Training Course on Remote Sensing for Environmental Monitoring and Change Detection

Professional Development Training Course Outline

Category	GIS	**Duration**	5 Days
Base Fee	$1,500 USD	**Delivery Mode**	Online / On-site Hybrid

Course Introduction

Remote Sensing for Environmental Monitoring and Change Detection is a crucial course for professionals seeking to leverage **cutting-edge geospatial technologies** to understand and manage our dynamic planet. As environmental challenges like **climate change, deforestation, land degradation, and urbanization** intensify, the ability to accurately assess and monitor these changes remotely becomes indispensable. Training Course on Remote Sensing for Environmental Monitoring and Change Detection empowers participants with the skills to acquire, process, and analyze **satellite imagery, aerial photography, and drone data** to extract actionable insights for effective environmental management and informed decision-making.

This intensive program delves into the **theoretical foundations and practical applications** of remote sensing, focusing on its utility in tracking **environmental transformations** across diverse landscapes. Participants will gain hands-on experience with **industry-standard software and advanced techniques** for **image classification, time-series analysis, and spatial modeling**. The course emphasizes real-world scenarios and **case studies** to equip learners with the confidence to apply remote sensing methodologies to critical environmental issues, fostering a new generation of **environmental data scientists** and **conservation technologists**.

Programme Curriculum

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Course Duration

5 days

Course Objectives

1. Master the fundamental principles of remote sensing, including electromagnetic spectrum interaction and sensor characteristics.
2. Acquire proficiency in remote sensing data acquisition from various platforms (satellite, UAV, aerial) and sensor types (optical, LiDAR, SAR).
3. Develop expertise in image preprocessing techniques such as radiometric, geometric, and atmospheric correction.
4. Implement advanced image classification algorithms (supervised, unsupervised, object-based) for land cover mapping and land use change analysis.
5. Perform multitemporal change detection analysis to quantify environmental transformations (e.g., deforestation, urban sprawl, glacier melt).
6. Utilize spectral indices (NDVI, NDWI) for vegetation health monitoring, water quality assessment, and drought monitoring.
7. Apply remote sensing for disaster monitoring and damage assessment (floods, wildfires, landslides).
8. Integrate remote sensing data with GIS for comprehensive spatial analysis and environmental modeling.
9. Gain practical experience with open-source and commercial remote sensing software and cloud-based platforms.
10. Analyze time-series satellite imagery for understanding phenological cycles and long-term environmental trends.
11. Develop skills in reporting and visualizing remote sensing results for diverse stakeholders and policy makers.
12. Explore emerging trends in AI and Machine Learning for remote sensing, including deep learning applications in earth observation.
13. Understand the role of big data analytics and geospatial cloud computing in scalable environmental monitoring solutions.

Organizational Benefits

- Equip staff with the ability to gather and analyze **real-time environmental data**, leading to more informed and proactive management strategies.
- Reduce the need for expensive and time-consuming field surveys by leveraging **broad-area remote sensing capabilities**.

- Enable accurate and regular monitoring of environmental parameters to ensure adherence to **regulatory requirements** and **sustainability goals**.
- Provide tools to identify and assess environmental hazards, facilitating better **disaster preparedness** and **risk management**.
- Foster a workforce capable of adopting and integrating cutting-edge **geospatial technologies** for novel solutions in environmental science.
- Optimize the management of natural resources, including forests, water bodies, and agricultural lands, through **precise monitoring and forecasting**.
- Position the organization as a leader in **environmental stewardship** and the application of **advanced scientific methodologies**.

Target Audience

1. Environmental Scientists & Analysts.
2. GIS Specialists & Geographers.
3. Conservation Biologists & Ecologists.
4. Urban Planners & Developers.
5. Forestry & Agricultural Professionals.
6. Disaster Management & Humanitarian Aid Workers.
7. Government & NGO Officials.
8. Academics & Researchers.

Course Outline

Module 1: Foundations of Remote Sensing & Earth Observation

- Introduction to **electromagnetic spectrum**, energy interaction with Earth's surface, and spectral signatures.
- Overview of **remote sensing platforms** (satellites, aerial, UAVs) and their characteristics (orbital parameters, spatial/spectral/temporal resolution).
- Understanding different **sensor types** (optical, thermal, microwave, LiDAR) and their applications.
- Introduction to **geospatial data formats** (raster, vector) and their storage.
- **Case Study**: Analyzing Sentinel-2 and Landsat-8 data for global land cover mapping.

Module 2: Remote Sensing Data Preprocessing

- **Radiometric corrections**: Calibration, atmospheric correction, and normalization techniques.
- **Geometric corrections**: Image registration, georeferencing, and orthorectification.
- Image enhancement techniques: Contrast stretching, filtering, and band combinations for improved visualization.
- Data mosaicking and subsetting for specific areas of interest.
- **Case Study**: Correcting Landsat imagery for atmospheric effects to accurately monitor vegetation health in a deforested region.

Module 3: Image Classification for Land Cover/Use Mapping

- Principles of **supervised classification**: Training data collection, algorithm selection (Maximum Likelihood, SVM, Random Forest).
- **Unsupervised classification** techniques: K-means clustering, ISODATA.
- **Object-Based Image Analysis (OBIA)**: Segmentation and classification of objects instead of pixels.
- Accuracy assessment: Error matrix, producer's and user's accuracy, Kappa coefficient.

- **Case Study**: Mapping agricultural land use change and urban expansion in a rapidly developing city using multi-temporal high-resolution imagery.

Module 4: Change Detection Methodologies

- Introduction to **change detection principles**: Detecting "from-to" changes over time.
- **Image differencing, image ratioing, and image regression** techniques.
- **Post-classification comparison**: Comparing classified maps from different time periods.
- **Time-series analysis**: Detecting trends and anomalies using long-term satellite data (e.g., NDVI time series).
- **Case Study**: Monitoring the rate of glacier retreat in polar regions using multi-decadal satellite imagery (e.g., MODIS, Landsat).

Module 5: Environmental Monitoring Applications I: Vegetation & Water

- **Vegetation indices (NDVI, EVI)** for assessing vegetation health, productivity, and drought stress.
- Remote sensing for **forest cover monitoring, deforestation assessment, and biomass estimation**.
- **Water body mapping and monitoring**: Surface water extent, water quality parameters (chlorophyll-a, turbidity) using spectral analysis.
- Applications in **wetland mapping and coastal zone management**.
- **Case Study**: Assessing the impact of a severe drought on agricultural productivity in a specific region using NDVI time series.

Module 6: Environmental Monitoring Applications II: Urban & Disaster

- **Urban sprawl analysis** and impervious surface mapping using remote sensing.
- **Urban Heat Island (UHI) detection** using thermal infrared imagery.
- Remote sensing for **disaster response**: Flood mapping, wildfire perimeter mapping, and damage assessment.
- Landslide and erosion monitoring using **DEMs derived from LiDAR** and optical imagery.
- **Case Study**: Mapping the extent of damage caused by a major wildfire to assess environmental impact and guide recovery efforts.

Module 7: Advanced Remote Sensing Techniques & Emerging Trends

- Introduction to **Synthetic Aperture Radar (SAR)** data and its applications in all-weather conditions (e.g., flood mapping, forest monitoring).
- **LiDAR data processing**: Generating **Digital Terrain Models (DTMs)** and **Digital Surface Models (DSMs)**, applications in forestry and urban planning.
- Introduction to **Hyperspectral remote sensing** for detailed material identification.
- Overview of **Machine Learning and Deep Learning** in remote sensing (e.g., convolutional neural networks for image classification).
- **Case Study**: Utilizing SAR imagery to map flood extent in a cloud-covered region, demonstrating its advantage over optical sensors.

Module 8: Integration with GIS & Decision Support

- Integrating remote sensing products into **Geographic Information Systems (GIS)** for advanced spatial analysis.
- Developing **geospatial models** for environmental impact assessment and vulnerability mapping.

- Data visualization, cartography, and reporting of remote sensing findings.
- Introduction to **Cloud-based geospatial platforms** (Google Earth Engine, ArcGIS Online) for large-scale analysis.
- **Case Study**: Developing a web-based GIS dashboard integrating remote sensing data to monitor and report on deforestation rates in a protected area, supporting conservation efforts.

Training Methodology

This training course employs a **blended learning approach** that combines theoretical instruction with extensive hands-on practical exercises. The methodology is designed to ensure participants gain both conceptual understanding and practical proficiency in applying remote sensing techniques.

- **Interactive Lectures & Presentations**: Engaging sessions introducing core concepts, principles, and methodologies.
- **Software Demonstrations & Tutorials**: Step-by-step demonstrations of industry-standard remote sensing and GIS software (e.g., QGIS, ArcGIS Pro, Google Earth Engine).
- **Hands-on Practical Exercises**: Participants will work with real-world satellite imagery and geospatial datasets, performing data processing, analysis, and interpretation tasks.
- **Case Study Analysis & Discussion**: In-depth examination of successful remote sensing applications in environmental monitoring and change detection, fostering critical thinking.
- **Group Activities & Problem-Solving**: Collaborative exercises to apply learned techniques to simulated environmental challenges.
- **Q&A Sessions & Personalized Feedback**: Opportunities for participants to clarify doubts and receive individualized guidance from instructors.
- **Project-Based Learning**: A final project where participants apply their skills to a relevant environmental monitoring scenario, culminating in a presentation of their findings.
- **Resource Sharing**: Provision of course materials, datasets, and recommended readings for continued learning.

Register as a group from 3 participants for a Discount

Send us an email: info@fineskilltrainingcenter.org or call *+254769199797*

Certification

Upon successful completion of this training, participants will be issued with a globally- recognized certificate.

Tailor-Made Course

We also offer tailor-made courses based on your needs.

Key Notes

a. The participant must be conversant with English.

b. Upon completion of training the participant will be issued with an Authorized Training Certificate

c. Course duration is flexible and the contents can be modified to fit any number of days.

d. The course fee includes facilitation training materials, 2 coffee breaks, buffet lunch and A Certificate upon successful completion of Training.

e. One-year post-training support Consultation and Coaching provided after the course.

f. Payment should be done at least a week before commence of the training, to Fineskill Training Center account, as indicated in the invoice so as to enable us prepare better for you.

Upcoming Scheduled Sessions

Start Date	End Date	Location	Price
23 Nov 2026	27 Nov 2026	Online	$1,000
23 Nov 2026	27 Nov 2026	Physical	$1,500
23 Nov 2026	27 Nov 2026	Physical	$3,000
23 Nov 2026	27 Nov 2026	Physical	$3,000
23 Nov 2026	27 Nov 2026	Physical	$6,000
23 Nov 2026	27 Nov 2026	Physical	$4,500
23 Nov 2026	27 Nov 2026	Physical	$6,000
23 Nov 2026	27 Nov 2026	Physical	$6,000

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