UAS APPLICATIONS & OPERATIONS IN ENVIRONMENTAL SCIENCE

Three Course Sequence

1. **Introduction to UAS in Biology, Ecology, and Conservation**: Discover the foundations of revolutionary drone technology and how it's being applied in environmental science and management. *(six weeks, asynchronous video lectures and assessments, plus six 1.5 hour in-person synchronous sessions)*
   Goal: Identify how drones can be applied in research, including your own

2. **UAS operations for Environmental Scientists**: Learn the basics of drone flight operations, how to become legally certified, and how to fly effectively for scientific research purposes*. (six weeks, asynchronous video lectures and assessments, plus six 1.5 hour in-person synchronous sessions)*
   Goal: Become the Scientist Pilot!

3. **Quantitative analysis of UAS data**: Gain hands-on experience with drone data and modern analytical software needed to assess habitat changes, count animal populations, study animal health and behavior, and assess ecosystem relationships. *(six weeks, asynchronous video lectures and assessments, plus six 1.5 hour in-person synchronous sessions)*
   Goal: Use drone data to test scientific hypotheses and communicate research results.

On successful completion of this course series, learners will be able to:

1. Explain basic aeronautics, flight physics, and describe how and why drones fly.
2. Describe the foundations of revolutionary drone technology and how it's being applied in environmental science and management.
3. Identify how drones can be applied in novel research, including your own.
4. Describe the basics of drone flight operations, how to become legally certified, and how to fly effectively for scientific research.
5. Identify the legal and ethical challenges of using drones in environmental science.
6. Analyze drone data to test scientific hypotheses and communicate research results.
7. Use modern analytical software to assess habitat changes, count animal populations, study animal health and behavior, and assess ecological relationships.

Course Level Outcomes:

1. Introduction to UAS in Biology, Ecology, and Conservation

On successful completion of this course, learners will be able to:

1. Explain the four physical forces that act on aircraft.
2. Describe how those forces act on different kinds of drones.
3. Describe or differentiate between types of drones and explain how they work.
4. Explain how drones are applied to the study of animal populations, individual animals, and their habitats--including humans.
5. Explain the basic theories for photogrammetry and structure for motion analysis.
6. Discover how drones can be used to record the behavior of animals.
7. Relate the potential of machine learning for efficient data analysis.
8. Explain the importance of key best practices in drone research, including legal and ethical concerns.
9. Analyze arguments for and against drone technology in surveillance and reconnaissance.
10. Create a conceptual model of how drones can be used in an environmental science/management context.

2. UAS operations for Environmental Scientists

On successful completion of this course, learners will be able to:

1. Explain variations in the four forces of flight and how to fly safely in response to them.
2. Describe how the sky is organized by the National Airspace System (NAS).
3. Read and interpret Federal Aviation Administration (FAA) sectional charts and identify various airspace designations.
4. Identify hazards and flight restrictions in FAA regional/sectional charts.
5. Anticipate possible interactions and environmental factors that could affect drone operations.
6. Describe the nature of accurate and precise drone data, and how to collect it.
7. Identify components of the electromagnetic radiation spectrum that are sampled by drones.
8. Address and account for the factors that can affect data collection for both multirotor and fixed wing drones.
9. Develop a research plan that employs drones to collect robust scientific data.

3. Quantitative analysis of UAS data

On successful completion of this course, learners will be able to:

1. Identify key aspects of precision and accuracy of drone-derived data.
2. Identify key factors of optical remote sensing and how they apply to drone data collection.
3. Analyze standard RGB, multispectral, and thermal imagery collected from drone sensors.
4. Create orthomosaics, 3D point clouds, and spectral indices of regions sampled with drones.
5. Combine GNSS surveys and drones data to create accurate and precise products for further analysis.
6. Analyze drone data to detect ecosystem change via reflectance variation or volumetric deviations.
7. Assess the body condition of whales using standard photogrammetric equations and open-source software.
8. Label imagery and count animal populations using a convolutional neural network.

Individual Course
- **$2,000.00**

Full Course Sequence and UAS Applications and Operations Certificate
- **$4,200.00** (30% Discount on individual course price)