The Hidden Cost of Biodiversity Loss: How Declining Microbial Diversity Fuels Allergies and Asthma

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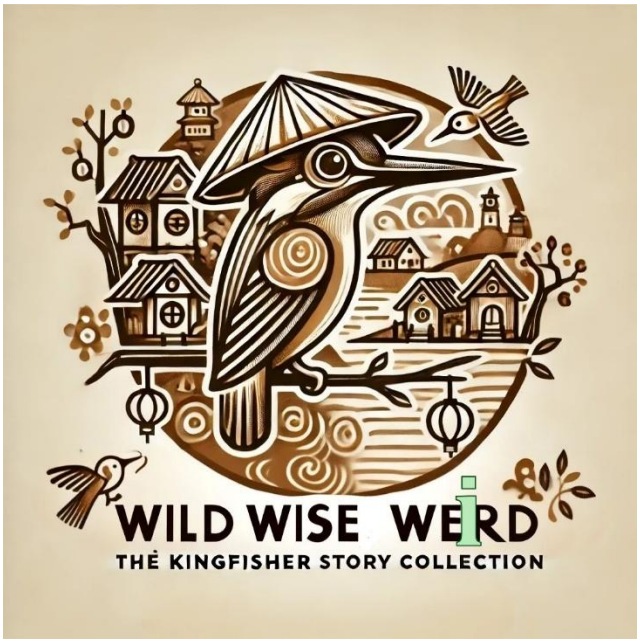

"Everything went smoothly until one night, Kingfisher intercepted a peculiar piece of information. The fish in the pond, aiming to counteract Kingfisher's increasing fishing efficiency, would add several Taboo Fish into the pond. This fish, almost identical to the others except for azure whiskers, was poisonous. If Kingfisher grasped Taboo Fish, he would lose his claws within two days and his beak within three. If he ingested this fish, he would suffer a fatal stomach rupture within an hour. With Taboo Fish present, Kingfisher could no longer fish carelessly."

In "Taboo Fish"; *Wild Wise Weird* [1]

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As the planet undergoes what many scientists term the sixth mass extinction, attention often centers on the visible loss of species such as insects and birds. Yet, an equally critical but less visible crisis is unfolding—the decline of microbial biodiversity [2]. A recent state-of-the-science review published in *Environmental Health Perspectives* sheds light on how diminishing microbial diversity, both in natural environments and within the human body, may be contributing to the global rise in asthma, allergies, and related inflammatory conditions [3].

Analyzing 82 studies, the review highlights that greater environmental microbial diversity—referred to as "outer-layer biodiversity"—is consistently associated with protective effects against asthma, wheezing, and allergic sensitization. In contrast, findings regarding "inner-layer biodiversity," the microbial communities residing within humans, were less conclusive, reflecting the complexity of human-microbe interactions [3].

Asthma, a chronic respiratory disease affecting over 262 million people worldwide in 2019, arises from a combination of genetic predisposition and environmental exposures. The review emphasizes that biodiversity loss—accelerated by climate change and ecosystem degradation—may be an underestimated environmental driver of immune-related diseases [3]. Diverse ecosystems not only support climate regulation through carbon sequestration but also foster microbial exposures critical for immune system development and tolerance [4,5].

Central to this discussion is the "biodiversity hypothesis," which suggests that reduced interaction with diverse natural environments leads to a decline in human microbiota diversity, impairing immune regulation and increasing vulnerability to allergic and inflammatory diseases [6]. Beneficial microbes, such as *Acinetobacter* species, have been identified as key players in promoting anti-inflammatory responses, offering a natural defense against allergic sensitization [7].

This research underscores the intricate connection between environmental health and human well-being. Biodiversity is not merely a measure of ecological richness but a foundational element of public health. The degradation of ecosystems disrupts microbial ecosystems essential for human resilience, potentially escalating healthcare costs and disease burdens.

Protecting biodiversity, therefore, extends beyond conservation—it is a proactive investment in human health. Failure to recognize this nature-human nexus risks compounding both ecological and medical crises [8,9]. Integrated policies that align environmental stewardship with public health strategies are imperative to mitigate these hidden costs.

References

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