Development Goals (SDG).

More than two-thirds of India's population are small-holder farmers living in rainfed areas. A large number of them do not own land and depend on secondary sources for their livelihood. Small-holder farmers are engaged in subsistence agriculture and practise family farming.

Scope of the Policy:

- Caritas India's Policy on Environment Management will be an overarching framework and a cross-cutting theme across all its programmatic areas, geography of operations, focus communities, partners and associates. It will weave a common thread of guiding principles for understanding and practising the environmental ethos across organizational and programme levels.
- This policy document is meant to help the staff, volunteers, partners, associates and decision-making bodies of Caritas India in internalizing the environmental justice concerns and in implementing uniform policy prescriptions.

Vision, Mission & Objectives

Vision: 'A future where our environmental interdependence "is met by joint responsibility, our common destiny by solidarity" where the goods of the creation are shared by all; and where all creation is cherished and held in trust for the common good and for future generations'

Mission: Promoting a proactive approach to make environmental justice an inherent cross-cutting element across the works of Caritas India and its partners based on science, catholic social teachings and doctrines and legally prescribed/accepted environmental principles and policies and seeking to deepen understanding and commitment towards environmental justice and fostering alliances and cooperation among the relevant stakeholders.

Objectives:

'Policy for Environmental Justice' will help Caritas- India and its partners

- To establish clear procedures and methodologies for the environmental, ethical and juridical review and compliances of organizational, programmatic and networking processes at Caritas- India;
- To specify appropriate roles and responsibilities, and outline the necessary reporting procedures, for managing and monitoring concerns of environmental justice related to the projects;
- To determine the training and capacity building needed to successfully implement the provisions of the policy;
- To establish the project funding areas required to implement the policy requirements; and
- To provide practical resource materials for implementing the policy.

Policy implementation: The policy Caring Creation @ Caritas India has been developed after due reflection and consultation with experts and activists in the field of Environment. It focuses on protecting, preserving and conservation of natural resources like land, water and biomass, thus bringing about much-needed balance in the environment. This policy, along with the introduction of long-term action-oriented programmes, helps in tackling environmental degradation through active participation of the focus communities. Focus will be made on the following:

- **Sustainable Development Goal & Climate Change:** "Goal 13 of Sustainable Development Goals (SDGs) seeks urgent action to combat climate change and its impact."
- **Laudato Si & Climate Change:** The very existence of Gods creations is at stake due to the extreme environmental degradation and the simultaneous extinction of various species on the earth. The extreme climate variability's adding more to the difficulties.
- **One Human Family, One Common Home:** Taking the inspirations from Laudato Si, Caritas Internationalis launched a campaign "One Human Family, One Common Home" during its General Assembly in 2019 to work together to face the unprecedented scale of difficulties being faced by the humanity.
- **Follow Green Protocol, Reduce the habit of generating waste:** Efforts will be made to green protocol as much as possible through adopting appropriate measures and mechanisms.
- **Integral Ecology:** In the encyclical Laudato Si, Pope Francis devoted entirely to ecological issues. Caritas India promotes environmental ethics to advocate for those at the margins of social consciousness who are most vulnerable to rapid environmental changes—the global poor and future generations.

Policy Statement: Caritas India is committed to protecting and promoting environmental health; solidarity with environmental justice and stewardship towards creation; and common good for all.

Recommended Practices

Promote Sustainable NRM and Sustainable Livelihoods

- Promote sustainable development of agriculture through technically sound, economically viable, environmentally non-degrading, and socially acceptable use of country's natural resources - land, water and genetic endowment
- Promote better management of natural resources through soil and water conservation, land-husbandry, nutrient recycling, forest protection, coastal zone and marine management, and ecosystem and biodiversity conservation
- For maintaining ecological balance and augmentation of bio-mass production in the agricultural systems, promote agro forestry and social forestry.
- Promote livelihoods improvement through sustainable NRM practices

Energy Conservation

- Promote an integrated approach to energy conservation and adoption of renewable energy technologies in the work and programs of the organization and partners.
- Set targets for reduction in energy consumption through saving and efficiency measures, devices and technologies

Climate Change

- Prioritize attention to the poor and vulnerable sections of society through an inclusive and sustainable development strategy, sensitive to climate change.
- Promote exploring of options to Achieve program objectives through a qualitative change in direction that enhances ecological sustainability, leading to further mitigation of greenhouse gas emissions.
- Promote appropriate technologies for both adaptation and mitigation of greenhouse gases emissions extensively as well as at an accelerated pace
- Facilitate organizational and programmatic ecological audits and set targets to reduce ecological (including carbon, water, energy etc.) foot prints in the organizational and programmatic functioning

Conclusion: Being an Organization committed to promoting and safeguarding the care for creations, It would serve as a guide of best practice environmental management in line with Caritas's ethical principles, catholic social teaching and environment concerns of the church and goals for the management of its organizations, partners as well as its developmental initiatives. It is hoped that this Policy will be beneficial in addressing issues systematically, consistent with globally and legally prescribed/accepted as well as self-defined ethical standards.

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