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Carbon Sequestration in Floriculture: Blooming Solutions for a Greener India

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Floriculture is the science and art of growing flowering and ornamental plants that adds beauty and fragrance to our lives. From vibrant gardens and festive garlands to indoor greenery and global flower exports, it enriches both human life and the economy. Yet, there's more to floriculture than just colors and fragrance, it's also a quiet warrior against climate change.

Through carbon sequestration, plants absorb carbon dioxide (CO_2) from the atmosphere during photosynthesis and store it in their tissues and surrounding soil. This helps reduce greenhouse gases responsible for global warming. With sustainable practices and thoughtful integration into cities and farms, floriculture can play a crucial role in India's green future.

Floriculture: India's Green Carbon Sink

India is among Asia's leading producers of flowers, with major cultivation areas in Karnataka, Tamil Nadu, Maharashtra, Andhra Pradesh and West Bengal. The country's diverse climate supports the growth of both tropical and temperate flowers that naturally act as carbon sinks.

Popular flowers such as rose, chrysanthemum, marigold, gerbera, gladiolus, anthurium and tuberose capture CO_2 efficiently through their rapid growth and high photosynthetic rate. Perennial ornamentals like *Bougainvillea*, *Hibiscus* and *Ixora* store carbon for longer periods, becoming living reservoirs of captured carbon.

The export-oriented flower industry can also benefit from quantifying its carbon sequestration potential, creating "green label" flowers that appeal to eco-conscious global markets and linking beauty with sustainability.

Ornamental Foliage and Indoor Plants: Natural Air Purifiers

Indoor ornamental plants are more than decorative, they are natural air filters and carbon absorbers. Species like Areca palm, Money plant, Snake plant, Spider plant and *Ficus benjamina* continuously absorb CO_2, even under low-light conditions.

NASA's 1989 study ranked these plants among the best for removing indoor pollutants such as formaldehyde and benzene. In offices, schools and homes, they reduce CO_2 buildup, improve oxygen levels and enhance mental well-being.

Modern cities are also embracing vertical gardens and living walls, which not only beautify spaces but also act as micro carbon sinks, regulating indoor temperatures and improving air quality.

Urban Landscapes and Green Infrastructure

Urbanization has brought challenges like air pollution, heat islands and the loss of green cover. Integrating floriculture into urban landscapes offers a natural solution.

Green belts, rooftop gardens and roadside plantations help offset emissions and cool urban microclimates. Research from the Indian Institute of Horticultural Research (IIHR, 2022) found that ornamental landscapes can sequester 2–5 kg of CO_2 per square meter per year, depending on plant type and density.

Grasses such as *Cynodon dactylon* (doob grass) and *Zoysia japonica* also contribute through extensive root systems that enrich soil carbon. By blending floral design with city planning, floriculture can transform cities into "breathing ecosystems" that balance beauty and environmental health.

Protected Cultivation and Carbon Utilization Efficiency

Modern floriculture increasingly uses protected cultivation systems, like greenhouses and polyhouses, that allow precise control of temperature, light and CO_2 levels. By maintaining CO_2 concentrations around 800–1,000 ppm, plants can grow faster and store 20–40% more carbon than those grown in open fields.

Sustainable soil amendments such as biochar, compost, and vermicompost—enhance soil organic carbon and nutrient availability. Additionally, solar-powered irrigation, rainwater harvesting and biodegradable pots are reducing the carbon footprint of greenhouse operations.

These technologies align floriculture with India's National Mission for Sustainable Agriculture, making it both eco-friendly and economically viable.

Carbon-Smart Floriculture for Climate Resilience

A carbon-smart approach to floriculture focuses on sustainability across every stage of production:

- Smart Species Selection: Grow high-biomass and perennial ornamentals that store more carbon.
- Waste Recycling: Reuse floral residues from temples and markets as compost or eco-products.
- Healthy Soils: Add organic matter and cover crops to boost soil carbon and microbial activity.
- Efficient Resource Use: Adopt drip irrigation, fertigation, and LED lighting to cut energy waste.
- Urban Integration: Include floriculture in city projects for carbon capture and beautification.

Together, these measures make floriculture a climate-resilient, low-emission sector that supports India's journey toward a carbon-neutral economy.

Socio-Economic and Policy Perspectives

Floriculture supports thousands of small and marginal farmers, many of whom are women, in rural and peri-urban areas. By adopting carbon-conscious practices, these farmers can participate in carbon credit markets, earning income while conserving the environment.

Conclusion

Floriculture is no longer just about creating beauty, it is about cultivating sustainability. Every flowering plant, from a rose in the garden to a palm in an office, plays a small yet significant role in cleaning the air and combating climate change. By integrating sustainable practices, carbon-smart technologies, and inclusive policies, India's floriculture sector can blossom into a climate-positive industry that nurtures both livelihoods and the planet. Indeed, every bloom that opens is not just a symbol of beauty—but a breath for the Earth.

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