



Role of Floriculture in Promoting Biodiversity and Enhancing Ecosystems: A Comprehensive Review

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ABSTRACT

Floriculture plays a noteworthy role in encouraging biodiversity and building up ecosystems. By cultivating and conserving a vast variety of flowering plants, floriculture comes up with the conservation of plant species and their habitats. Floriculture is a domain of horticultural sciences, concerning with growing, handling, maintaining and marketing of ornamentals, growing at the neck-breaking speed, reflecting the gesture of this business globally. The Sustainability of floriculture is aiming to reduce environmental degradation, maintain productivity, build up economic viability, conserve resources and energy and maintain stable communities and quality of life. The sustainable practices include INM (Integrated Nutrient Management), IPM (Integrated Pest Management), crop rotation and efficient utilization of water. There is considerable interest in the loss of ecosystems and the associated biodiversity, due to intensive agriculture, pasture desertion,

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pollution and climate change. In agroecosystems, biodiversity performs a variety of ecological services beyond the production of food, including recycling of nutrients, regulation of microclimate and hydrological processes, suppression of undesirable organisms and detoxification of harmful chemicals.

Keywords: Floriculture; biodiversity; urban ecosystem; green infrastructure.

1. INTRODUCTION

Floriculture plays an important role in the global horticulture industry by focusing on the cultivation and trade of ornamental plants and flowers. It encloses various activities, such as production, marketing, and distribution of cut flowers, potted plants, and foliage. The role of floriculture extends beyond its aesthetic appeal, impacting economic, social, and environmental aspects. Economically, floriculture contributes to job creation and income generation for farmers, workers, and related industries. According to the International Association of Horticultural Producers (AIPH), the global flower and plant market was valued at USD 103.3 billion in 2020, indicating the economic significance of the industry [1].

From a social perspective, floriculture enhances the quality of life by providing beauty, improving mental well-being, and creating opportunities for leisure and cultural activities. Flowers and plants are used in various social and cultural contexts, such as weddings, religious ceremonies, and celebrations. Environmentally, floriculture plays a role in conservation and biodiversity. The production of flowers and plants encourages the preservation of green spaces, as well as the cultivation of native and endangered species. Additionally, floriculture can contribute to the reduction of carbon dioxide levels through photosynthesis and help mitigate the effects of climate change.

1.1 Background of Floriculture

The first recorded evidence of Floriculture dates back to the early 1500s when flowers were grown in greenhouses in Holland. Today, Floriculture is a multibillion-dollar industry with a global reach. In the United States, Floriculture is a nearly \$20 billion industry, with California being the top producer of flowers. The Netherlands is the world's largest exporter of flowers, followed by Germany and Italy.

The types of flowers grown for Floriculture are largely dictated by the climate and the market

demand. However, roses and orchids (which also happen to be the highest-value flowers in the floriculture industry) are grown throughout the world. Certain varieties of these high-value crops have been developed for specific climates as well. In Korea, which boasts a temperate climate with warm summers and cold winters, 'Kimigayo' (a type of orchid) is grown.

1.2 Floriculture Business

There is a high scope in both floriculture and horticulture wherein Floriculture businesses produce fresh and dried flowers and foliage for a mixture of markets such as wholesale flower markets, florists and retail outlets, and in some cases for export. Industrial Floriculture has a lot of promise. Soil, environment, manpower, transportation, and demand are all significant factors in deciding the scope of Commercial Floriculture.

People now realize the value of open space, parks, and gardens for leisure, peace of mind, leisure, and unpolluted air as almost all major cities expand rapidly to meet this rapidly increasing population, cement concrete, the jungle is also evolving at the same time. Thus, bio-aesthetic planning, which goes hand and hand with town planning, is required to resolve both of these concerns. In today's world, a floriculture garden in a country yard is an important feature of everyday life.

Importance of biodiversity preservation for ecological balance and sustainable development: Biodiversity preservation is crucial for ecological balance and sustainable development due to the following reasons:

1. **Ecosystem Stability:** Biodiversity helps maintain the stability and resilience of ecosystems. Species interactions, such as pollination, seed dispersal, and predation, contribute to the overall functioning of ecosystems, ensuring their long-term stability and productivity [2].
2. **Nutrient Cycling:** Biodiversity plays a vital role in nutrient cycling within ecosystems.

Different species contribute to the breakdown of organic matter, nutrient absorption, and recycling processes. The loss of biodiversity can disrupt these essential processes, leading to imbalances and reduced ecosystem productivity [3].

3. **Climate Regulation:** Diverse ecosystems, such as forests and wetlands, are crucial for climate regulation. They absorb and store carbon dioxide, a greenhouse gas, helping to mitigate climate change. Preserving biodiversity ensures the maintenance of these ecosystems, which are essential for climate regulation [4].
4. **Economic Benefits:** Biodiversity provides numerous economic benefits, including food, medicine, and raw materials [5].
5. **Resilience to Environmental Changes:** Biodiversity enhances the resilience of ecosystems to environmental changes, such as natural disasters and climate variability [6].

1.3 Floriculture and Plant Species Diversity

Role of floriculture in promoting biodiversity and enhancing ecosystems: Floriculture plays a significant role in promoting biodiversity and enhancing ecosystems. By cultivating and conserving a wide variety of flowering plants, floriculture contributes to the conservation of plant species and their habitats. Here are some key points about the role of floriculture in

promoting biodiversity and enhancing ecosystems:

1. **Plant Diversity:** Floriculture involves cultivating a wide range of flowering plants, including both native and exotic species. This diversity contributes to the overall plant biodiversity in an area, supporting various pollinators, birds, and other wildlife that rely on specific plants for food and habitat [7].
2. **Pollinator Support:** Many flowers grown in floriculture serve as nectar and pollen sources for bees, butterflies, and other pollinators [8].
3. **Habitat Creation:** Floriculture can create new habitats for various organisms. Greenhouses, for instance, offer sheltered environments where plants can grow year-round, providing nesting sites and food sources for birds, insects, and small mammals [9].
4. **Genetic Conservation:** Floriculture often involves the cultivation of endangered or rare plant species. By propagating and conserving these plants, floriculture contributes to genetic preservation, supporting biodiversity conservation efforts [10].
5. **Educational and Cultural Value:** Floriculture enhances public awareness and appreciation for plant diversity, ecosystems, and the importance of biodiversity conservation.

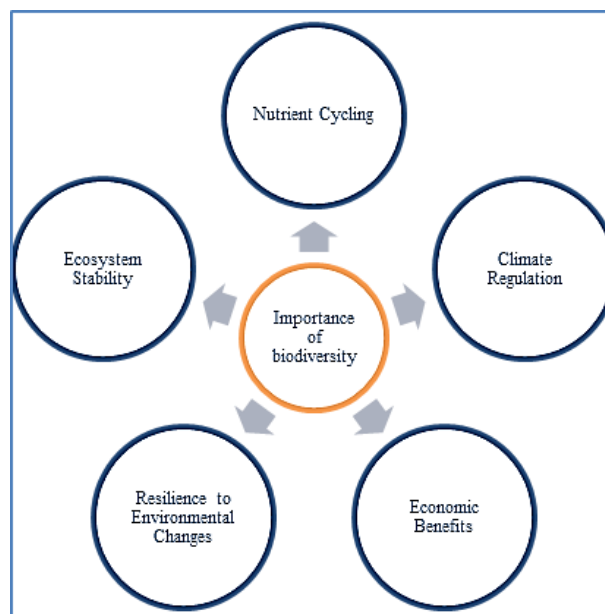


Fig. 1. Importance of biodiversity preservation

Table 1. Floriculture and Plant Species Diversity

Plant Diversity					
Ornamental trees species	Ornamental Shrubs	Ornamental Climber	Ornamental Palm	Ornamental Cactus	Ornamental bulbous plants
1. <i>Acacia suma</i>	<i>Abutilon striatum</i>	<i>Derris scandens</i>	<i>Bactris gasipaes</i>	<i>Myrtillocactus geometrizans</i>	<i>Alpinia</i> spp.
2. <i>Acer caesium</i>	<i>Acalypha</i> spp.	<i>Passiflora edulis</i>	<i>Bactris major</i>	<i>Neogomesia agaviodes</i>	<i>Alstomeria</i> spp.
3. <i>Adansonia digitata</i>	<i>Acalypha hispida</i>	<i>Petrea volubilis</i>	<i>Elaeis oleifera</i>	<i>Pelecyphora asseliformis</i>	<i>Amaryllis belladonna</i>
4. <i>Careya arborea</i>	<i>Beloperone guttata</i>	<i>Gloriosa superba</i>	<i>Euterpe edulis</i>	<i>Pereskia</i> spp.	<i>Gloriosa superba</i>
5. <i>Cassia excelsa</i>	<i>Datura chlorantha</i>	<i>Dioclea glycinoides</i>	<i>Nypa fruticans</i>	<i>Wilcoxia viperiana</i>	<i>Gloxinia speciosa</i>
6. <i>Delonix regia</i>	<i>Ixora aliporensis</i>	<i>Hiptage madablota</i>	<i>Chamaerops humilis</i>	<i>Zygocactus truncactus</i>	<i>Gladiolus</i> spp.
7. <i>Gustavia augusta</i>	<i>Jacobinia carnea</i>	<i>Antigonon leptopus</i>	<i>Actinorhytis calapparia</i>	<i>Frailea castanea</i>	<i>Freesia refracta</i>
8. <i>Erythrina variegata</i>	<i>Eranthemum laxiflorum</i>	<i>Aristolochia elegans</i>	<i>Hyphaene coriacea</i>	<i>Gymnocalycium</i> spp.	<i>Dahlia variabilis</i>
9. <i>Barringtonia racemosa</i>	<i>Brunfelsia americana</i>	<i>Camoensia maxima</i>	<i>Kerriodoxa elegans</i>	<i>Haageocereus versicolor</i>	<i>Heliconia</i> spp.
10. <i>Barringtonia acutangula</i>	<i>Daedalacanthus</i> spp.	<i>Bougainvillea spectabilis</i>	<i>Acrocomia aculeata</i>	<i>Acanthocalycium violaceum</i>	<i>Hemerocallis fulva</i>

[11,12]

Contribution of floriculture to the conservation of endangered and threatened plant species: Floriculture, the cultivation and trade of flowers and ornamental plants, can contribute to the conservation of endangered and threatened plant species in the following ways:

1. **Ex situ Conservation:** Floriculture often involves the cultivation of rare and endangered plant species in controlled environments, such as botanical gardens, nurseries, and specialized facilities. These cultivated populations serve as "ex situ" conservation collections, providing a safe haven for endangered plants outside their natural habitats [13].
2. **Propagation and Multiplication:** Floricultural practices often involve propagation techniques such as tissue culture, micropropagation, and seed germination, which can be applied to endangered and threatened plant species. These techniques allow for the rapid multiplication of plants, increasing their numbers and genetic diversity for future reintroduction or restoration efforts [14].
3. **Market Demand and Economic Incentives:** The commercial value of rare and exotic plant species can create economic incentives for their conservation [13].

4. **Awareness and Education:** Floriculture can raise public awareness about endangered and threatened plant species by showcasing them in gardens, exhibitions, and floral displays. These public-facing platforms provide opportunities to educate the public about the importance of plant conservation and the need for sustainable practices [15].

Benefits of maintaining diverse plant species for ecosystem resilience: Maintaining diverse plant species within ecosystems provides several benefits for ecosystem resilience:

1. **Resistance to Disturbances:** Ecosystems with higher plant diversity are often more resistant to disturbances such as drought, disease outbreaks, and invasive species [16].
2. **Ecosystem Services Provision:** Diverse plant communities support the provision of essential ecosystem services, such as pollination, water purification, and soil fertility. Plant diversity also enhances water filtration and nutrient cycling processes, benefiting human well-being and ecosystem functioning [17].
3. **Adaptation to Climate Change:** Plant diversity plays a critical role in adapting to climate change. This adaptive capacity is

essential for ecosystems to withstand the impacts of climate change, such as temperature fluctuations and altered precipitation patterns [18].

4. **Genetic Resources for Future Adaptation:** Maintaining diverse plant species preserves a broad genetic pool that can be tapped into for future adaptation [19].

1.4 Floriculture and Ecosystem Services

Importance of pollination in ecosystem functioning and crop production: Pollination plays a critical role in ecosystem functioning and crop production due to the following reasons:

1. **Ecosystem Functioning:** Pollination is vital for maintaining the biodiversity and stability of ecosystems. It facilitates the reproduction of flowering plants, ensuring the production of seeds, fruits, and subsequent generations of plants [20].
2. **Crop Production:** Pollinators, such as bees, butterflies, birds, and bats, are essential for the production of many crops. Approximately 75% of global food crops rely to some extent on animal pollination. Pollinators transfer pollen between flowers, enabling fertilization and the development of fruits and seeds [21].
3. **Economic Value:** Pollination services provided by insects have substantial economic value. [22].

Role of floral cultivation in providing habitat and food sources for pollinators: Floral cultivation plays a significant role in providing habitat and food sources for pollinators, benefiting their populations and overall biodiversity:

1. **Habitat Provision:** Floral cultivation, including gardens, agroforestry systems, and green spaces, can provide additional habitat for pollinators. These cultivated areas offer nesting sites, shelter, and suitable microclimates, supporting the survival and reproduction of pollinator species [23].
2. **Diverse Food Sources:** Floral cultivation can offer a diverse array of flowering plants that provide nectar and pollen resources for pollinators [24].
3. **Conservation of Native Species:** Floral cultivation can include native plant species that are well-suited for local pollinator

communities. Using native plants helps preserve the natural floral resources that pollinators have evolved with [25].

4. **Corridor Creation:** Floral cultivation in the form of pollinator-friendly corridors can enhance connectivity between fragmented habitats. These corridors facilitate the movement of pollinators, promoting genetic exchange, population resilience, and the maintenance of diverse pollinator communities [8].
5. **Citizen Engagement:** Floral cultivation engages individuals and communities in pollinator conservation efforts. Planting and maintaining pollinator-friendly gardens raise awareness about the importance of pollinators and their conservation. Such initiatives can inspire broader action and foster a sense of stewardship towards pollinators and their habitats [26].

Impact of floriculture on soil health, water conservation and climate regulation: Floriculture practices can have both positive and negative impacts on soil health, water conservation, and climate regulation:

- **Soil Health:**

Positive Impact: Floriculture can improve soil health through the addition of organic matter, such as compost or cover crops, which enhances soil structure, nutrient availability, and microbial activity [27].

Negative Impact: Intensive floriculture practices, particularly when combined with improper soil management and excessive use of fertilizers and pesticides, can lead to soil degradation, erosion, and nutrient imbalances [28].

- **Water Conservation:**

Positive Impact: Some floriculture techniques, such as drip irrigation and efficient water management practices, can minimize water use and promote water conservation. Proper irrigation scheduling, mulching, and water-efficient greenhouse designs can help reduce water consumption in floriculture operations [29].

Negative Impact: Improper irrigation practices, such as excessive water application or poor drainage systems, can lead to water waste, runoff, and soil erosion. Over-irrigation can also contribute to nutrient leaching and groundwater pollution [30].

- **Climate Regulation:**

Positive Impact: Floriculture, particularly when implemented in greenhouses, can contribute to climate regulation by sequestering carbon dioxide (CO₂) through photosynthesis [31].

Negative Impact: The use of fossil fuels for greenhouse heating and energy-intensive production practices can result in greenhouse gas emissions, contributing to climate change [31].

1.5 Case Studies and Examples

Examination of successful initiatives where floriculture has enhanced biodiversity and ecosystems: Floriculture can contribute to enhancing biodiversity and ecosystems in various ways. Here are a few successful initiatives:

1. **Pollinator-Friendly Practices:** Implementing pollinator-friendly practices in floriculture, such as planting native flowering plants, providing nesting sites, and reducing pesticide use, can support pollinators like bees and butterflies. These practices promote biodiversity and contribute to the overall health of ecosystems. ("Best Management Practices for Bee Health in Floriculture" by the University of Florida Extension)
2. **Agroforestry Systems:** Integrating floriculture with agroforestry systems can create diverse habitats and improve ecosystem services. This approach increases biodiversity and supports ecological balance. ("Agroforestry for Biodiversity and Ecosystem Services: Science and Practice" by the World Agroforestry Centre)
3. **Wetland Restoration and Conservation:** In areas where floriculture occurs near wetlands, successful initiatives have focused on restoring and conserving these valuable ecosystems. By preserving wetlands and their associated flora and fauna, floriculture can coexist with and contribute to biodiversity conservation efforts. ("Floriculture and Biodiversity in Protected Wetlands: A Case Study from the Veneto Region, Italy" by A. Marchesini et al.)
4. **Organic and Regenerative Practices:** Adopting organic and regenerative farming practices in floriculture eliminates the use

of synthetic pesticides and promotes soil health. ("Biodiversity and Organic Agriculture: A Meta-Analysis of European Studies" by D. Gabriel et al.)

5. **Habitat Restoration and Creation:** Some floriculture operations engage in habitat restoration and creation efforts within their production areas. By incorporating native plants, creating water features, and providing shelter, these initiatives enhance overall ecosystem biodiversity. ("Enhancing Biodiversity in the Agricultural Landscape: Lessons Learned from Long-Term Research in the Netherlands" by E. C. J. Verbaarschot et al.)

2. FUTURE DIRECTIONS AND RECOMMENDATIONS

While significant research has been conducted in various fields, there are still several research gaps and areas for further exploration. Some of these include:

1. **Climate Change Adaptation Strategies:** Further research is needed to develop and evaluate effective climate change adaptation strategies for different plant species and ecosystems. This includes studying the impacts of climate change on plant phenology, distribution, and resilience, as well as exploring adaptive management techniques.
2. **Sustainable Agricultural Practices:** While sustainable agricultural practices are gaining attention, there is a need for further research to assess their long-term environmental, economic, and social impacts. This includes studying the effectiveness of different sustainable practices (e.g., organic farming, agroforestry) in improving soil health, mitigating climate change, promoting biodiversity, and ensuring food security.
3. **Urban Ecosystems and Green Infrastructure:** As urbanization continues to increase, there is a need for research on urban ecosystems and the role of green infrastructure in enhancing ecological resilience and human well-being. This includes studying the ecological functions of urban green spaces, the impacts of urbanization on biodiversity, and the effectiveness of urban greening initiatives in promoting sustainability and improving urban ecosystem services.

3. CONCLUSION

Floriculture and landscaping play important roles in the sustainable management of our vulnerable and resilient environment. Because of the side effects of the use of fertilizers and artificial chemicals on humans and the environment, organic fertilizers should be employed as alternatives to synthetic ones and also plant extracts should be used in place of artificial chemicals in the control of plant pest and diseases in floriculture management. Floriculture can be integrated into ecosystem restoration initiatives such as reforestation, wetland rehabilitation and habitat restoration projects. Sustainable practices in floriculture, such as efficient irrigation systems and soil conservation techniques, help conserve water resources and prevent soil erosion. These practices reduce the negative impacts of water scarcity and soil degradation, protecting aquatic ecosystems and maintaining soil health and fertility.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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