

AN APPLICATION OF GEOSPATIAL ANALYSIS TO MANAGE NATURAL RESOURCES IN AGRICULTURAL SETTINGS

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ABSTRACT

Due to the on-going use of chemical fertilizers and pesticides and unsustainable resource exploitation, farming in the contemporary world is infamous for being significantly exploited. It is undeniable that to sustainably feed a growing population, more and more grain products will be required. However, we cannot improve agricultural output and productivity at the expense of the natural environment. This is something that just cannot be done. This paper was created by doing significant desk research, appropriately developing the issue, and carefully analyzing the data. Using various modern, climate-smart, and ecologically friendly agriculture methods, farm output, and productivity may be boosted without endangering or exploiting the environment. These methods include rooftop gardening, low-input farming, precision farming, conservation agriculture, and many more.

Keywords: *Unsustainable, Productivity, Climate-Smart, Rooftop Gardening, Farm Output.*

Introduction

Water and nutrients required by plants and other living micro-and macro-organisms are stored in the soil as a reservoir. The nation's land productivity, which is not only inelastic but also heterogeneous in different parts and regions with varying configurations, capabilities, and suitability for various land resources, must be maintained and improved to meet the demand for food, energy, and other necessities for humans (Chakraborty, 2021). The preservation of land resources via integrated nutrient management may promote responsible land use consistent with the land's capabilities or suitability. It may help jump-start the growth of suitable land resources and their usefulness in the country. Over the last several decades, the availability of land has decreased as a direct result of the growing human and animal population. Since 1951, the amount of land that was available on a per-person basis has reduced all the way down to 0.27 hectares in 2011. During this period, the amount of public agricultural land per person dropped from 0.48 hectares to 0.15 hectares and then dropped again, this time to 0.12 hectares in 2016 (Goyal, 2019). Because crop production depends on rainfall, which may be somewhat unpredictable and varies in location and time, annual crop output is vulnerable to significant volatility.

Expanding economic growth and reducing poverty in rural areas may be done via implementing agricultural methods and social protection programmes. In point of fact, agriculture and social security may be able to complement and assist one another in a manner that is advantageous to both parties (Dahiru & Tanko, 2018). The Food and Agriculture Organization of the United Nations (FAO) can provide the knowledge and expertise on agriculture essential to developing practical solutions.

Objectives

- To elucidate the adverse impact of crop diversification.
- To investigate some aspects of natural resources management.
- To emphasize natural resource management and development planning and management of plant, animal, and micro-organism resources in a multidisciplinary and holistic manner with an institutional framework that can provide the basis for future sustainable food security.
- To find out ways to increase the production of environmental friendly products.
- To determine how we can avoid any further damage to our natural resources and how we can solve the problems of current farming methods.

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Methodology

This research article is mainly based on secondary data sources. Information is collected from different types of government websites and various kinds of journals. It is a qualitative research design.

Theoretical Concept

To effectively manage natural resources, it is necessary to guide how people engage with the settings in which they live. This concept integrates the management of water resources, biological diversity conservation, and long-term sustainability of sectors including forestry, mining, tourism, and agriculture. The management of natural resources places a strong emphasis on the ability of such resources to sustain life and scientific and technical knowledge of resources and ecology.

Some Aspects of Natural Resource Management

- **Agricultural Practices that Save Resources**

Agriculture that practices conservation, also known as "agricultural, environmental management," has the potential to be sanctioned and supported via various conservation programmes. Agriculture is "one of the most essential themes in the economics of most countries," according to the New Standard Encyclopaedia. The issue of resource preservation has become more essential as a result of the growing need for food by an increasing world population (LVan et al., 2021).

- **Farming in Precision**

The precision agricultural farming management strategy's three cornerstones are the observation, measurement, and control of inter-and intra-field variability in crop output. This concept has also been referred to as site-specific crop management, satellite farming, and precision agriculture (PA) (S. Singh et al., 2018). The capacity of both the farmer and the researcher to precisely determine their location within a field permits the construction of maps that depict the spatial variability of as many different variables as may be monitored. Using these maps, one may determine the most effective way to manage the field (Chakraborty, 2021). These sensors can communicate wirelessly even without a human observer, and variable rate technology (VRT) is used in conjunction with satellite imagery to guarantee that resources are allocated in the most efficient manner possible (Chopra, 2012).

- **Organic Farming**

More than half of Australia's land area is used for certified organic agriculture, which spans an area of 60 million hectares. Using fertilizers obtained from organic sources, such as compost, green manure, and bone meal, are one of the defining characteristics of organic farming. It emphasizes agricultural strategies such as crop rotation and companion planting to improve agricultural productivity (WMO, 2020). The cultivation of insect predators, the employment of natural ways to control pests, and the use of mixed cropping are all practices that are encouraged. Organic farming is a holistic method of agriculture that aims to improve both the soil fertility and the biological variety of the plants and animals raised on farms. Organic farming does not allow synthetic fertilizers, antibiotics, growth hormones, pesticides, and fertilizers. Artificial fertilizers are not allowed in organic agriculture. Market growth for organic foods and other goods has been exponential since 1990; in 2012, it was worth \$63 billion worldwide. Around 71,500,000 hectares of farmland globally, or 1.5% of all farmland, were used for organic farming as of 2018 (UNOSSC, 2018).

- **Low Input Farming and Sustainable Agriculture**

If just a tiny proportion of the available natural resources were directed into agricultural production, there would be the potential for far higher levels of output and productivity. Agriculture significantly impacts the natural world and is a significant factor in developing many environmental problems. The maintenance of a human population is dependent on several factors, one of which is the creation of ecologically sound food distribution networks (Murugan, 2019).

- **Management of Water Resources**

Water management in the agricultural sector must surmount the most significant challenge of enhancing water consumption efficiency while preserving agricultural sustainability. This may be performed by boosting crop water production, lowering the amount of water lost via soil evaporation, and increasing the amount of soil water stored within the rooting zone of the plant. The development of water management packages will be significantly aided by applying isotopic and radioactive technologies to investigate the relative impact of soil and irrigation management variables. For field-scale rooting zone investigations of soil water, the neutron probe for detecting soil moisture is ideally suited. It provides reliable data on the availability of water, which is required for measuring the amount of water that crops

consume and how efficiently they utilize it (NITI Aayog, 2020). It also makes it feasible to build strategies that will increase agricultural output, cut down on water losses that aren't useful, and halt the degradation of land and water.

- **Gardening on a Rooftop**

In the United States and Europe, a rooftop garden may be found on around one building out of every ten. Rooftop gardening offers the women of the family a fantastic opportunity to make productive use of their spare time while also contributing financially to the household in another sense. This is one of the most significant advantages of rooftop gardening and one of the most important benefits. Green roofs benefit the environment in several ways, including lowering carbon dioxide emissions and increasing the amount of plant and animal life on the top. Other familiar places for gardening on roofs include atriums, balconies, and window boxes. Roof gardening may also be done in these places (Zaman et al., 2018).

Growing plants on roofs is an important and doable alternative, especially for places experiencing rapid population growth. It has been reported that Senegal, Peru, Egypt, China, and India have all had successful experiences in horticulture (William J. Cosgrove, 2018). Even though urbanization and population growth have increased over the last several decades, the quantity of agricultural land that is accessible per person has decreased to 0.8 hectares (ha) due to the unplanned development of concrete jungles in different regions around the world. Local garbage can be utilized as a source of an organic and general-purpose growing substrate (Chakraborty, 2021), which may be used in a rooftop garden that relies only on waste from the surrounding metropolitan area. If there were a sufficient number of green roofs, environmental conditions would improve owing to a decrease in pollutants and an attenuation of the effects of climate change. This would be possible because of the increased surface area of green roofs (Pradhan, 2022).

This investigation aimed to shed light on the operational and conceptual parallels with income-production, addressing future possibilities and the benefits of having a rooftop garden. Transportation services are required in the food manufacturing and distribution sectors because of the high population density in urban areas. Gardening on rooftops is one of the probable possibilities that might help alleviate the problems that were discussed before (Thorpe, 2014).

- **An Ecological Strategy Focused on Resilience**

Stewardship of the environment is the responsible use of natural resources and the proactive conservation and preservation of those resources via implementing sustainable practices. Three different people work out for the environment: doers, givers, and practitioners. Those who are doers go out and support the cause by acting in some way. For instance, the "doers" would be the volunteers that traveled down the coast and assisted in cleaning up the oil that had been spilled on the beaches in the event of an oil spill (ANAND, 2017). A person who contributes monetarily to a good cause is called a donor. To generate finances, they may engage in various activities, ranging from contributing their own money to organizing events open to the public (Toppo, 2022).

In most cases, these entities are associated with the government. The third category consists of practitioners. Every day, they put forth an effort to guide governmental agencies, scientific communities, stakeholder organizations, and other entities in any direction that may result in better stewardship. These three organizations work together as environmental stewards and, with their assistance, ensure that the ecosystem continues to function healthily (Ledward, 2017).

Several International Strategies for NRM in Agriculture

- **Israel**

The Israeli agricultural sector stands out because of pressure irrigation systems, fully automated and manually controlled automation, and high-quality seeds and plants. Israel exports more than 5 million agricultural crops, 1.15 billion liters of milk, and 1.6 billion eggs annually (Chakraborty, 2021). It is utilized on more than half of the nation's cropland. Treated wastewater makes up around one-third of the 1,129 MCM of water that farmers use annually. To start, the Ministry of Agriculture and Rural Development strives to promote agriculture as a sustainable way to dispose of sewage. Treated wastewater (TWW), used to drip water orchards and crops not intended for human consumption, accounts for around one-third of agriculture's annual 1,129 million cubic meters (MCM) of water.

In terms of compatibility with treated wastewater, next-generation subsurface drip irrigation (SDI), also known as "subsurface drip irrigation," (Chakraborty, 2021) outperforms surface drip irrigation technology. Government agencies, including the Ministry, are dedicated to promoting water recycling while improving water treatment and wastewater treatment effectiveness. A new price structure in the

water business entices farmers to utilize treated wastewater in more significant quantities. Governments in Israel have to work closely together because of Israel's unique environment to promote agricultural development and sustainability. This ability is critical if we are to improve agriculture and ensure its long-term viability ("Water Governance: Challenges and Prospects," 2019).

- **United States of America**

The relationship between agriculture and the environment is a focus of the Economic Research Service (ERS), which conducts research. Agricultural producers may benefit from USDA (United States Department of Agriculture) conservation programmes that help them improve their environmental footprint (Chakraborty, 2021). The demand for organic products has grown in the double digits for more than a decade. Worldwide, the production of organic agricultural products has increased in developed or developing nations.

- **European Union**

An EU parliament committee is concentrating on water management in its Science and Technology Options Assessment (STOA). There is a focus placed on water management and the use of agricultural resources as part of the project. Other EU programmes' funding, the potential for better integration inside the EU, and environmental effects are all considered challenges. Thus, the project's objective is to give unbiased and qualified assistance in the ecologically responsible management of natural resource systems (Uzamukunda, 2015).

An EU-wide study of the potential role of scientific research and technology and industry best practices may ensure sustainable resource usage in Europe. Researchers are looking at these technologies' impact on various environmental elements, such as soil, air, and biodiversity. Another objective of the research is to determine which agricultural and land management issues may be handled using technology and which issues can best be resolved via the encouragement of non-technological alternatives (Chakraborty, 2021).

- **African Countries**

Despite the potential advantages, sustainable land management (SLM) has not yet been widely adopted. Sustainable landscape management is increasingly being included in the development objectives of African countries, claim Liniger et al. (2011). The three basic foundations of African forest policies are conservation areas, environmentally responsible wood harvesting, and community-based forest management. The rate of deforestation in Africa has only been somewhat slowed by conservation and development efforts. Outside the forest business, these policies have failed to consider the causes contributing to deforestation and forest degradation. An increasing number of African nations are participating in REDD+, promoting agricultural intensification and the development of sustainable wood-fuel supply chains.

Some Programmes in India for taking Care of Natural Resources

- **National Initiative for the Promotion of Sustainable Agriculture**

The National Action Plan on Climate Change, or NMSA, aims to make agriculture more sustainable (Toppo, 2022). The main goal is to increase agricultural production, especially in areas that depend on rain. The NMSA helps with mission deliverables that mainly involve agriculture and conservation. Rainfed agriculture, soil health management, organic farming, and every other part of the NMSA are essential to reaching the SDGs and INDCs ("Regulatory Environment for Organic Food Safety in Asia Pacific," 2020).

- **Development of Rainfed Areas**

It emphasizes integrated farming systems, also known as IFS, to boost output while simultaneously lowering the risks associated with the unpredictability of the weather. The Pradhan Mantri Krishi Sinchayee Yojana (PMKSY) was initiated in 2015–2016 with the tagline "Har Khet Ko Paani" to offer comprehensive solutions for the irrigation supply chain (Ministry of Jal Shakti, 2021). The PMKSY is not only concerned with ensuring sufficient water for agriculture but also about capturing rainfall at the micro-level by using "Jal Sanchay" and "Jal Sinchan." Pradhan Mantri Krishi Sinchai Yojana (PMKSY). This programme helps farmers get the most out of their farms to make a living and get the most out of their farms.

India has taken several steps to increase agriculture's adaptability and resistance to climate change's impacts. The goal is to reduce carbon emissions during this. According to a report from the Planning and Implementation Board (PIB), one of the eight goals that make up the National Action Plan

for Climate Change is the National Mission for Sustainable Agriculture (UNOSSC, 2018). The three most successful initiatives in this space are the National Food Security Mission, Bringing Green Revolution to Eastern India Initiative, and Rashtriya Krishi Vikas Yojana (RKVY), Crop Diversification Programme (NFSM). These initiatives include the National Bamboo Mission, Paramparagat Krishi Vikas Yojana (PKVY), Soil Health Card (SHC), and Mission Organic for Value Chain Development for the North East (MOCVD) (Chakraborty, 2021).

- The System of Rice Intensification (SRI), an alternative to transplanted rice, may be employed to expand the area under cultivation ("The Soils of India," 2020).
- Planting rabi crops in the rice crop leftovers without burning them using a zero-tillage drill and other residue management methods.
- Fertilization employing urea supergranules, slow-release nitrogen fertilizers, nitrogen injected under leaf colour charts, etc. Nutrient management integrated rice cultivation by direct planting, soaking, and drying alternately.
- (d) Application of a nectar-based coating to the region is necessary.
- Micro-irrigation is recommended for the Pradhan Mantri Krishi Sinchai Yojana-Per Drop More Crop effort (Chakraborty, 2021).
- Planting trees under the BGREI, NFSM, SMAF, and NBM programmes (Chakraborty, 2021).
- For replication in Krishi Vigyan Kendras (KVKs) and individual states, 45 integrated farming system (IFS) models were created to support climate-resilient agriculture (Chakraborty, 2021).

The Indian Council of Agricultural Research focuses on all 151 districts in the nation, intending to enhance the resilience of at least one hamlet in each. Disaster plans for agriculture are now being created for each of the 633 districts. A rule on utilizing biomass to produce electricity was created by the Ministry of Power in November 2017. According to the CEA, utilities for power plants, manufacturers of power equipment, and other stakeholders have been instructed to enhance the usage of biomass pellets. The Ministry of Power states that Punjab and Haryana would submit bids for any coal-based thermal power plants employing pellets made up of 5 to 10 percent biomass. A sum of Rs. 1151.80 crore has been set aside for the newly established central sector programme "Promotion of Agricultural Mechanization for In-situ Management of Crop Residue." (Pande, 2012) IEC (Information, Education, and Communication) programmes will use this funding to raise farmers' awareness (Chakraborty, 2021).

NRM's Significance in Agriculture

Overlying soil is shielded from the impact of precipitation by mulch, a standard ground cover. Wind and water erosion may be minimized by creating a layer of mulch on top of the soil that acts as a barrier between the soil and the mulch. This study shows that conventional agricultural production methods must be re-evaluated since natural resources such as land, air, water, and other natural resources are being depleted without restriction (S. Singh et al., 2018).

It has far-reaching consequences for the future availability of natural resources and ecosystem services when humans use ecosystems to their full potential (Chakraborty, 2021). These ramifications might impair food quality and increase the risk of natural disasters and health risks, among other things. An additional threat to ecosystems is the threat of invasive species and infectious diseases.

- **Sustainability in Agriculture**

In an essay published in the *Physiological Transactions of the Royal Society*, conservation agriculture and sustainable agriculture were explored. Conservation and sustainable agriculture were the main themes of the piece. Several diseases can be controlled by rotating crops. A natural pesticide and herbicide may be administered to certain crops by rotating crops. A plant's ability to absorb nutrients is boosted by the breakdown of organic molecules in the soil into phosphates and nitrates.

- **Farming with Pinpoint Accuracy**

Farmers in developing countries like India may benefit from precision agriculture, according to research by Anil K. Rajbanshi (2013). Precision agriculture reduces the environmental impact of traditional farming by improving the operating efficiency of agricultural equipment and increasing the amount of time it is put to use. Using remote management devices, such as GPS, may reduce fuel use in agriculture (Chakraborty, 2021). With the help of variable-rate fertilizer and pesticide applications, farmers may save money while also cutting down on toxic runoff into rivers. Research shows that precision farming can be a problem-solving tool in managing natural resources, as this study shows ("Climate Change and Resilient Food Systems," 2021).

- **Growing Food Organically**

According to Paul John (2006), agriculture has been practiced without synthetic chemicals for thousands of years. Artificial fertilizers date from the middle of the nineteenth century. Artificial fertilizer and other modern agricultural methods have long-term negative repercussions. Concerns were expressed concerning the presence of harmful substances in the food supply.

To enhance the nation's traditional agricultural practices, Albert Howard, the pioneer of the organic movement, and his wife Gabrielle Howard, a distinguished botanist, created the Institute of Plant Industry in India in 1921, according to research by Conford P. (2001). Gardening and farming in a biodynamic way. The Summer School and Conference on Biodynamic Farming of Bette Hanger were conducted at North Bourne's farm in Kent. Albert Howard and his wife, Gabrielle Howard, established the Institute of Plant Industry in India to improve agricultural practices there. Ehrenfried Pfeiffer, the author of the first book on "biodynamic agriculture," was invited to the UK by Walter James, 4th Baron of North Bourne, in July 1939. The supply-driven organic movement changes to demand-driven as public awareness of the environment rises. Farmers were attracted to the market by premium pricing and distinctive government incentives. Farming methods that mimic organic farming, but are not recognized by the government, are common in many developing nations.

- **Agriculture with Little Inputs and that is Sustainable**

Studies carried out in the arid Middle Eastern area of Wadi Ziqlab suggest that when planning and managing land use, it is crucial to consider how changing land use would affect factors like soil erosion. While the animals graze there, farmers cultivate cereals, vegetables, and olives. The Food and Agriculture Organization of the United Nations projects that industrial and urban growth will continue to take agricultural land in the following decades (Chakraborty, 2021). This loss is also impacted by the reclamation of wetlands and the conversion of forests into cropland. Increasing agricultural land use may have an influence on biodiversity in addition to contributing to deforestation. Studies in the Faroe Islands in the North Atlantic, for instance, revealed that natural grazing had less of an immediate impact on soil erosion and degradation than the customary Norse invaders' (Vikings') partition of land plots. On-renewable energy sources will only get more expensive as fossil fuels become scarcer. A lack of effort to "decouple" fossil fuels from agricultural production might harm global food security. Agricultural compounds are also produced using oil (Nautiyal et al., 2013).

According to the Agricultural Sustainability Institute at UC Davis, drought-resistant agricultural systems may be built via several measures. The water supply is being drained faster than it can be replenished in certain places, such as the Ogallala Aquifer. To avoid salinization, irrigation systems must be maintained appropriately and not use more water from their source than is replaced. It is now feasible to reliably produce large crop yields in locations that formerly relied only on rainfall, which has historically made the production of thriving agriculture uncertain (Gulbenkian Think Tank, 2014).

- **Water Management in Agriculture**

Carrying on business as usual is putting the Earth System at risk of being tipped out of the environment in which it has evolved and developed over time. Only a few decades ago were people aware of this. This new geological age has been dubbed the anthropogenic by some. The scarcity of clean water is one of the most pressing challenges of our day. This is true for creatures in freshwater and saltwater environments of all sizes (ANAND, 2017).

According to the World Health Organization (2007), over two billion people were impacted by natural catastrophes in the final decade of the twentieth century. Closed basins, where population expansion is more limited, are expected to house 1.4 billion people by 2050. The frequency and severity of flood-related damage have been increasingly exacerbated by developing potentially flood-prone regions near rivers and beaches.

The human component of water management, rather than the technological one, is likely to be the most significant challenge or limitation in the future. This is partly owing to the rapid speed of technological advancement and the sluggish pace of societal implications. Integrating water resources management is one technique to enhance water management (IWRM). The integrated development and management of water, land, and related resources are promoted by the IWRM process. Both IWRM and the concept of sustainability are more of a vision than a checklist to be checked off.

According to the Organization for Economic Co-operation and Development (OECD), a more thorough governance structure is required to manage integrated water resources (IWRM). Water was disregarded mainly at the 1992 Rio de Janeiro UN Conference on Environment and Development

(Randalls, 2011). The UN Sustainable Development Committee endorsed "Strategic Approaches to Freshwater Management" in 1998. Water has long been recognized as a need for achieving long-term development goals. Effective water governance has recently gained traction as a concept. Due to this, there is now a broader focus on corruption and power inequalities in poorer nations as part of the water agenda (Kapuria, 2018).

- **Rooftop Gardening**

Regarding modern-day resource management, rooftop gardening is becoming more popular. Recently, rooftop gardens have been the subject of a significant increase in literature on urban consumption. There are gardens in people's yards, on their balconies, and on the roofs of buildings, whether private or communal. Rooftop urban gardens may be a component of a wide range of systems.

Another justification for rooftop projects is that an increasing number of studies suggest that food production sites should gradually be close to central consuming regions in locations like South Africa and the United States, where urban space is limited, and poverty is rampant. These urban rooftop gardens may serve as meeting areas for locals and artisans to raise food. Local artists constructed some of the inventive structural components of the garden using recycled and repurposed materials (William J. Cosgrove, 2018).

A study by the University of Melbourne in Australia found that looking at a roof covered in grass for forty seconds may boost mental focus. People from all walks of life come together in a social networking space to grow food and develop their links to the local community. Some countries have unique constraints to using rooftop gardens to manage their resources; they include India ("Regulatory Environment for Organic Food Safety in Asia Pacific," 2020).

- **Protecting the Earth's Natural Resources**

Another very successful method in today's society is environmental stewardship. Intercultural methods for Earth Stewardship have been suggested by Ricardo Rozzi and his colleagues (2015). Long-term Socio-Ecological Research (LTSER) sites in the southern hemisphere are being highlighted for their ability to bring together local and global efforts to address pressing issues. As part of resilience-based ecosystem management, the focus is on ecosystems that offer a wide range of services rather than a particular resource.

Strategy for Agricultural Extension and Advisory Services in Natural Resource Management

The Agriculture Innovation System defines a commercialization network as "a network of organizations, firms, and people focused on commercializing innovative goods, processes, and organizational forms, as well as the institutions and regulations that control their behaviour and performance" (AIS). The Agriculture Innovation System (AIS), a network of organizations, businesses, and people, works to sell cutting-edge tools, processes, and business models. This is how different agents communicate, share information, access, trade information, and utilize knowledge. The AIS approach emphasizes the need to cultivate connections across the whole value chain, significantly beyond the farm gate. FPOs, AKSTs, rural organizations, farmers' organizations, and other similar entities play an essential role in the AIS-guided natural resource management process (Ledward, 2017).

- **Constant Depletion of Natural Resources**

India's landmass includes both lush rainforests and scorching deserts. The world's coal reserves rank fourth. Deposits in the Bombay High oil field off the shores of Maharashtra, Gujarat, Rajasthan, and eastern Assam may be able to provide around 25% of India's oil requirements (Chakraborty, 2021). To provide an integrated plan for managing the nation's natural resource base, the National Natural Resources Management System (NNRMS) was formed at the national level in 1983. Both NASA and the Planning Commission are in favour of it.

Approximately 24.02 percent of the total land surface is covered by trees and other types of flora. This information was included in a report on environmental accounting created and released by the Ministry of Statistics and Program Implementation (Chakraborty, 2021). In practically all states, the gross state product (GSDP) increased between 2005 and 2015 at an average rate of 7–8%. Progress doesn't necessarily have to cost money.

The biological forces that provide valuable goods and services to mankind are referred to as natural capital. A United Nations-approved framework system of environmental and economic accounts is used in this approach. The biological elements that provide humans with valuable goods and services are frequently referred to as "natural capital."

The wetlands and water bodies of Himachal Pradesh, Sikkim, Jammu, and Kashmir are feeling the effects of climate change, according to Down to Earth's 2018 State of India's Environment report. In certain areas, the amount of land covered in snow and glaciers has decreased by up to 24 percent. Due to unsustainable agricultural and household use, groundwater resources are being depleted in the Indian states of Tamil Nadu, Chhattisgarh, Goa, and Odisha. Assam and Uttarakhand slightly changed forest cover between 2010-2011 and 2015-2016, while the increasing stock declined by 10%. In contrast, inventory growth in the Indian states of Jharkhand, Madhya Pradesh, Maharashtra, and Rajasthan has exceeded 10%. More than a quarter of a billion cubic meters of natural gas were withdrawn from the north eastern region during 2006–07.

• **The Exploitation of Natural Resources for Agricultural Purposes**

The integrated farming system aims to reduce the adverse effects of intensive farming while still maximizing revenues and sustaining high output levels. Cropping, animal husbandry and fishing, forestry, and horticultural crops all play a role in achieving this goal. The IFS technique improves the reliability and environmental impact of the manufacturing process. Tropical island agriculture is susceptible to the biotic and abiotic pressures and natural disasters that these islands experience (Chakraborty, 2021). Natural resource depletion and harm to ecosystems have all played a role in this. Additionally, some factors lacked appropriate and high-quality germplasm and an integrated viewpoint. Crop rotation, cover crops, and crop rotation are examples of this.

Coconuts, areca nuts, black pepper, and tree spices are just a few of the precious commodities grown on these islands' plantations. Increasing output and productivity per square meter may be achieved by growing crops compatible with coconuts and integrating them with other businesses like dairy and poultry. Using plantations as an intercrop setting for planting spices like black pepper and clove is the best method for these places. Agricultural, dairy, and backyard poultry plantation-based farming techniques boosted farm production and productivity in the mountains on tropical islands. All three are linked to soil erosion, poor water retention, and low soil fertility (Chakraborty, 2021). An increased yearly net revenue of around \$1,070 and the creation of 198 jobs per hectare per year occurred from a change to the present agricultural scheme. In addition to crops, you may include dairy, poultry, and fish in your diet.

Recommendations

Based on what we've learned from the discussions, we're prepared to offer some recommendations to the decision-makers and other relevant authorities, including:

- To mobilize the local people for natural resource management, a community task force for minimizing and optimizing the use of natural resources was formed (NRM).
- Continuous local monitoring, auditing, and stewardship of local natural resources.
- A database on natural resource management will be developed utilizing participatory and non-participatory techniques. A few examples are a database of water bodies, biodiversity, local tribes, etc.
- A PBR (registrar of people's biodiversity) should be maintained by local governments so that changes over time may be tracked and compared.
- Initiate "climate managers" and other community-based stewardship groups for biodiversity, water, and livestock.
- Set up a local gene bank to safeguard the agricultural and pastoral ecologies.
- Furthermore, indigenous technological know-how is compiled to manage natural resources in a way that is effective and environmentally beneficial.
- Communities, non-governmental organizations (NGOs), schools, and local governments are involved in community-based decentralized planning.
- Restoring lost and buried lineages of biodiversity through enacting policies at both micro and macro levels to protect, regenerate, and preserve biodiversity.

Conclusion

"Wrong Civilization" eventually brings civilization to its knees, although it develops from the cultivation of natural resources and is directed by the benign earth. Humans are the only ones who can save the natural resources that have been given to us, and it is up to us to do it. A caveat, however, is that they must be preserved, used, and regenerated! The NRM uses both methodological and

operational approaches. Natural farming, landscape management, conservation, reproduction stewardship, and harnessing ecological resilience are a few strategies that fall under the umbrella term "conservation agriculture." No matter how hard we try, we will never be able to halt soil erosion, avoid contaminating water sources, or restore the natural diversity of plants and animals if we don't act now. With 75 percent of our food coming from 20 species and 80 percent of our animal protein coming from 30 species, we are no longer happy to allow the considerable biodiversity loss to go unchecked. Each year, an acre of land loses around 16 tonnes of topsoil owing to erosive forces, including wind and rain. It is not surprising that our country's food output has varied at 275 (+/-15) million tonnes per year with searing inelasticity, leading to policy paralysis for food security. If we wait one more day, we risk losing the identity and future of a few thousand more individuals. Our only choice is to return to our lovely environment and take care of its natural riches.

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