2026 Volume: 02 Issue: 03 www.ijrpa.com ISSN 2456-9995 Research Article

International Journal Research Publication Analysis

Page: 01-08

AGROBIODIVERSITY CONSERVATION AND SUSTAINABLE AGRICULTURE: CHALLENGES AND OPPORTUNITIES WITH SPECIAL REFERENCE TO INDIA

***[1]M V V Satyaveni, [2]B. Ramana Rao, [3]Dr. Nagendra Prasad Kosuri, [4]N. Nageswara Rao**

[1]Assistant Professor of Botany, Government College (A), Rajahmundry., Andhra Pradesh.

[2]Associate Professor of Botany, Government College, Bhupalpally, Telangana State.

[3]Assistant Professor of Botany, Government College (A), Rajahmundry., Andhra Pradesh.

[4]Assistant Professor of Botany, Government College (A), Rajahmundry. Andhra Pradesh.

Article Received: 3 February 2026
Article Revised: 23 February 2026
Published on: 16 March 2026

***Corresponding Author: M V V Satyaveni**
Assistant Professor of Botany, Government College(A), Rajahmundry., Andhra Pradesh.

DOI: https://doi-doi.org/101555/ijrpa.2190

ABSTRACT

Agrobiodiversity plays a critical role in sustaining agricultural productivity, ecological balance, and global food security. It includes the diversity of crops, livestock, microorganisms, and ecological processes that support agricultural systems. However, the rapid expansion of industrial agriculture, monoculture farming, and the widespread adoption of high-yielding crop varieties have resulted in significant losses of traditional crop varieties and genetic resources. This study examines the importance of agrobiodiversity, the factors contributing to its decline, and strategies required for its conservation, with special reference to India as one of the world's major centres of genetic diversity. Using both primary and secondary data sources, the study analyses the role of traditional agricultural practices, policy frameworks, and conservation strategies in maintaining agrobiodiversity. The findings highlight the urgent need for integrated conservation approaches, including in situ and ex situ strategies, policy reforms, and protection of indigenous knowledge systems. Strengthening agrobiodiversity conservation is essential for sustainable agriculture, climate resilience, and long-term food security.

KEYWORDS: Agrobiodiversity, biodiversity conservation, sustainable agriculture, genetic resources, traditional knowledge, India.

1. INTRODUCTION

Agrobiodiversity, also referred to as agricultural biodiversity, encompasses the variety and variability of plants, animals, and microorganisms that contribute to food production and agricultural ecosystems. It includes genetic resources of crops and livestock, soil organisms, pollinators, and diverse farming systems that support agricultural productivity and environmental sustainability (FAO, 2019).

Agrobiodiversity provides several ecosystem services such as soil fertility maintenance, nutrient cycling, pest control, pollination, and climate resilience (Altieri, 2002). Traditional agricultural systems historically maintained a rich diversity of crops and livestock adapted to local environmental conditions.

However, the rapid transformation of agriculture during the twentieth century, particularly during the Green Revolution, led to increased reliance on monoculture farming systems and high-yielding crop varieties. Although these developments significantly increased food production, they also resulted in the erosion of genetic diversity and the decline of traditional farming systems (Shiva, 1991).

The loss of agrobiodiversity threatens the resilience of agricultural systems and increases vulnerability to climate change, pests, and diseases. India represents one of the world's most significant centres of agrobiodiversity, hosting a wide range of crop species, wild relatives, and indigenous farming practices developed over centuries. Despite this richness, rapid agricultural modernization has contributed to the gradual decline of traditional crop varieties and indigenous knowledge systems.

Therefore, understanding the importance of agrobiodiversity and identifying effective strategies for its conservation have become major priorities for sustainable agricultural development.

2. Research Gap

Although substantial research has been conducted on biodiversity conservation and agricultural sustainability, significant gaps remain in understanding the integrated relationship between traditional farming systems, agrobiodiversity conservation, and modern agricultural development, particularly in developing countries such as India.

Most studies focus either on genetic resource conservation or agricultural productivity, while relatively few examine how traditional knowledge systems, indigenous crop varieties, and policy frameworks collectively contribute to agrobiodiversity conservation. Furthermore,

limited attention has been given to the role of local communities and rural women in preserving traditional plant varieties and ecological knowledge.

Therefore, comprehensive research is required to explore the ecological, socio-cultural, and policy dimensions of agrobiodiversity conservation.

3. Objectives of the Study

The major objectives of this study are:

1. To examine the concept and components of agrobiodiversity.
2. To analyse the causes and consequences of agrobiodiversity loss.
3. To evaluate the role of traditional farming systems in conserving biodiversity.
4. To assess the current status of agrobiodiversity in India.
5. To propose policy measures and conservation strategies for sustainable agriculture.

4. Methodology

This study adopts a **descriptive and analytical research design** using both primary and secondary sources of data.

4.1 Primary Data

Primary information was obtained from official documents and reports published by the **Indian Council of Agricultural Research (ICAR)** and other agricultural research institutions.

4.2 Secondary Data

Secondary data were collected from scholarly journal articles, books, government reports, international organization publications, and policy documents related to agrobiodiversity and sustainable agriculture.

The collected information was analysed qualitatively to identify patterns, trends, and policy implications associated with agrobiodiversity conservation.

5. RESULTS

5.1 Importance of Agrobiodiversity

Agrobiodiversity plays a vital role in ensuring food security, improving soil health, and maintaining ecosystem stability. Diverse agricultural systems reduce vulnerability to pests, diseases, and climatic stresses. Genetic diversity also provides essential resources for plant breeding and crop improvement (Brush, 2004).

Traditional farming systems such as mixed cropping, agroforestry, and home gardens maintain high levels of biodiversity and enhance ecological resilience.

Food Security and Nutrition

Agrobiodiversity ensures the availability of diverse crops and livestock species that provide balanced nutrition and essential micronutrients.

Climate Change Adaptation

Diverse crop varieties and livestock breeds enhance the adaptive capacity of farming systems to climate variability, including droughts, floods, and extreme temperatures.

Pest and Disease Regulation

Crop diversification disrupts pest cycles and reduces reliance on chemical pesticides.

Soil Health and Fertility

Different plant species contribute to nitrogen fixation, organic matter accumulation, and improved soil structure.

Economic Stability for Farmers

Diversified farming systems reduce financial risks and provide multiple sources of income.

Conservation of Genetic Resources

Agrobiodiversity preserves traits such as drought tolerance, disease resistance, and stress adaptability that are crucial for crop improvement.

Ecosystem Services

Agricultural biodiversity supports pollination, nutrient cycling, water regulation, and carbon sequestration.

Cultural and Indigenous Knowledge

Traditional farming communities conserve diverse crop varieties through generations of indigenous knowledge and farming practices.

5.2 Decline of Agrobiodiversity

Despite its importance, agrobiodiversity has declined significantly during the past century. The expansion of monoculture farming, excessive use of agrochemicals, and the replacement

of traditional varieties with high-yielding hybrids have contributed to the erosion of genetic diversity (FAO, 2019).

Currently, only a few crop species dominate global agriculture. Rice, wheat, and maize together account for a large proportion of global food production, creating a narrow genetic base that increases vulnerability to environmental stresses.

5.3 Status of Agrobiodiversity in India

India is recognized as one of the world's **twelve mega-biodiversity countries**. The country hosts more than **18,000 species of higher plants**, including numerous crop species and their wild relatives (ICAR, 2020).

Traditional farming communities utilize nearly **1,500 wild edible plant species** and numerous ethnobotanical plants for medicinal and nutritional purposes. India is also considered a centre of origin for several important crops such as rice, sugarcane, banana, mango, pigeon pea, sesame, and black gram.

Traditional agricultural systems maintain complex ecological relationships among crops, livestock, soil organisms, and pollinators. However, the spread of modern agricultural technologies has significantly reduced crop diversity in several regions.

5.4 Agro-Ecological Diversity of India

India's agrobiodiversity is influenced by diverse climatic conditions and ecological zones. Major agrobiodiversity regions include:

- Western Ghats – rich diversity of spices and plantation crops
- North-Eastern Himalayas – high diversity of rice and millets
- Indo-Gangetic Plains – diversity of cereals, pulses, and oilseeds
- Central Indian Plateau – diversity of minor millets and pulses
- Himalayan Region – centre for temperate fruits and medicinal plants

These regions host significant crop genetic diversity and traditional landraces.

5.5 Traditional Agricultural Systems

Several traditional farming systems help conserve biodiversity naturally, including:

- Mixed cropping
- Agroforestry
- Home gardens
- Shifting cultivation (Jhum)

These systems integrate crops, trees, and livestock, promoting ecological resilience and sustainable agricultural production.

5.6 Threats to Agrobiodiversity

Major threats include:

- Monoculture farming
- Replacement of traditional crop varieties
- Chemical-intensive agriculture
- Climate change impacts
- Land degradation and habitat loss

Approximately **30% of India's land area is affected by degradation**, which negatively impacts agricultural biodiversity.

5.7 Conservation Strategies

Agrobiodiversity conservation involves two main approaches.

In-situ Conservation

Conservation within natural ecosystems and traditional farming systems, including on-farm conservation and community seed banks.

Ex-situ Conservation

Conservation outside natural habitats through gene banks, botanical gardens, and research institutions.

India maintains significant plant genetic resources through the **National Bureau of Plant Genetic Resources (NBPGR)** and other national institutions.

6. DISCUSSION

The findings highlight the critical role of agrobiodiversity in maintaining sustainable agricultural systems. Traditional farming practices historically conserved diverse crop varieties and ecological interactions. However, modernization of agriculture has disrupted these systems and contributed to biodiversity loss.

Effective conservation requires a combination of **in situ conservation within traditional farming systems and ex situ conservation through gene banks and research institutions**. Strengthening policy frameworks, farmer participation, and protection of indigenous knowledge systems is essential for long-term conservation.

7. Policy Implications and Recommendations

The following measures are recommended to strengthen agrobiodiversity conservation:

- Development of national policies promoting biodiversity-friendly agriculture
- Protection of farmers' rights and traditional knowledge
- Promotion of agroecological farming practices
- Strengthening research institutions and gene banks
- Increasing public awareness on biodiversity conservation
- Enhancing participation of local communities in conservation programmes

8. CONCLUSION

Agrobiodiversity is fundamental for sustainable agriculture, ecological stability, and global food security. The erosion of genetic diversity caused by industrial agriculture and monoculture farming poses serious threats to future food systems.

India, as a major centre of agrobiodiversity, possesses significant potential for conserving traditional crop varieties and indigenous knowledge systems. Effective conservation strategies must integrate scientific research, traditional agricultural practices, and supportive policy frameworks.

Strengthening agrobiodiversity conservation will enhance agricultural sustainability, improve climate resilience, and ensure long-term food security.

REFERENCES

1. Altieri, M. A. (2002). Agroecology: The science of natural resource management. *Agriculture, Ecosystems & Environment*, 93(1–3), 1–24.
2. Altieri, M. A., & Nicholls, C. I. (2017). The adaptation and mitigation potential of traditional agriculture in a changing climate. *Climatic Change*, 140(1), 33–45.
3. Brush, S. B. (2004). *Farmers' bounty: Locating crop diversity in the contemporary world*. Yale University Press.
4. Convention on Biological Diversity. (1992). *Convention on Biological Diversity*. Rio de Janeiro.
5. FAO. (2010). *The Second Report on the State of the World's Plant Genetic Resources for Food and Agriculture*. Rome.
6. FAO. (2019). *The State of the World's Biodiversity for Food and Agriculture*. Rome.
7. ICAR. (2020). *Plant Genetic Resources in India: Conservation and Utilization*. New Delhi.

8. Jarvis, D. I., et al. (2011). An integrated approach to crop genetic diversity management. *Proceedings of the National Academy of Sciences*.
9. Perfecto, I., & Vandermeer, J. (2010). The agroecological matrix as alternative to the land-sparing model. *PNAS*.
10. Shiva, V. (1991). *The Violence of the Green Revolution*. Zed Books.
11. Tilman, D., et al. (2011). Global food demand and sustainable intensification of agriculture. *PNAS*.
12. Thrupp, L. A. (2000). Linking agricultural biodiversity and food security. *International Affairs*.
13. Wood, D., & Lenné, J. (1997). The conservation of agrobiodiversity on-farm. *Biodiversity and Conservation*.
14. Zimmerer, K. S. (2014). Conserving agrobiodiversity amid global change. *Agriculture and Human Values*.