AgriFutures Australia

HGA Annual Conference October 2025

Recent advances in technologies for use in hazelnut orchards

Dr Jian Liu, Charles Sturt University

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Newer Tech

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Autonabit - 'Avvy"

- Avvy is an autonomous vehicle that navigates vineyard/orchard without a driver.
- Avvy is designed to carry tools for bird control, such as kites, loud speakers, and gas guns.
- Avvy is fully electric, designed to reduce carbon emissions and costs.
- NZ based startup, trials in 2024. Two units currently in Australia – Tamworth and Melbourne
- Appx $20,000 NZD and can be shipped to Australia for ~$2000.
- Works on GPS, need a nearby reference station or company can set up (appx $1000) and a GPS survey of orchard rows (using handheld GPS device)

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BirdSol – ‘Cherrp’

- AI Integrated system that uses visual and sound detection to identify the bird species and communicate with them to move them on to alternate feeding sites – doing away with habituation problem.
- Uses machine vision to identify a particular targeted species, while advanced AI algorithms select contextual bio-acoustic sounds to play in the birds’ own language, to either repel or attract.
- Has had trials at an apple orchard in SA – initial yields less than 5%, increased to 96% after Cherrp installation; and at Murray Bridge Council in SA where it had a 98% effectiveness in deterring Corellas.
- The company has worked with peanut, almond and pecan producers.

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Digital Toolbox and BirdNET

BirdNET: Bird Sound Identification App
The Cornell Lab of Ornithology

AI Deterrent 'Digital Toolbox':

- Automated digital tool currently in development that will perform digital sound surveillance to identify bird presence and species and then use various targeted deterrent methods (visual & auditory) deployed automatically.
- It uses AI machine learning and integrates with the BirdNET Sound ID platform.
- US-based project funded out of the Centre for Produce Safety, led by researchers at University of Tennessee. Project is due to conclude at the end of 2025

BirdNET Sound ID:

- Based out of Cornell University, BirdNET is a research platform focused on detection and classification of avian sounds using machine learning.
- Can currently identify around 3000 common species.
- Download app via Apple App Store or Google Play

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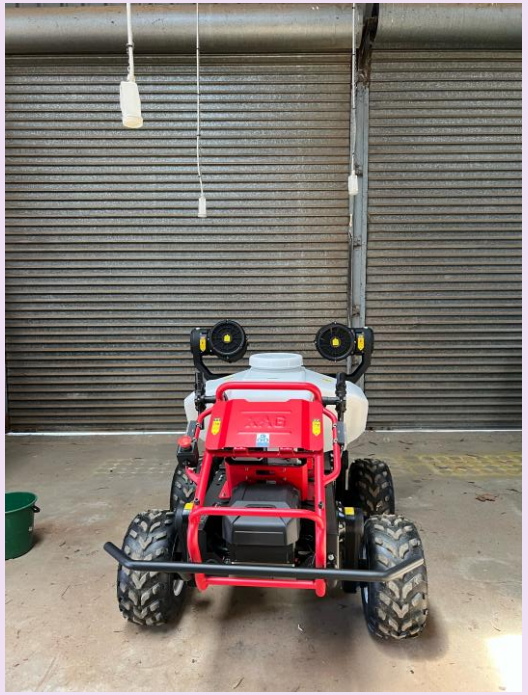
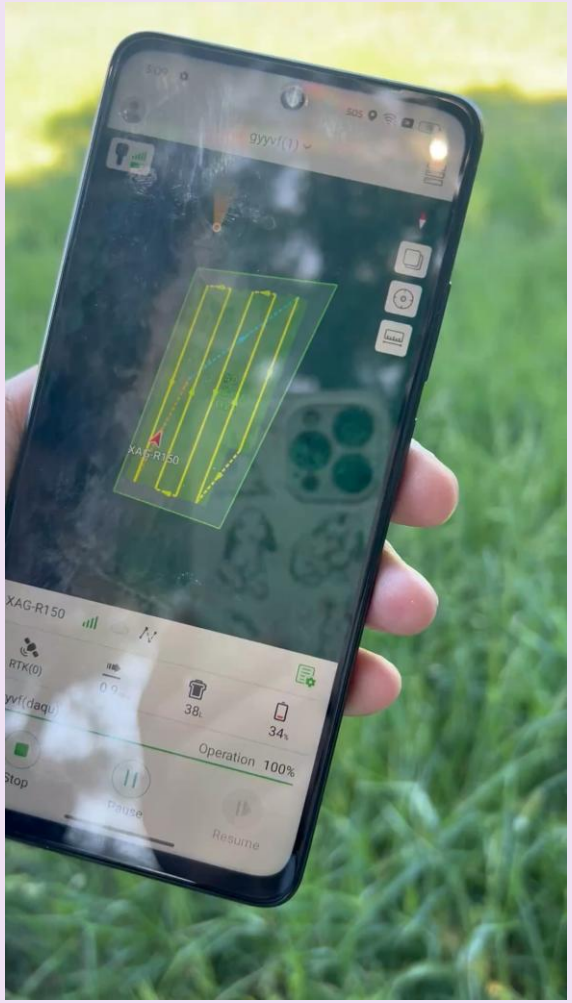
Unmanned Ground Vehicle





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Drones

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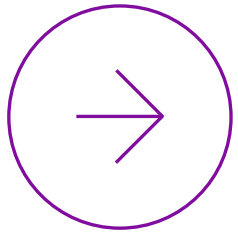
General Drones



Overview

Quickly evolving technology, different companies offer different features:

- manual or semi-automated (the most common);
- fully automated using AI (newly developing);
- integrated bird or warning sounds;
- drones made to look like predatory species
- Costs: vary significantly based on usage and type of drone etc.

Pros

- Studies show that regularly flying a drone in the field has a high percentage of effectiveness for protecting yield.
- Isn't yet solid data across the range of usage and drone type to give a clear sense of when, how, which type etc is most effective.
- AI looks set to increase effectiveness with fully automated systems still being developed but have the potential to offer a holistic solution eliminating need for multiple pest management strategies.

Cons

- Range of rules and licencing requirements (Civil Aviation Authority) – unclear yet how fully automated systems would be regulated.
- AI-enabled versions are currently expensive.
- Operating is weather-dependent.
- Manual operation during flight or during pre-programming stage is needed – either farmer or trained pilot in some cases.
- If the flight pattern is too simple, or repetitive, birds adjust.
- When drone not in-use birds quickly resume feeding.

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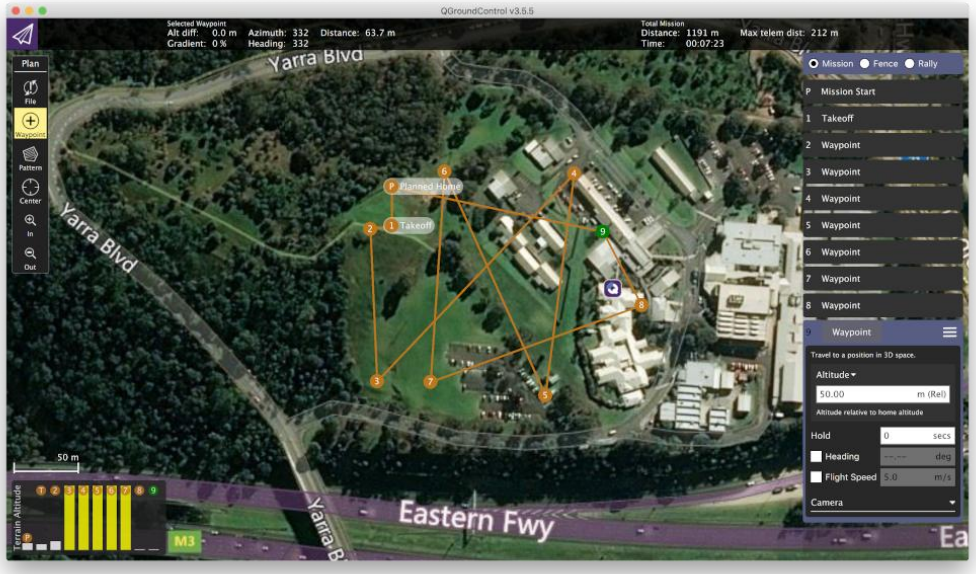
Current Tech Examples

Bask Aerospace – ‘Avian Scout’

- Australian company
- Semi-automated, equipped with on-board ‘screecher’ speaker that puts out a variety of bird sounds. Accompanying software is supported on most platforms and allows pilot to plan flight missions so random flight paths can be mapped, keeping birds from habituating and allowing full coverage of orchard/crop.
- Offer new and refurbished drones which gives some price flexibility



Images: Bask Aerospace

https://baskaerospace.com.au/products/aerodrone/avian-scout/

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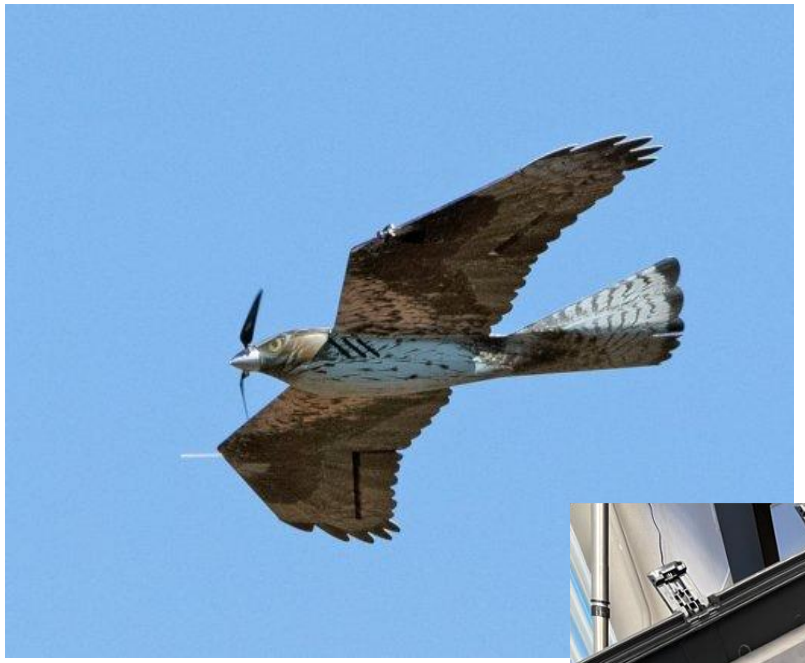
Biomimetic Drones

- Designed to imitate predator birds
- Variety of companies produce this kind
- Manual and semi-auto available

Examples:

- **Drone Bird** - Dutch company, 'The Drone Bird Company', pioneering drones that look like the Ornithopter Peregrine Falcon and Fixed Wing Peregrine Falcon. They require trained pilots to use on-farm.
- **V-Raptor** – Spanish company, 'Ventor Innovations'. Flies autonomously from pre-programmed flight plans. It also uses some AI and machine learning to allow drone to adapt and change its flight behaviour based on birds' behaviour.



Above: V-Raptor. Image: Ventor Innovations

Opposite: One of the Falcon drone. Image: The Drone Bird Company

Developing Tech: Sensorem ‘Drone in a Box’

- Based in Perth, Australian company piloting a remote operating drone system (built by DJI Enterprise) for the West Australian Grain Cooperative, Cooperative Bulk Handling (CBH).
- A pilot operates the drone remotely (100s of kms away) to protect grain storage sites (birds rip the tarp coverings and damage grain piles).
- Deployed on six trial sites, follow automated flight paths, emit noise via on-bord speaker systems and fly 5am-8pm.
- Video capability, so the drones monitor crops, grain stockpiles and can-do site inspections.
- Noted a ‘significant’ reduction in bird numbers and the drones’ ability to handle challenging environments like that in the WA wheatbelt

https://sensorem.com.au/projects/drone-in-a-box-grain-storage-facilities/
https://enterprise.dji.com/dock

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Cost consideration….

Is this overkill?

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Washington State Uni Drones

A manually operated WSU drone flies over a vineyard during tests for bird deterrence and fruit damage assessment. Credit: WSU Agricultural Automation and Robotics Lab

- In 2022 – Washington State Uni developed a 24/7 fully automated system.
- Their machine vision system detects and counts birds and automatically deploys to deter them.
- This type of system would overcome the current challenge of needing trained pilots or farmer flying and monitoring semi-automated drones.
- Potential to integrate additional deterrence tools such as audio or visual devices.
- Tech not yet commercially available.

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Lasers

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Pros:

- Laser must move across, 'scan' the orchard. It's the constant movement that disturbs the birds and prevents them from settling-in to forage and eat
- doesn't damage birds' eyesight and no evidence of other permanent damage.
- When combined with black netting it can provide a more distinct laser presence, further deterring birds.
- Once set-up and programmed they are maintenance free.
- Silent (means they can run 24/7), autonomous once programmed and can protect large areas – but not typically a whole commercial orchard so price can be prohibitive if multiple units needed.
- As they are permanently located a licence is not usually required as it is for hand-held.

Cons:

- High initial cost and set-up, typically $5000-23 000+ per unit. Costs also must factor in mounting – laser units are weighty, so a sturdy pole or other mounting mechanism is needed. Further, if connecting to electricity mains there is that ongoing cost, but they can also run off solar.
- Pathway of laser light must carefully consider neighbours or orchard workers, avoiding damaging eyesight.

AVIX Autonomic Mark II, Bird Control Group – example of a fully automated laser bird repellent. Image: Bird Control Group

AvePro Max Agricultural and Industrial Bird Deterrent Laser

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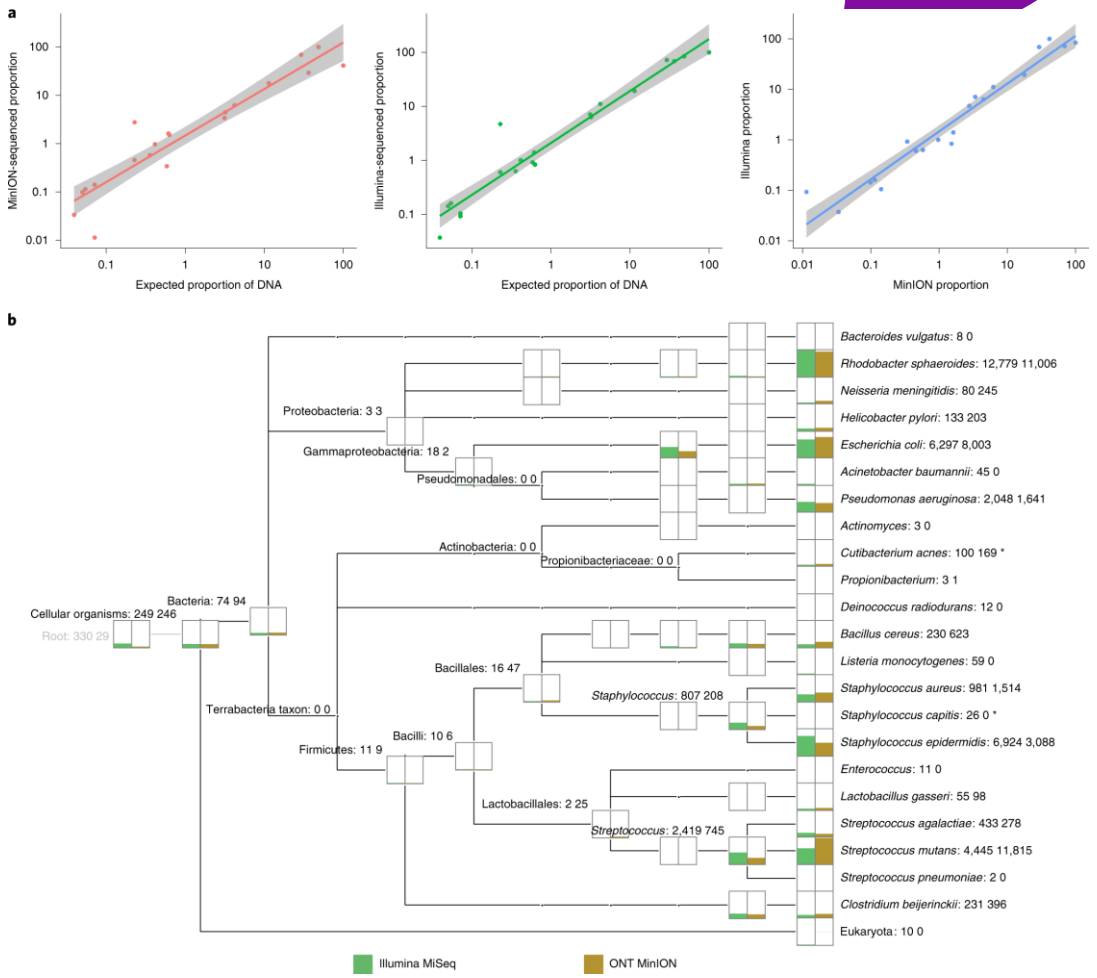
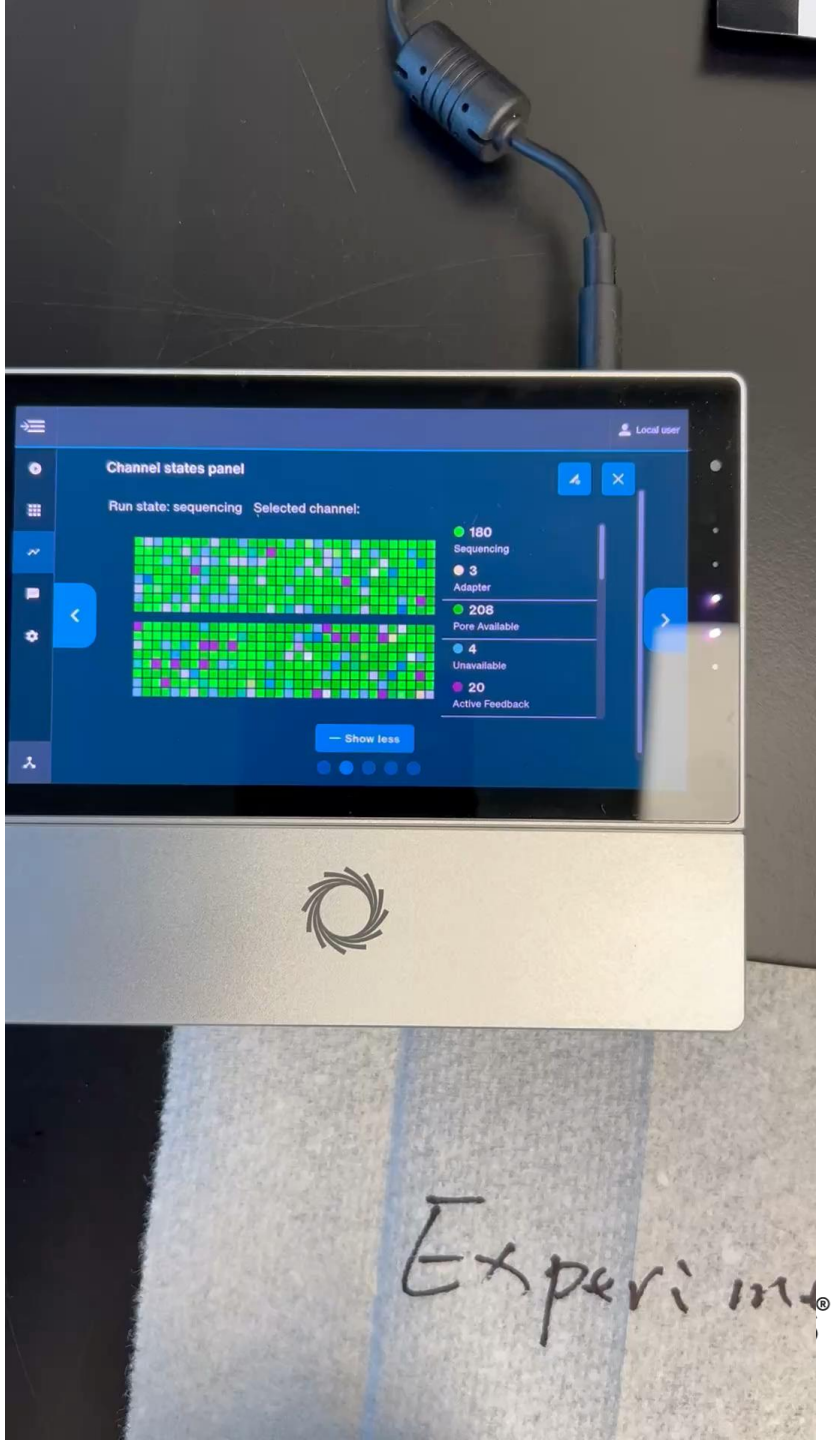
Pest and Disease detection

Nanopore Sequence



https://www.nature.com/articles/s41564-019-0626-z/figures/1



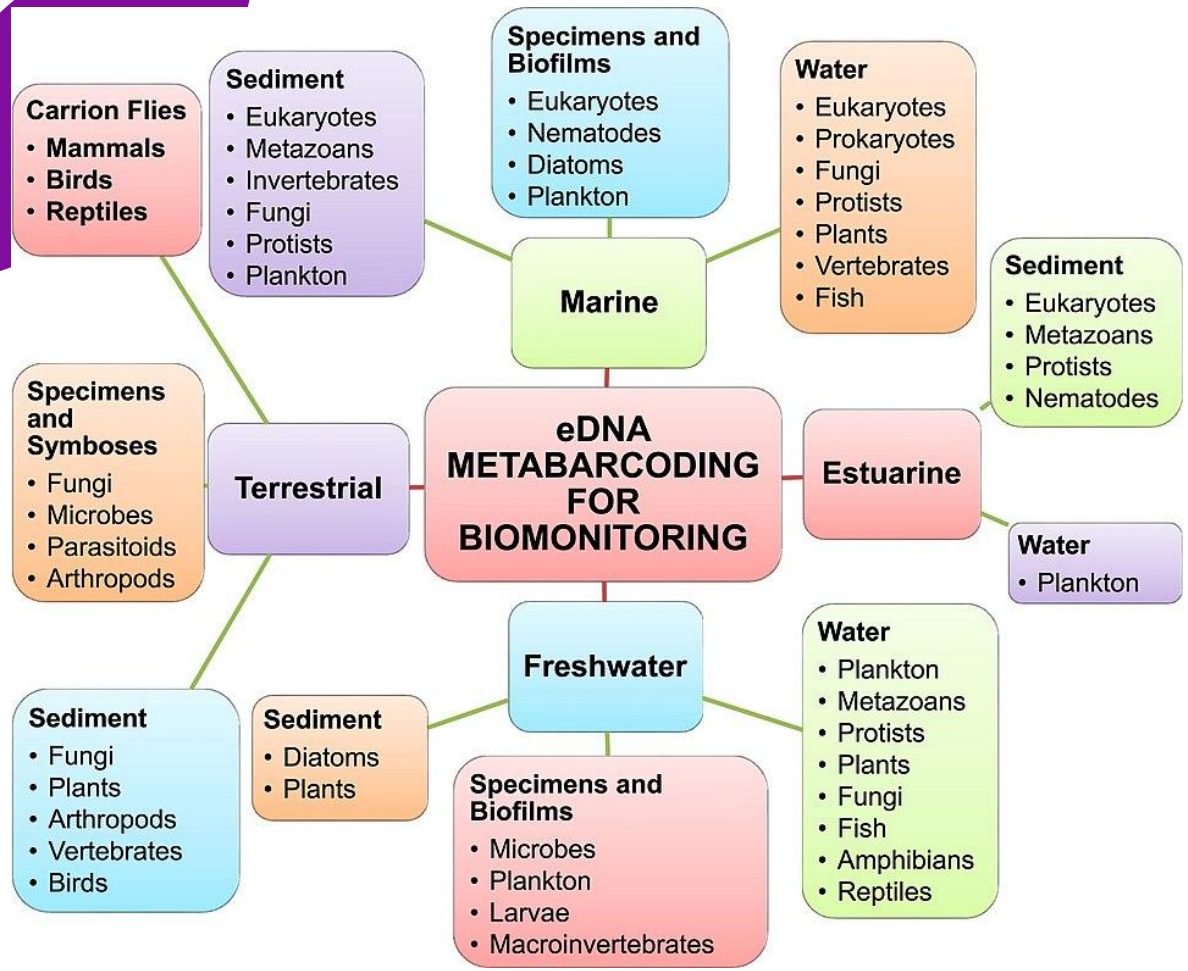
Pest and Disease detection

dDNA

eDNA methods involve analysing trace DNA from environmental sources like water, soil, or air to detect species without physical observation, offering non-invasive, cost-effective, and efficient biodiversity monitoring for various applications, from single-species detection to ecosystem health assessments.

The information this method could reveal is enormous and likely more attractive to researchers. It could be a potential for biothreat monitoring or detection.

Too much research???



Global ecosystem and biodiversity monitoring with environmental DNA metabarcoding

Ruppert, K. M., Kline, R. J., & Rahman, M. S. (2019). Past, present, and future perspectives of environmental DNA (eDNA) metabarcoding: A systematic review in methods, monitoring, and applications of global eDNA. Global Ecology and Conservation, 17, e00547.

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Thank you!

Jian Liu jialiu@csu.edu.au

Kim Doyle-Smith kidoyle@csu.edu.au

Geoff Gurr ggurr@gmail.com

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