



CONSERVATION OF BIODIVERSITY FOR SUSTAINABLE AGRICULTURE

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Biodiversity conservation is

indispensable for sustainable agriculture. This concise abstract underscore its pivotal role in sustainable farming. Biodiversity, encompassing genetic diversity, species richness, and ecosystems, provides resilience to agriculture by facilitating adaptation to changing conditions and bolstering pest resistance. It offers vital ecosystem services, including pollination and pest control, enhancing crop yields and reducing reliance on chemical inputs. Furthermore, biodiversity sustains soil health, contributing to long-term agricultural viability. It preserves cultural heritage and supports diversified income sources for farmers, fostering sustainable livelihoods. To promote biodiversity conservation in agriculture, agroecological practices, habitat preservation, and organic farming should be embraced, supported by education and policy incentives for a sustainable agricultural future.

Introduction

Conservation of biodiversity is crucial for sustainable agriculture. It aims to protect and maintain the genetic diversity of plants and animals, ensuring their survival and evolution. Biodiversity is essential for the production of food, spices, medicines, fuels, fodder, and building materials. It also plays a vital role in preserving ecosystem health and resilience. Sustainable agriculture is the practice of cultivating and maintaining food, fibre, and other agricultural products in a way that preserves and improves ecosystem health and productivity while promoting social and economic well-being (Erbaugh et al., 2019). Sustainable agriculture recognizes the value of biodiversity and promotes the utilization of native species, the preservation of natural habitats, and the promotion of beneficial organisms such as pollinators and natural predators to control pests (Shreshta et al., 2020). By incorporating a greater diversity of crops and livestock, practicing sustainable soil management, and reducing the use of synthetic inputs, we can increase biodiversity and ecosystem services without negatively affecting yields. To secure existing genetic biodiversity while allowing evolution, it is important to build a wide base of genetic resources that meet present and future demands. Currently, approximately 7.4 million germplasm accessions representing more than 16,500 plant species are conserved in gene banks worldwide. It entails incorporating environmental stewardship, economic viability, and social responsibility ideals into agricultural systems.

Agriculture's Biodiversity: Dimensions

Agricultural biodiversity has the following criteria to consider.

- Genetic resources for food and agriculture:



- Plant genetic resources, such as those found in crops, wild plants that are managed for food production, farm trees, and species found in pastures and rangelands,
- Animal genetic resources, such as those from domesticated species, wild species that are sought for food, wild and farmed fish, and other aquatic organisms, the genetic resources of microbes.
- These make up the primary units of production in agriculture, and they include wild relatives of cultivated and domesticated species as well as managed wild plants and animals.

Biodiversity elements that sustain the ecological services that underpin agriculture. These include a wide variety of creatures that participate in a number of processes at different scales, including nutrient cycling, pest and disease control, pollination, pollution and sediment control, hydrological cycle maintenance, erosion control, climate regulation, and carbon sequestration.

Abiotic factors that influence agricultural biodiversity include regional meteorological and chemical variables, ecosystem physical characteristics, and ecosystem processes. Social, economic, and cultural factors. A huge number of people rely on agricultural biodiversity for sustainable livelihoods, and it is substantially influenced and preserved by human activities and management practises. These characteristics include participatory methods, cultural elements, traditional and local knowledge of agricultural biodiversity, and tourism related to agricultural landscapes.

Importance of Biodiversity in Agriculture

Agriculture must be sustainable in achieving society's objective of supplying enough, secure, and nourishing food. Production methods that depend on artificial feeds,

supplements, and antibiotics for livestock and aquaculture production as well as chemical fertilisers, pesticides, herbicides, and water for crop production need to be changed. They are not sustainable, harm the environment, lessen the food's nutritional and health benefits, impair the performance of crucial ecosystem functions, and cause biodiversity loss. At the same time, food production must do its part to lower the almost 1 billion people who still suffer from food insecurity and malnutrition.

Special Nature of Agricultural Biodiversity

Agricultural biodiversity is crucial to provide fundamental human requirements for food and livelihood security. Over many generations, human activities and practises have shaped and continued to shape the agricultural biodiversity (Bruno and John Antle, 2020). Farmers' communities are crucial in their capacity as managers and stewards of agricultural biodiversity. Because of this, local and traditional knowledge and culture are seen as essential components of managing agricultural biodiversity. The preservation of agricultural biodiversity in production systems is inextricably connected to sustainable use because of the extent of human management. But nowadays, a lot of agricultural biodiversity is preserved outside of its natural habitat in gene banks or breeders' materials (Wang et al., 2023).

Agriculture has considerably increased species diversity, which is at least as important for domesticated animals and crops as species diversity between species. There is a significant degree of reliance between countries when it comes to the genetic resources for food and agriculture because many farming systems are dependent on exotic crop species that have been imported from abroad. Agro-



ecosystems' in-situ interactions with the environment, genetic resources, and management techniques frequently help to preserve a dynamic array of agricultural biodiversity (Jules Pretty, 2020).

Main Threats to Biodiversity

When natural ecosystems are altered or modified to meet human demands, habitat loss results.

Climate change: It changes the ecosystems and climate patterns that have supported and sustained organisms throughout their evolutionary histories.

Overexploitation, also known as unsustainable use, occurs when biodiversity is used more quickly than it can be replaced (Niesenbaum, 2019). Over time, this can lead to species extinction.

Invasive alien species (IAS) are a major factor in biodiversity loss because they have spread outside of their natural environment and pose a hazard to the local ecosystem. These animals threaten native biodiversity in a variety of ways, including as predators, parasites, disease vectors (or carriers), or as direct rivals with local species for food and habitat (Yuki et al., 2023).

Pollution is a rising hazard to both terrestrial and aquatic ecosystems, especially when it comes to nutrients like nitrogen and phosphorus. Although the widespread use of fertilisers has enhanced food production, it has also seriously harmed the environment, leading to eutrophication.

Role of farming systems in biodiversity

Biodiversity is a key regulator of agro-ecosystem functions, not just in the strictly biological sense of impact on production, but also in terms of meeting a variety of requirements of the farmer and society at large, (Buchs, 2003). In particular, it makes agro-ecosystems more resilient and serves as a tool for risk management and climate change adaptation as a result. Farmers and

other agro-ecosystem managers can build on, improve, and manage the vital ecosystem services that biodiversity provides in order to move towards sustainable agricultural output. This is possible through effective agricultural methods that adhere to ecosystem-based techniques intended to increase the sustainability of production systems (Wilhelm, 2020). These should:

- Maintaining a high degree of crop genetic diversity will help to boost and sustain output levels and nutritional diversity throughout the broad spectrum of various agro-ecological settings;
- Integrate planned biodiversity (crop sequences and associations) and related diversity (for instance, wild pollinators) through ecosystem-approach tactics;
- Adopt management techniques for the production system, such as maintaining mulch layers made of agricultural wastes and cover crops to boost the biological activity and variety of the system
- Take into account how better biological processes like pollination can result from having land fragmented (such as riparian areas and forest land inside an agricultural landscape)

Aim to produce commodities that meet consumer demands for high-quality, safe products that are produced in an environmentally and socially responsible manner (Hrustek, 2020). Improve the adaptation of good farming practises (e.g., pest management strategies, etc.) that adhere to ecosystem-based approaches designed to improve the sustainability and agricultural biodiversity of production systems.

**Conclusion**

In conclusion, the conservation of biodiversity is not merely an option but an imperative for achieving sustainable agriculture. Biodiversity plays a multifaceted and indispensable role in ensuring the resilience, productivity, and ethical integrity of our food systems. By preserving genetic diversity, agriculture gains access to a wealth of adaptive traits, safeguarding against environmental uncertainties and pest pressures. Biodiversity-driven ecosystem services, from pollination to pest control, optimize agricultural productivity while reducing environmental harm. Moreover, biodiversity sustains soil health, enriching the very foundation of agriculture.

Beyond the ecological advantages, biodiversity in agriculture fosters cultural heritage, diversified income streams, and sustainable livelihoods for farmers. It is a bridge between the past and the future, preserving age-old wisdom while pioneering innovative, sustainable practices. To secure a sustainable agricultural future, we must embrace and prioritize biodiversity conservation. Through agroecological practices, habitat preservation, and organic farming, supported by education and policy incentives, we can harmonize food production with the preservation of our planet's invaluable biodiversity, ensuring a healthier and more resilient world for generations to come.

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