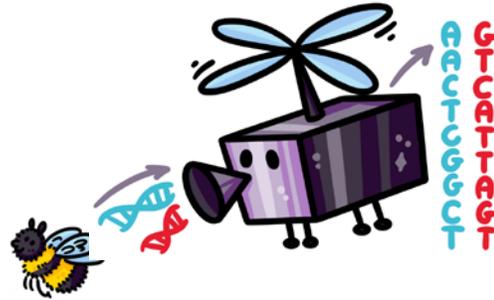


DNA Sequencing of Air for Insect monitoring in Real-time by anyone, anywhere (DroneS-AIR)



Physilia Chua

Assessing UK insect diversity through DNA ([BIOSCAN Project](#))

Tree of Life, Wellcome Sanger Institute

	Low				High	
Impact	●	●	●	●	●	How significant will the effects be?
Likelihood	●	●	●	●	○	How likely is this to happen?
Controversy	●	●	●	●	○	How much do people agree on this?
Where		Global				Global? Local? Domestic?
When		10 years				e.g. 5 years time, 10-15yrs time
How fast		Years				How quickly will this happen?

Environment pressures as such **climate change** will lead to a drastic decline of insects worldwide, with severe consequences for the economy and society within the next decade. This multi-faceted issue will accelerate innovations in science and technology to tackle this global societal challenge of **halting insect loss**. A key to successful conservation efforts will be real-time monitoring data of insects, ensuring swift decisions can be made. A predicted pivotal technological development for **real-time insect monitoring** is an easy-to-use drone capable of extracting DNA from insects found in the air to identify insects. Policymakers must be ready to respond to the implications of this technology, including the implementation of legal frameworks governing usage to prevent controversies arising from privacy issues.

Summary

Impact: In 10 years, climate change will result in more than **75% decline in insect** population globally¹. The loss of pollinators alone is worth at least **£128 billion a year** now, a value equivalent to 10% of the world's agricultural food production². Hence, the race to conserve what insect remains will make **monitoring insect populations in real-time an urgent global priority** to safeguard food security and the wellbeing of society. **Likelihood:** Advances in science and technology from the past two decades are predicted to **accelerate future innovations** to tackle this priority. The discovery of DNA barcodes in 2003, a concept similar to supermarket barcodes where short sections of DNA can be used to identify insects³, has led to the rapid uptake of DNA-based insect monitoring. However, DNA-based monitoring often requires insect capture. To bypass this, DNA of insects found in the air has been piloted for insect monitoring⁴. The development of a hand-held sequencing device the size of a thumb drive makes identifying insects from their DNA easily achievable, making it possible for anyone to participate in monitoring⁵. Additionally, technologies such as drones have been used to survey insects through high-resolution aerial images⁶. While drones can readily access inaccessible areas, images must first be analysed by experts which is a bottleneck when swift actions are required. This critical need for real-time monitoring of insects will see a high possibility of merger between these technologies; **a future where drones are outfitted with vacuums to collect DNA from the air and equipped with a mini sequencer to identify insects in real-time, easily used by anyone, anywhere.** Policymakers must be poised to act rapidly for the governance of these technologies and their implementation for insect monitoring. **Implications:** The application of these insect-monitoring drones on a global level can provide large-scale perspectives of insect population changes worldwide in real-time. This can help align and **coordinate joint conservation efforts** across governments. The outcomes of these efforts can prevent further economic losses by halting the decline of key pollinator species through data-informed conservation interventions and addressing food security issues from pollinator loss. Locally in the UK and other nations, **legal frameworks governing the use** of this technology will need to be drawn up concerning privacy laws and public access to prevent misuse. Given the ease of use of these drones, environmental education is essential to educate the public and encourage citizen science participation. **Controversy:** Without proper governance and education, unrestricted use of drones would lead to strong public opinions on privacy issues, pushing back global efforts to insect monitoring.

References

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