

# Nature's Role in Sustainable Waste Management and Conservation

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“By natural order, birthing needs good timing and at a moderate pace. [...] Looking for food in the fields and gardens farther from home is important. Also, try eating different kinds of nuts and worms. Mastering all of this would guarantee a prosperous life.”

—In “Food”; *The Kingfisher Story Collection* [1].

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Human activities have caused a range of environmental problems, including pollution, waste generation, and habitat destruction [2]. Pollution arises from various sources such as industrial activities, transportation, agriculture, and improper waste disposal, contaminating air, water, and soil. Likewise, the generation of large volumes of waste, including plastic and electronic waste, poses significant threats to environmental and human health. At the same time, habitat destruction driven by urbanization, deforestation, and agricultural expansion results in biodiversity loss and ecosystem service disruptions. These environmental problems have profound negative impacts on ecosystems, biodiversity, air quality, water sources, and soil ecosystems, threatening plant and animal populations and human health [3].

While important, traditional approaches to environmental management are often insufficient to tackle modern environmental problems' scale and complexity [4]. Transformative solutions using nature's power to restore ecosystems, mitigate pollution,

and promote sustainable resource management are urgently needed. By working with nature and protecting biodiversity, we can find better ways to care for the environment sustainably [5].

Natural solutions in environmental conservation use nature's processes, ecosystems, and biodiversity to deal with environmental problems, which differs from methods that rely on human-made things [6]. Examples include ecosystem restoration, which rehabilitates degraded ecosystems to enhance biodiversity and services, and bioengineering techniques employing plants or microorganisms to remediate soil and water contamination. Conservation agriculture practices like agroforestry promote soil health, water conservation, and biodiversity while sustaining or enhancing productivity [7]. These solutions offer advantages over conventional methods, being cost-effective and sustainable and providing multiple co-benefits beyond environmental conservation, such as supporting livelihoods and enhancing food security. Moreover, they align with indigenous and traditional knowledge systems, promoting social acceptance and cultural appropriateness [8].



**Illustration.** Generated by Gencraft AI (<https://gencraft.com/generate>)

Building upon the concept of natural solutions in environmental conservation, utilizing organisms such as black soldier flies highlights a distinctive approach to waste management. Black soldier flies (*Hermetia illucens*), found in diverse climates worldwide, are renowned for their waste management abilities. Unlike many other fly species, adult black soldier flies do not pose health risks, as they solely consume water and do not exhibit biting or stinging behavior. Furthermore, the larvae produce antibacterial compounds that

inhibit the growth of pathogens, making them suitable for large-scale waste management without significant concerns about disease transmission [9].

In waste management, black soldier flies play a crucial role in bioconversion, converting organic waste into valuable resources. Their larvae transform waste into nutrient-rich frass, or insect manure, serving as an excellent organic fertilizer that enriches soil and enhances plant growth. Moreover, these larvae are protein-rich, offering a sustainable feed source for poultry, fish, and livestock. By effectively processing organic waste, black soldier flies help reduce waste sent to landfills, lower greenhouse gas emissions, and support the circular economy by extracting value from waste streams [10].

Despite the numerous benefits of natural solutions, potential challenges and limitations impede their widespread adoption. A recent paper suggests these obstacles may include financial issues through the stock market and eco-deficit of environmental companies and investors. Specifically, natural solutions, such as biological waste management methods utilizing organisms like black soldier flies, face challenges due to financial considerations and the prevailing eco-deficit culture within the business and investment sectors.

Financial challenges, particularly evident in the stock market, pose significant barriers to the implementation of natural solutions for waste management. Despite their potential for generating substantial environmental benefits, companies operating in the environmental sector often struggle to attract adequate investment and financing. The stock market, as a reflection of the financial priorities of investors, often struggles to attract adequate investment and financing, leading to limited access to capital for technology development, infrastructure, and scaling operations.

Furthermore, the eco-deficit culture prevalent among environmental companies and investors exacerbates these financial challenges. Many businesses prioritize short-term profit generation over long-term environmental sustainability. This perspective is reflected in their capital allocation strategies, which prioritize maximizing profits for shareholders rather than investing in developing and scaling environmentally sustainable practices [11].

To address this problem, the paper advocates for societal transitions toward an eco-surplus culture, promoting pro-environmental attitudes, values, beliefs, and behaviors among the public [12,13]. Within such a society, environmental companies, especially those in waste management, would be rewarded with higher revenue and premium market prices for their environmental contributions. This recognition not only benefits these companies financially but also attracts increased interest from investors, providing them with more

opportunities to attract capital from the public.

Moreover, as investors increasingly prioritize environmentally sustainable businesses, companies in the environmental sector are set to gain greater recognition and support, leading to a positive cycle of investment and environmental stewardship. Applying the semiconducting principle of monetary and environmental values exchange can prevent companies from merely offsetting their eco-deficits with financial resources, promoting more responsible environmental practices [14,15].

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