



Sensors for Pest and Disease Monitoring

Early Detection for Precision Management

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Traditional Pest Monitoring Methods



Examples



Visual Scouting



Pheromone Traps



Sweep Nets



Light Traps

Limitations



Labour Requirement



Delayed Detection



Limited Spatial Coverage

Manual Scouting is Labour Intensive, Subjective and Technically Demanding



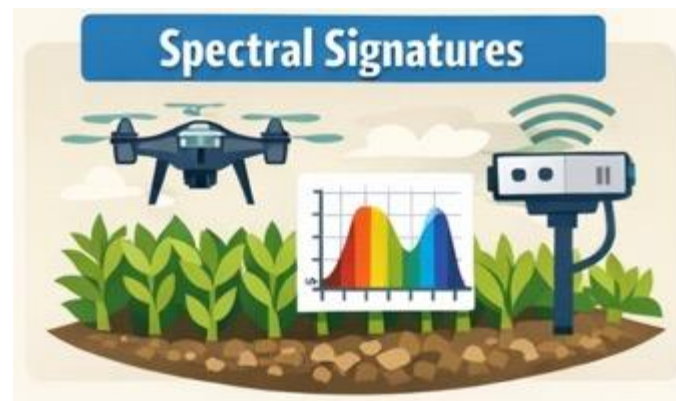
Digital Sensors Lend Accuracy And Ease for Precision Pest Monitoring



What are Farm Sensors?

Sensors are devices that detect biological, chemical, or physical signals and convert them into digital information

Examples of Signals:



Types of Sensors

Optical, Sound, Smell, Pheromones, Infrared, AI etc.

1



Smartphone AI Detection

2



Smart Pheromone Traps

3



Optical Insect Sensors

4



Acoustic Insect Detection

5



Spectral Crop Sensors

6



Gas Sensors (Electronic Nose)

7



Drone & Satellite Sensors

Smart Pheromone & Light Traps

Pheromone Trap



Lure attracts insects

Camera



Captures images

AI Insect Identification



AI analysis of species

Wireless Data Transmission



Data sent to cloud

Benefits



Automated Counting

Accurate insect counts



Remote Monitoring

Check traps from anywhere



Early Warnings

Alerts for pest outbreaks

Optical Insect Sensors



Laser

Insects flying through the sensor beam are identified by:

- Wingbeat Frequency
- Optical Signature

Advantage

Real-time Monitoring of Insect Flights

3

Acoustic (Sound) Sensors



Piezoelectric Sensors: Detect sounds of internal feeding.

Microphones & MEMS: Specific insect frequency characteristics

Ultrasonic Sensors: Detect signals between 20 and 200 kHz

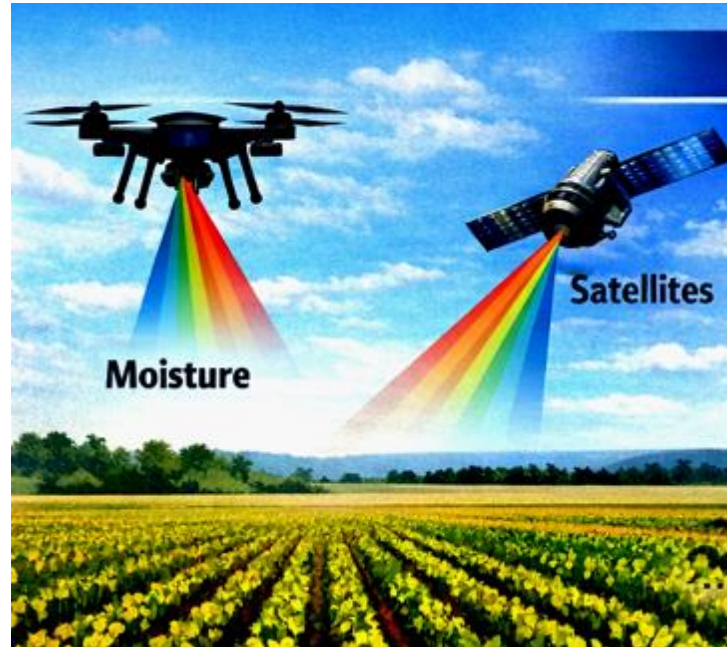
Laser Doppler Vibrometers (LDV): Detect vibrations or wing-beat frequencies



4

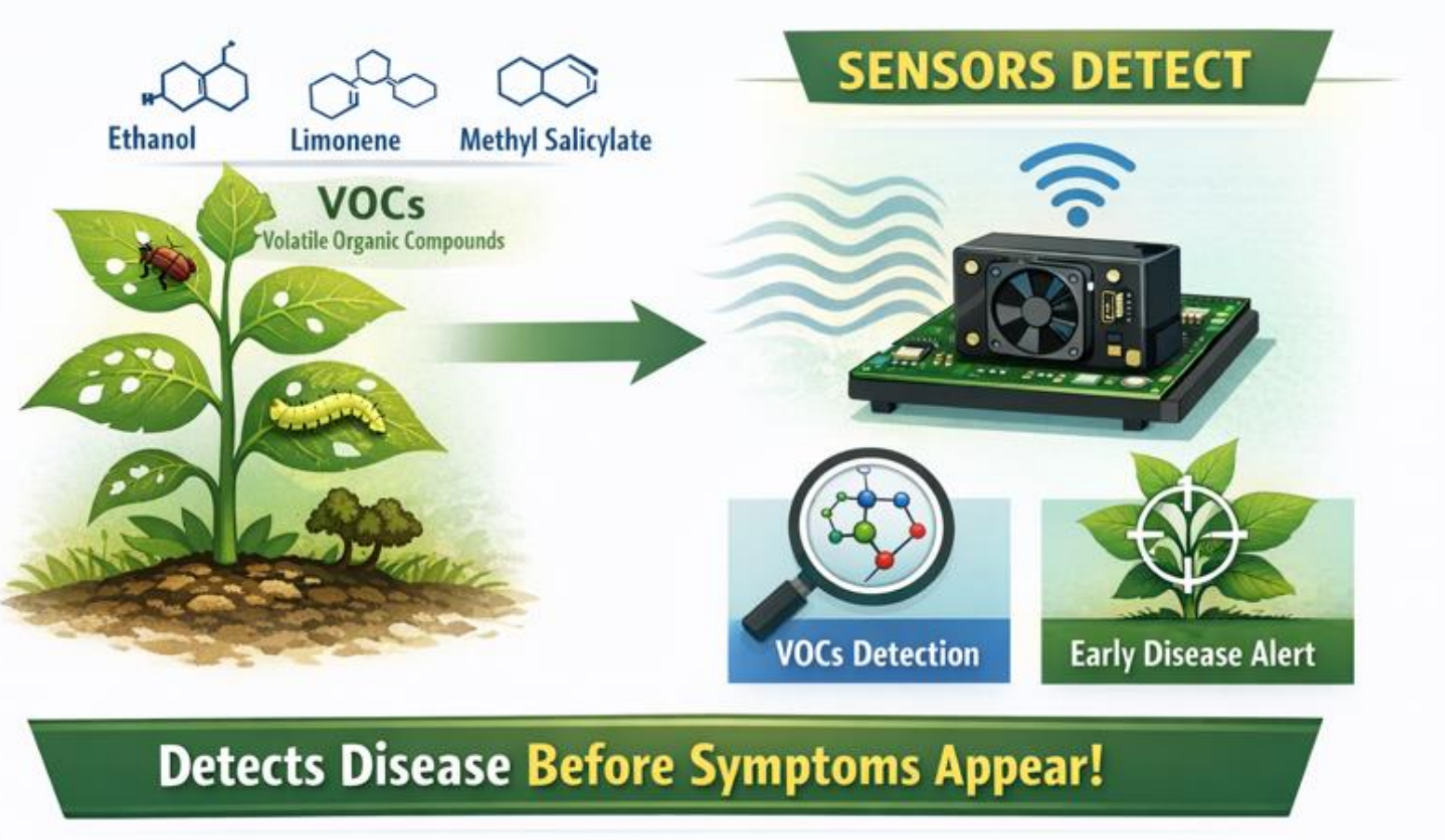
Spectral Sensors Detect Plant Stress

Sensors detect damage spectral signatures induced by pests, diseases and climate

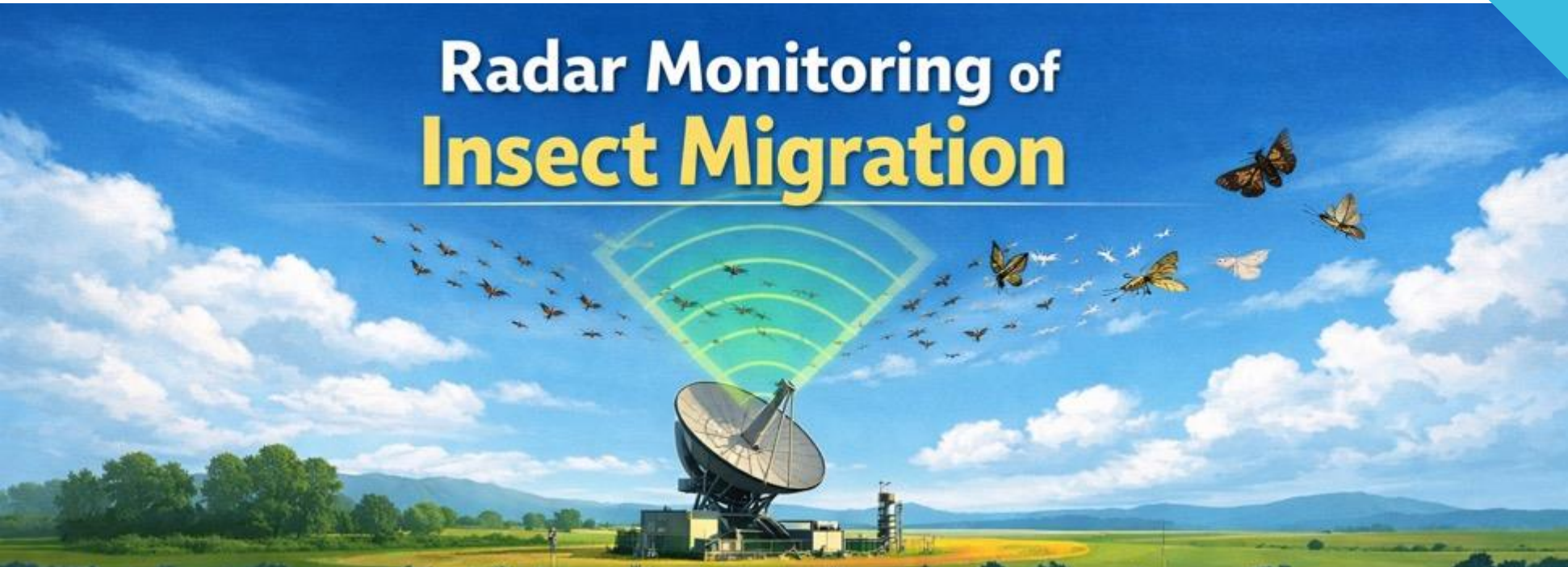


Electronic Nose Sensors

Plants emit specific chemicals when attacked by different insect pests and diseases



Radar Monitoring of Insect Migration



Radar systems track mass movement of insects in the atmosphere.

Applications



Armyworm Migration



Locust Monitoring



Moth Migration

Countries Using It



China



UK



Australia

AI Smartphone Pest Detection

Farmers take photos of:



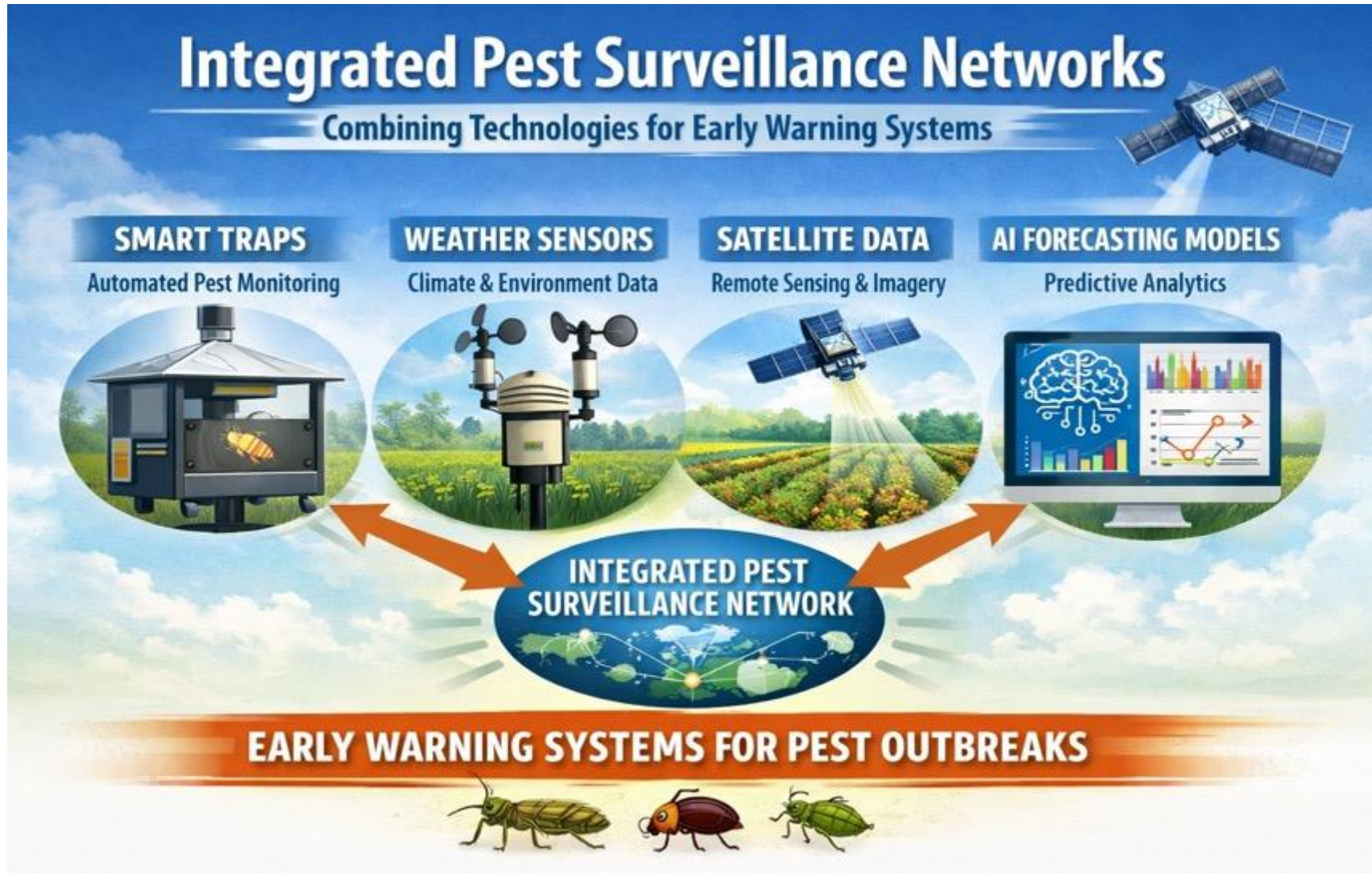
AI Apps Identify Pests Instantly

Examples:



Combination of Digital Sensors

Different sensor detection systems could be used in combinations as soon as they become economical



Sensors Do Not Replace IPM

They support IPM decisions, not replace agronomic expertise.

1. Data Integration is Critical



2. Accessibility for Smallholder Farmers

The biggest challenge is cost and scalability.



3. Global Pest Monitoring Networks



Future agriculture will likely rely on regional pest surveillance networks.

Pest Monitoring Sensors

Commercial Devices: Examples



<https://trapview.com/>



<https://blog.semios.com/>



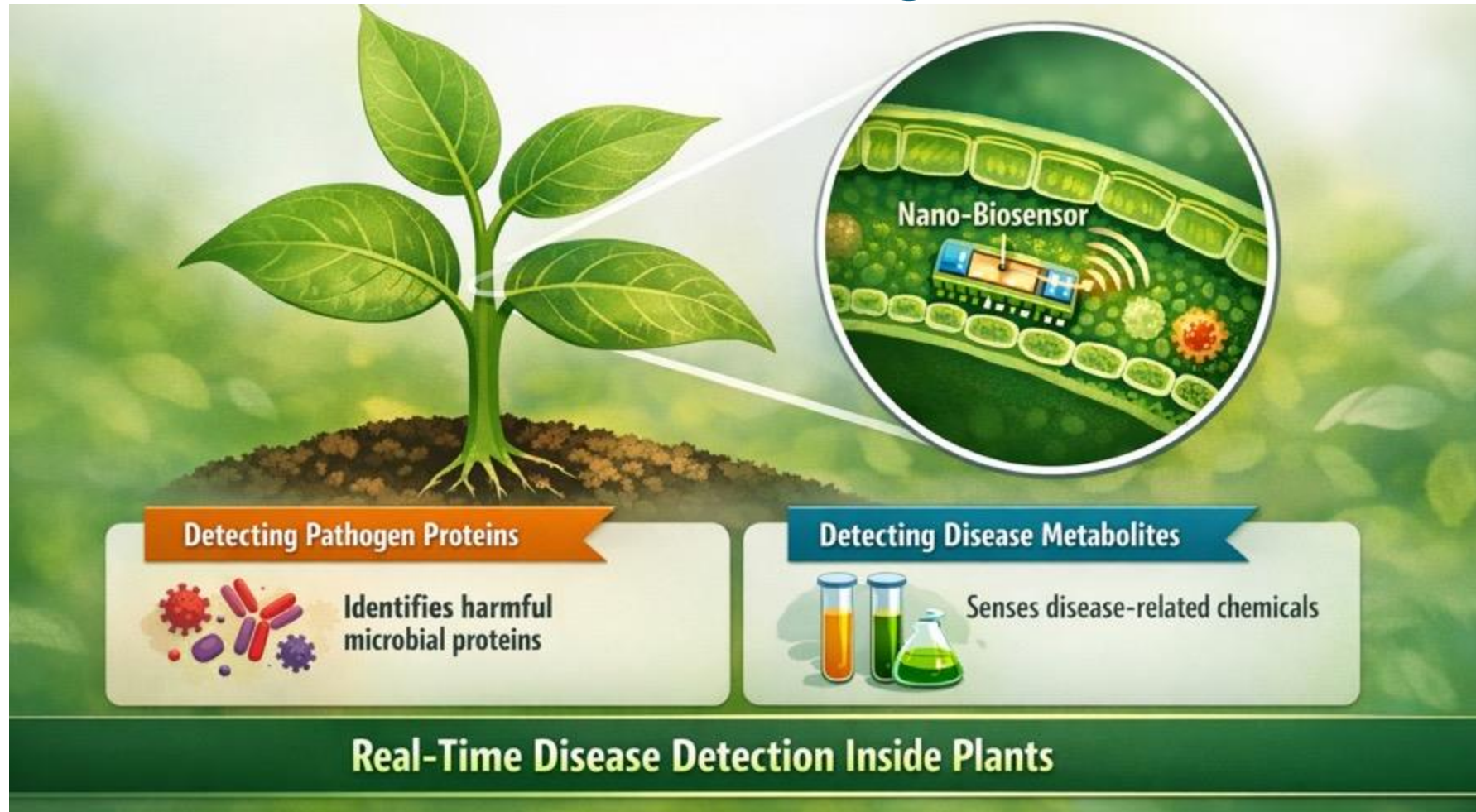
<https://metos.global/>



<https://www.accio.com/>

Nano-biosensors for Disease Detection

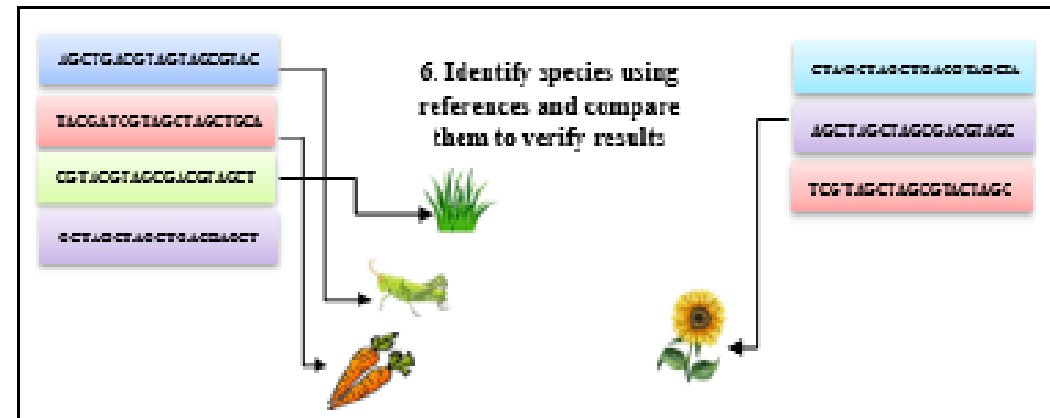
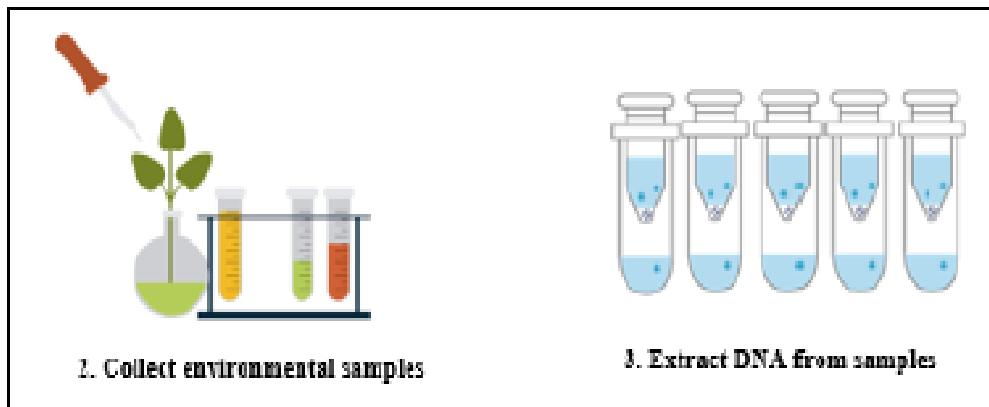
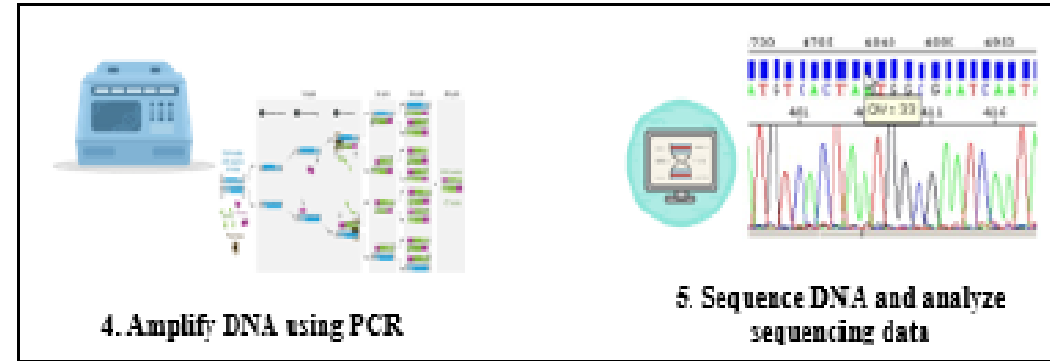
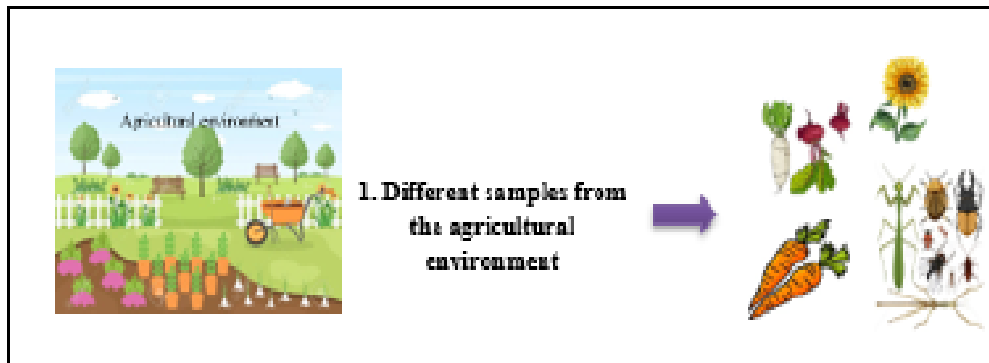
Research Stage



Arben Merkoci (2025) Towards the next generation of nanobiosensors. Nature Nanotechnology. volume 20, pages 1346–1349 (2025)

Environmental DNA (eDNA) pest detection

Research Stage



Aroni Preya Biswas, Farhatun Nisa, Disha Mallick, Pratik Raj Karki, Md. Motaher Hossain, Md. Mamunur Rahman (2024). Revolutionizing Pest Control: Harnessing eDNA Technology for Precision Insect Pest Management. *Tropical Agroecosystems*, 5(2): 58-66.

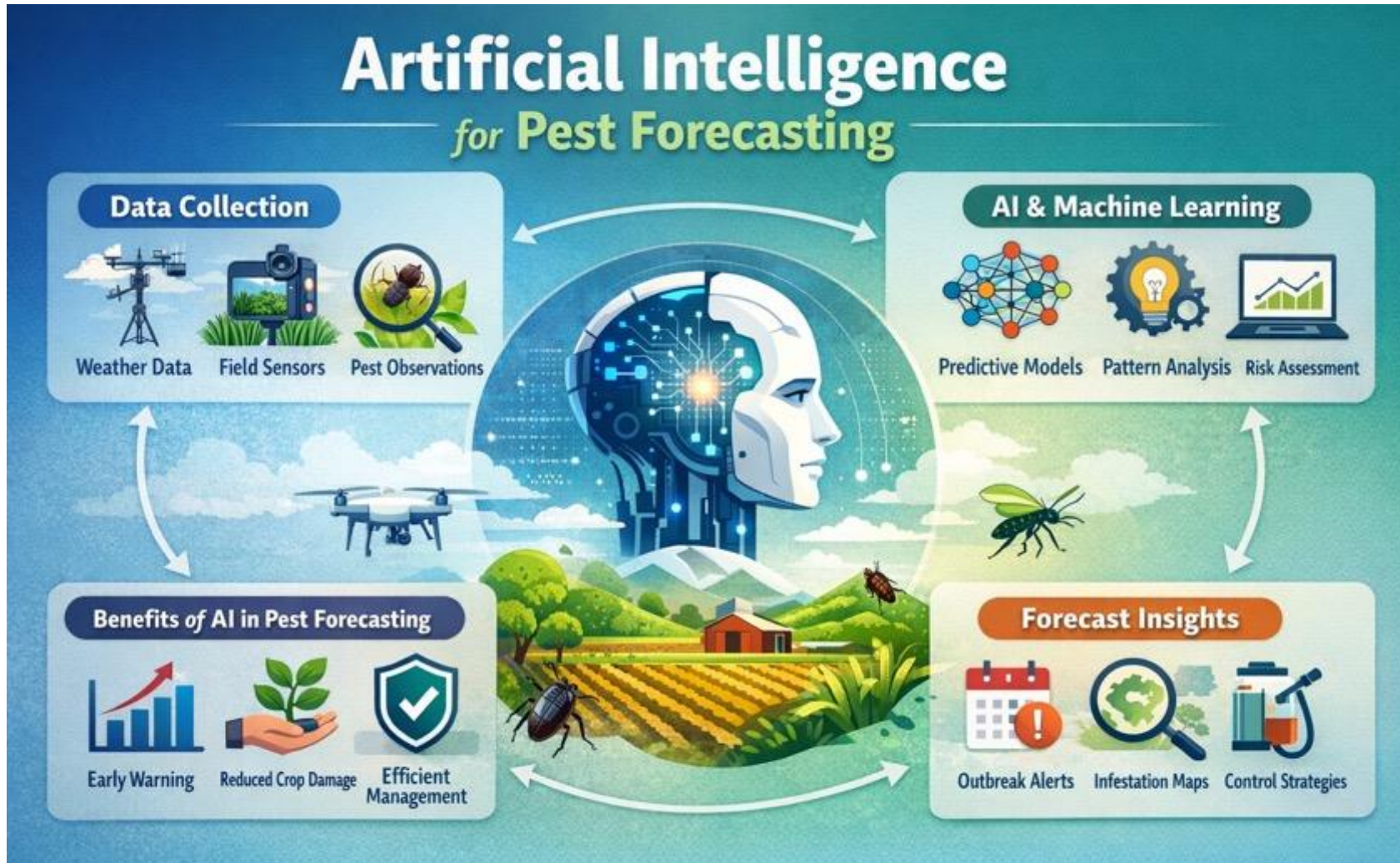
Robotic Pest Monitoring

Research Stage



Cubero et al. (2020) RobHortic: A Field Robot to Detect Pests and Diseases in Horticultural Crops by Proximal Sensing. *Agriculture* 2020, 10(7), 276

Research Stage



Mohamed Ashick and Tamilvanan (2026) Artificial Intelligence in Pest Forecasting. Digital Tools in Pest Surveillance. Golden Leaf Publishers. Pp 65-89



Thank You