

Insect Declines in the Anthropocene

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Abstract

Insects, comprising the most abundant and diverse group of organisms on Earth, play indispensable roles in ecosystems, including pollination, nutrient cycling, and pest control. However, in recent decades, alarming declines in insect populations have been documented worldwide, a phenomenon exacerbated by human activities during the Anthropocene epoch. Due to these Anthropocene activities, action needs to be taken on conservation initiatives, and policy interventions to safeguard insects in the face of escalating human impacts, ensuring the resilience of ecosystems and the sustainability of our planet in the Anthropocene era.

Keywords: Insect decline, anthropocene, deforestation, and insecticide use

Introduction

Insects, encompassing a wide range of species, play a crucial role in the complex web of land-based ecosystems. They contribute to processes such as pollination and decomposition and serve as vital links in food chains, making them indispensable heroes that sustain life on Earth. The intricate web of life, known as biodiversity, is now at risk due to threats like habitat destruction, pesticide use, and climate change affecting insects. This phenomenon demands urgent attention, as its repercussions extend well beyond the realm of entomology, impacting agriculture, food security, and the delicate balance of the biosphere. This exploration into the 'Decline of Insects in the Anthropocene' delves into the multifaceted dimensions of this crisis (Wagner, 2020).

Habitat Degradation

Habitat degradation refers to the decline or deterioration of a natural habitat, making it less suitable for the plants, animals, and other organisms that live there. This can occur through various human activities, Deforestation and land conversion (e.g., agriculture, urbanization), Pollution, Overexploitation of resources, Climate change, Invasive species, and human

population growth and expansion. Example: In Sinsablegbini Forest Reserves, Ghana the insect abundance is in the following order, undisturbed forest> encroached forest> burnt forest mainly due to Indiscriminate bush burning, encroachment, logging, and human-induced fires (Husseini *et al.*, 2019).

Deforestation

Tropical forests are home to much of the planet's terrestrial biodiversity, including the majority of insects. Clearing of tropical forests for crops, pasture, and wood fuel is proceeding at alarming rates in Central Africa, Central America, many parts of South America, and Southeast Asia. Tropical deforestation has been linked to population declines and extinction of many plants and vertebrates.

Agricultural Intensification

Modern farms and farming practices are often larger in extent, involve herbicide-tolerant crops that encourage herbicide use, are planted with genetically modified varieties that produce insect toxins, embrace monoculture, have become increasingly dependent on pesticides and fertilizers, tile their fields to increase arable acreage, and place greater emphasis on hygiene and cosmetic practices.

Insecticide Use

Non-target insects such as pollinators become stressed, disoriented, immunocompromised, or otherwise disadvantaged by non-lethal insecticide exposure, and cause harmful effects on the honey bee pollinators. Numerous reports have explored the link between insecticides and insect declines, with much of the recent attention focused on neonicotinoids and fipronil, especially their threat to pollinators.

Invasive or introduced species

Non-native species - pathogens, plants, or animals and pose a potential threat to native biodiversity which disrupts and overrun communities and leads to Competitive displacement of native species. For Example,

Case 1 Ovipositing females ignore the introduced plant - no effect

Case 2 Oviposition on introduced plant - successful development of further life stages

Case 3 Oviposition on introduced plant - development arrested

In case 3, the native Colorado *Pieris napi* and the introduced Eurasian mustard, *Thlaspi arvense L.* leads to maladaptation.

Elevated Atmospheric Carbon Dioxide Concentrations

Elevated concentrations of atmospheric carbon dioxide have the potential to alter the nutritional properties of host plants for herbivorous insects. Plants grown under higher carbon dioxide concentrations commonly have lower available nitrogen and may augment their carbon-based plant defenses. Elevated CO₂ alters the nutritional properties of the host plants Example: low available N. Example: Soybeans with elevated CO₂ cause 57 percent more damage by insect pests - accelerated food intake by insects to compensate for the low leaf Nitrogen (Sable and Rana, 2016).

Conclusion

Anthropocene leads to dramatic biodiversity loss. Through collective efforts, informed decision-making, and a commitment to coexist with nature, we can strive to reverse the trends of insect decline and safeguard the delicate equilibrium that sustains life on Earth.

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