DISASTER WAITING TO HAPPEN: THE IMPACT OF INSECT BIOMASS DECLINE

MM. Musthafa[1*]
[1]Department of Biosystems Technology, Faculty of Technology, South Eastern University of Sri Lanka, Oluvil. #32360. Sri Lanka.

[1*]muneeb@seu.ac.lk

1. INTRODUCTION

Biodiversity makes human life possible on Earth. Biodiversity delivers a large number of goods and services to sustain life in the biosphere (CBD, 2000). The components of biodiversity - genes, species, and ecosystems are highly interconnected (National Research Council, 1999). Biodiversity plays a variety of roles that we bestow upon, such as economic, ecological, cultural, scientific, and recreational (Morton and Hill, 2006).

The global biodiversity includes insects as an integral part due to their very high diversity, ecological role, and influences on agriculture, human health, and natural resources. It has been estimated that all the world's arthropods, a group that includes insects, arachnids, millipedes, centipedes, and crustaceans, weigh 17 times more than the planet's 7.5 billion humans. Moreover, insects create the biological foundation for all terrestrial ecosystems (Scudder, 2017), but their cumulative biomass is minuscule compared to some of the other prominent organisms on earth (Bar-on et al., 2018) Consequently, it has been generally presumed that these small insects make comparatively negligible influences on ecosystem processes (Yang and Gratton, 2014), nevertheless they play numerous roles in ecosystems (Noreiga et al., 2018).

The roles of insects in an ecosystem include pollination, seed dispersal (entomochory), mediation in carbon and nutrient recycling, decaying plant and animal materials, pest control, climate regulation, biodiversity protection, provide food and nutrients to higher trophic levels (Noreiga et al., 2018; Lister and Garcia, 2018). Wild plants mainly rely on insects for pollination, while more than 50% of bird food requirements are fulfilled by insects as well (Ollerton, 2011). The economic valuation of pollination is projected to be around $235–577 billion per year worldwide (IPBES, 2016). Moreover, pollinators improve the genetic and reproductive diversity of many plant species (IPBES, 2016). Insects widely assist in seed dispersal and diversity (Linhart, 2015). Insects take part in important roles in carbon and nutrient cycling by modulating the quality and quantity of resources that enter the food web, with consequences at the ecosystem level (Yang and Gratton, 2014). Insects play a significant part in the degradation processes of plant and animal remains (Douglas, 2009). According to Losey and Vaughan (2006), the economic value of ecosystem services provided by insects is worth at least $57 billion per year in the United States.

2. CONSERVATION PROBLEM

The insect biomass decline is not yet been quantified, which is anticipated to threaten every ecosystem found in the world (Goulson, 2020). Hallmann et al. (2017) reported on insect biomass decline from some protected localities in Germany. Lister and Garcia (Lister and Garcia, 2018) reported a drastic decline of arthropods from Puerto Rico, while Shortall et al. (2009) reported on total aerial insect biomass decline from Hereford (Sothern Britain). The insect biomass decline is a serious disaster that waiting to jeopardize the whole functions of the biosphere, which ultimately pave way for the systematic collapse of every ecosystem function (Cardoso et al., 2020). Some entomologists strongly suggest that there is an insect Armageddon (The Insect Apocalypse) is underway as a result of multiple whammies of environmental impacts: pollution, habitat changes, overuse of pesticides, and global warming. The decline of these prominent organisms on earth will create cascading effects on the ecosystem (Hallmann et al., 2017).

Insect biomass decline is directly related to the decline of aerial insectivore birds (Kelly, 2013; Inger, 2014), where Bird Studies in Canada, reported a decline of 50 to 70%. According to BirdLife International (2018), around 40% of the bird species globally have decreasing populations and the main reason for this drop are declining insect populations.

There is a pressing need to assess the insect biomass decline to be addressed and studied in detail focusing on all ecosystems. Insect biomass decline will disturb the whole biosphere since the insect roles have been linked to all the functions of ecosystems and the resilience on which lives depend upon. The hypothesis such as overuse of chemicals can be assessed using different policy-related research works. No large-scale programs are in place to monitor population levels of aerial insects and we know very little about their population dynamics or trends. Therefore, we propose to quantify the biomass decline of insects in Sri Lanka on a long-term scale using the existing data with adding new data and assess the cascading effects of insect decline.

3. IMPACT

There is a huge drop in insect numbers all over the world, but it’s a little off the public radar. The causes and consequences are still remaining a mystery, even though many reasons have been suggested. When the insect number declines, so do the birds that eat them, due to the fact that the majority of the birds' food is made up of insects at the lower end of the food web. Consequently, members of the higher trophic order might be at risk, including humans. Moreover, Insects are the pollinating agents of most plants to produce much of human food. Good numbers of agricultural crops are pollinated by insects other than bees.

The insect decline trend could pave way for other complicated issues that we haven’t even thought of yet. Therefore, the study on insect decline is coming at a critical point where there have been suggestions of bird insectivore decline due to the decline of insect biomass, but we have a big knowledge gap about this insect decline.

Therefore, this concept note draws attention towards that should be addressed very urgently by the scientific community all around the globe under the current context with highly influenced human-impacted combined with climate change. This idea will be used as a bench throughout the world in assessing insect decline.

REFERENCES

Bar-On, YM, Phillips, R. and Milo, R. (2018). The biomass distribution on Earth. PNAS 201711842.

BirdLife International. (2018). State of the world's birds: taking the pulse of the planet. Cambridge, UK: BirdLife International.

Cardoso., (2020). Scientists' warning to humanity on insect extinctions. Biological Conservation 242: 108426.

CBD. (2000). Sustaining life on Earth. How CBD promoted nature and wellbeing. Secretariat of Convention on Biological Diversity.

Douglas, AE. (2009). The microbial dimension in insect nutritional ecology. Functional Ecology 23, 38–47.

Goulson, D. (2020). Insect declines and why they matter. South West Wildlife Trusts, Somerset, UK.

Hallmann, C.A., Sorg, M., Jongejans, E., Siepel, H., Hofland, N., Schwan, H., Stenmans, W., Müller, A., Sumser, H., Hörren, T. and Goulson, D., (2017). More than 75 percent decline over 27 years in total flying insect biomass in protected areas. *PloS one*, *12*(10), p.e0185809.

Inger, R., Gregory, R., Duffy, J. P., et al. (2014). Common European birds are declining rapidly while less abundant species' numbers are rising. Ecology Letters, DOI:10.1111/ele.12387.

IPBES. (2016). The assessment report of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services on pollinators, pollination and food production. S.G. Potts, V. L. Imperatriz-Fonseca, and H. T. Ngo, (eds). Secretariat of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services, Bonn, Germany.

Kelly JF, Bridge ES, Frick WF, Chilson PB. (2013). Ecological Energetics of an Abundant Aerial Insectivore, the Purple Martin. PLoS ONE 8(9): e76616.

Linhart, Y. (2015). Plant Pollination and Dispersal. R.K. Monson (ed.), Ecology and the Environment, The Plant Sciences. 89-117 pp. Springer Publishers.

Lister, BC. and Garcia, A. (2018). Climate-driven declines in arthropod abundance restructure a rainforest food web. PNAS. 1-10.

Losey, JE. and Vaughan M. (2006). The economic value of ecological services provided by insects. Bioscience 56(4): 311-323.

Morton, S. and Hill, R. (2006). What is biodiversity and why is it important? In Science and Solutions for Australia, Eds. Steve Morton, Andy Sheppard, Mark Lonsdale. CSIRO Publishers, Australia.

National Research Council. (1999). Perspectives on Biodiversity: Valuing Its Role in an Ever changing World. Washington, DC: The National Academies Press. https://doi.org/10.17226/9589.

Noreiga, JA, et al. (2018). Research trends in ecosystem services provided by insects. Basic and Applied Ecology 26: 8–23.

Ollerton, J., Winfree, R. and Tarrant S. (2011). How many flowering plants are pollinated by animals? Oikos 120(3): 321-326.

Scudder, GGE. (2017). The Importance of Insects. In Insect Biodiversity: Science and Society, Second. Eds. Robert G. Foottit and Peter H. Adler. John Wiley and Sons Publishers.

Shortall, C.R., Moore, A., Smith, E., Hall, M.J., Woiwod, I.P. and Harrington, R., (2009). Long-term changes in the abundance of flying insects. *Insect Conservation and Diversity*, *2*(4), pp.251-260.

Yang, LH. and Gratton, C. (2014). Insects as drivers of ecosystem processes. Current Opinion in Insect Science 2: 26–32.