

The Benefits of Composting: Climate, Community, and Ecosystem Impact



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This white paper highlights compost's core benefits in improving soil health and explores how composting addresses broader environmental and social challenges, such as climate change, biodiversity, and community resilience.

Composting is a biological process transforming organic waste into a stable, nutrient-rich soil amendment. It is vital beyond soil health, serving as a multifaceted solution to environmental and social challenges. Composting is a powerful tool for building resilience in ecosystems and societies, from reducing greenhouse gas emissions to fostering local communities.

Compost is the product manufactured through the controlled aerobic, biological decomposition of biodegradable materials. The product has undergone mesophilic and thermophilic temperatures, which significantly reduces the viability of pathogens and weed seeds (per EPA 40 CFR 503 standards) and stabilizes the carbon such that it is beneficial to plant growth. Compost is typically used as a soil amendment, but may also contribute plant nutrients. (American Association of Plant and Food Control Officials (AAPFCO) definition, official 2018) Finished compost is typically screened to reduce its particle size, to improve soil incorporation.

1. Fighting Climate Change

A. Landfill Diversion:

Organic materials—food scraps, yard trimmings, and wood waste—comprise approximately 24% of municipal solid waste in the United States ([US EPA](#)). In anaerobic landfill conditions, these materials generate methane, a greenhouse gas with 28 times the warming potential of carbon dioxide over a 100-year period ([GHG Protocol](#)). Diverting organic waste to composting facilities minimizes methane emissions while reducing landfill overflow, extending existing landfill lifespans, and reducing the need for new landfills. Composting redirects organic matter to productive, carbon-sequestering processes, contributing to the circular economy ([Ellen MacArthur Foundation](#)).



B. Replacing Synthetic Fertilizers:

Compost acts as a natural soil amendment by improving soil organic matter, nutrient cycling, and microbial activity.

Replacing synthetic fertilizers with compost reduces reliance on nitrogen-based products, whose production, transportation, and application contributes to 10.6% of agricultural emissions and 2.1% of global GHG emissions ([Menegat et al.](#)). Compost enhances soil carbon sequestration by increasing stable organic carbon fractions, locking carbon in the soil long term. The result is a measurable reduction in atmospheric carbon dioxide and nitrous oxide emissions ([Washington State Dept of Ecology](#)). This mitigates the environmental damage caused by synthetic fertilizers and supports resilient, healthy ecosystems.

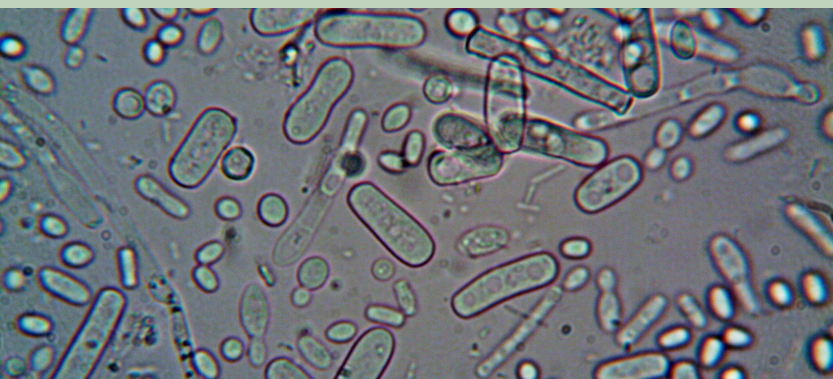
The over-application of synthetic fertilizers has led to long-term environmental degradation, contributing to acid rain, polluted drinking water, and oxygen depletion in water bodies, causing “dead zones” ([US EPA](#)). Compost reduces harmful nutrient runoff by improving soil structure, nutrient retention, and water infiltration ([University of California](#)).

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2. Improving Biodiversity and Habitat Restoration

Compost improves soil structure, porosity, and moisture retention, fostering diverse microbial communities that support nutrient cycling and plant resilience. By enriching degraded soils, compost enables habitat restoration, facilitating native vegetation growth and erosion control ([Lucchetta et al.](#)). It reduces soil contamination by binding heavy metals and neutralizing pH imbalances, improving ecosystem recovery in post-industrial sites and urban areas ([Li et al.](#)). Enhanced soil biology further supports pollinators, soil fauna, and wildlife dependent on healthy vegetation, strengthening terrestrial biodiversity. Composting also helps restore urban green spaces and promotes environmental equity.

3. Education

Composting offers a hands-on platform for environmental science education, integrating topics such as microbiology, nutrient cycling, and waste reduction. By demonstrating decomposition processes, composting illustrates closed-loop systems and circular economy principles. Schools, universities, and municipalities can use compost programs to engage students in soil health management, carbon emissions analysis, and sustainable resource systems ([Papanek et al.](#)). Education efforts highlight the economic and environmental benefits of organic waste recovery, and provide a bridge between ecological theory and practice ([EPA](#)).



4. Community

Community composting programs address local waste management challenges while promoting environmental and economic equity. These systems reduce local emissions and toxins associated with landfills or incineration ([Oregon State Legislature](#)). Locally produced compost supports urban agriculture and community gardens, improving food security and access to nutrient-dense produce. Composting initiatives also encourage local partnerships, knowledge sharing, and job creation ([The Guardian](#)). The Next Generation Science Standards list the exchange of matter between the environment, animals, and decomposers as a critical learning standard (5-LS2-1), which can be demonstrated through compost demonstrations and practices ([NextGenScience](#)). By embedding composting practices within communities, municipalities strengthen regional resilience and environmental stewardship.

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5. Tangible Benefits

- Compost improves the biological, chemical, and physical structural health of soils, which in turn contributes to healthy plants and successful projects.
- Compost supplies significant quantities of organic matter and beneficial microorganisms to the soil and growing media.
- Compost can be used for its promotion of healthy plant growth and suppression of soil-borne plant disease pathogens ([CREF](#)).
- Compost can also conserve water due to its ability to retain and efficiently transfer water. This both helps the environment and makes your project more drought resistant ([MSU](#)).
- Compost helps to reduce soil erosion in a number of ways, including by binding soil together, increasing infiltration, and slowing the surface flow of water ([CREF](#)).
- Compost can assist highway and transportation departments in activities related to the protection, reclamation, or creation of wetlands. Compost installed between roadways and wetlands can filter pollutants caused by automobile traffic. In addition, compost is a great additive to wetland reclamation or projects since those ecosystems require highly organic material.



Conclusion

Composting is a scalable, science-backed solution to global challenges, including greenhouse gas emissions, soil degradation, and habitat loss. By diverting organic waste, replacing synthetic fertilizers, restoring ecosystems, and fostering education & community action, composting contributes to resilient food systems and carbon-neutral economies. Increasing participation in composting programs is critical to advancing sustainable development and addressing the climate crisis.

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About the USCC: The United States Composting Council (USCC) is a national not-for-profit organization dedicated to the development, expansion and promotion of the composting industry. For more information visit www.compostingcouncil.org.

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