

Lesson 2:

Environmental Monitoring with drones





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Lesson Objectives

Learn the basic of drone technology for
environmental monitoring



Identify various applications of drones
in environmental monitoring

Explain the advantages of using drones
for environmental data collection and



Environmental Monitoring



What is it?

Periodic or continued measuring of environmental parameters in order to prevent negative and damaging effects to the environment. Involves the collection, analysis, and interpretation of environmental data.

Key Elements: Air quality, water quality, vegetation health, wildlife populations, and climate patterns.

Environmental Monitoring _ Timeline

Early Observations (Ancient Times)

- Civilizations like the Egyptians and Mesopotamians observed natural resources to manage agriculture.
- This is historically documented as one of the first examples of environmental observation.

Remote Sensing (1980s)

- By this time, satellite imagery was being widely used for environmental purposes, including tracking deforestation and urbanization.

GIS Integration (1980s-1990s)

- GIS technology, pioneered by companies like Esri, enabled mapping and analysis of environmental data in a spatial context.

Drone Technology (2010s)

- Drones started being deployed for environmental monitoring applications, thanks to advancements in UAV (unmanned aerial vehicle) technology.
- Cost-effective tool for high-resolution monitoring.

Meteorological Instruments (17th-18th Century)

- Instruments like the barometer and the thermometer laid the groundwork for systematic weather monitoring.

Satellite Technology (1950s-1970s)

- The launch of TIROS-1 (1960) and later environmental satellites like Landsat (1972) marked a turning point in global monitoring. Landsat provided the first continuous, detailed Earth observation data.

Real-Time Sensors and IoT (2000s):

- Environmental sensors became more sophisticated, and IoT allowed these devices to transmit data in real-time.

AI and Machine Learning

- (2020s): Technologies actively used in analyzing massive amounts of environmental data, optimizing models for prediction, and automating workflows in

Methods of monitoring

TRADITIONAL METHODS

Ground-Based Sensors: Measuring air quality, soil conditions, and water pollution.

- Limitation: Localized data, limited spatial coverage.

Satellite Imaging: Providing large-scale observations of land and ocean systems.

- Limitation: Lower resolution, cloud cover interference, high costs.

Manual Surveys: Collecting data through fieldwork.

- Limitation: Time-intensive, challenging in remote or hazardous areas.



MODERN INNOVATIONS

Internet of Things (IoT): Networks of connected sensors provide real-time, scalable data.

Artificial Intelligence (AI): Enhances data analysis with pattern recognition and predictive modeling.

Drones: Offer high-resolution, localized monitoring with flexibility and efficiency.

Drones bridge the gap between ground-based and satellite methods, combining accessibility with precision, making them indispensable in modern environmental science.

Drones and Environmental Monitoring



Forest

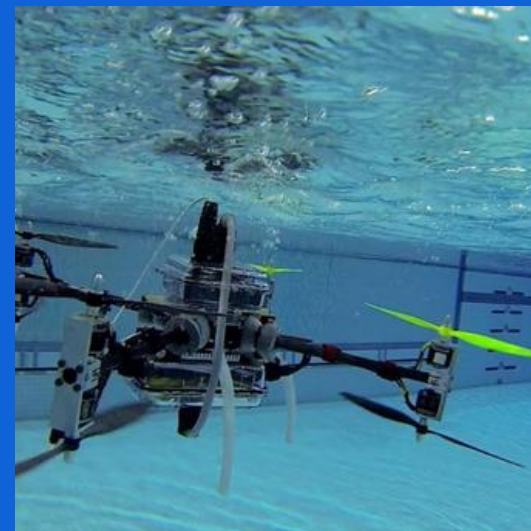
Monitoring

Detect illegal logging.
Monitor forest health

Enable non-invasive
monitoring of
wildlife in remote
areas



Wildlife Surveys



Water Resource

Monitoring:

Measures nutrients
and pollutants in
soil

Drones quickly
assess areas
affected by natural
disasters



Disaster

Management:



Agricultural

Applications

Analyze crop health
and detect soil
conditions.

Drones and Environmental Monitoring



Drones and Environmental Monitoring



Drones and Environmental Monitoring

Working together: SWARM MODE

A Swarm mode work is a coordinated operation of multiple drones working together as a unit, often using advanced algorithms to communicate and synchronize their actions. This allows them to efficiently cover large areas, perform complex tasks simultaneously, and adapt dynamically to changing conditions in real time.

Main applications:

- Coordinated Data Collection.

Drones and Environmental Monitoring

BASIC NEEDS FOR DRONE MONITORING

- **Drone Selection.** Match the drone type to the task:
 - Fixed-wing: Long-duration flights for wide-area monitoring.
 - Multi-rotor: Precision and maneuverability for close-up surveys.
 - Swarm: Large-scale data collection with synchronized operations.
- **Flight Planning.**
 - For efficient usage of the battery routes must be carefully designed and optimized.

- **Data Accuracy and Processing.**
 - Calibrate cameras and sensors before flights.
 - Use AI-powered software for post-flight data analysis and visualization.
- **Regulatory and Safety Compliance:**
 - Follow local drone regulations and secure required permits.
 - Prioritize safety for operators and nearby ecosystems.

Additional Resources

Further reading:

[Drone environmental management in Australia](#)

[How drones monitor environmental changes](#)

Further viewing:

[Drought Monitoring and Planning with Drones](#)

[Drone Wildlife Monitoring at Sanjiangyuan National Park](#)



Thank you for your
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