Time-Series Remote Sensing for Land Use/Cover Change Training Course

Professional Development Training Course Outline

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

Course Introduction

Time-Series Remote Sensing for Land Use/Cover Change Training Course provides a comprehensive dive into **Time-Series Remote Sensing** for analyzing **Land Use/Cover Change (LULCC)**, equipping participants with cutting-edge skills to monitor and understand dynamic landscape transformations. Leveraging the power of multi-temporal satellite imagery, this program addresses the critical need for accurate, up-to-date **geospatial intelligence** in an era of rapid environmental and socio-economic shifts. Participants will master advanced **image processing** and **geoinformatics** techniques to extract actionable insights from vast remote sensing datasets, facilitating informed decision-making in diverse fields.

The curriculum emphasizes practical, **hands-on application** of **geospatial analysis** tools and methodologies, including **cloud-based platforms** like Google Earth Engine. By focusing on real-world scenarios and **case studies**, this course empowers professionals to effectively quantify and map LULCC, identify **drivers of change**, assess environmental impacts, and contribute to **sustainable development** and **climate resilience** initiatives. This specialized skill set is crucial for transforming raw satellite data into powerful, evidence-based solutions for **land management**, **urban planning**, and **conservation**.

Programme Curriculum

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Course Objectives

1. Master fundamental concepts of Time-Series Remote Sensing and its critical role in Land Use/Cover Change (LULCC) analysis.
2. Identify and access diverse multi-temporal satellite imagery datasets (e.g., Landsat, Sentinel, MODIS) from various archives.
3. Perform advanced image preprocessing techniques for time-series data, including radiometric normalization, atmospheric correction, and cloud masking.
4. Apply various image classification algorithms (e.g., Supervised, Unsupervised, Machine Learning) for generating accurate Land Use/Cover maps.
5. Execute a range of change detection methodologies (e.g., Post-Classification Comparison, Image Differencing, Spectral Mixture Analysis) to quantify LULCC.
6. Analyze and interpret LULCC patterns, trends, and rates over different temporal scales.
7. Utilize geospatial analytics to identify drivers of LULCC, including human activities and natural phenomena.
8. Assess the accuracy and validate LULCC products using robust validation techniques and statistical metrics (e.g., confusion matrices, Kappa coefficient).
9. Integrate remote sensing outputs with Geographic Information Systems (GIS) for comprehensive spatial analysis and visualization.
10. Develop skills in cloud-based geospatial platforms (e.g., Google Earth Engine) for efficient processing of large-scale time-series data.
11. Communicate LULCC findings effectively through professional maps, reports, and interactive visualizations.
12. Apply LULCC analysis to support sustainable land management, environmental monitoring, and climate change adaptation strategies.
13. Contribute to evidence-based policy-making and natural resource governance through robust geospatial insights.

Organizational Benefits

- Access to real-time, data-driven insights on land changes facilitates more informed and agile decisions in land use planning, resource allocation, and environmental management.
- Improved tracking and quantification of land use changes enable better adherence to environmental regulations and reporting requirements.

- Leveraging open-source remote sensing tools and reducing the need for extensive fieldwork can lead to substantial operational cost reductions.
- Adopting cutting-edge geospatial technology positions organizations as leaders in their respective fields, fostering innovation and efficiency.
- Early detection of land use conflicts, environmental threats, and unsustainable practices helps mitigate potential risks and liabilities.
- Accurate LULCC data supports optimized allocation of resources for development projects, conservation efforts, and infrastructure planning.
- Automation of data processing and analysis, particularly with cloud platforms, allows for more efficient large-area assessments and scalable operations.
- The ability to generate professional-quality maps, reports, and visualizations enhances stakeholder communication and transparency.
- This training directly contributes to achieving SDGs related to climate action, sustainable cities, and land degradation neutrality by providing essential monitoring and assessment capabilities.

Target Audience

1. GIS Professionals & Analysts
2. Environmental Scientists & Conservationists
3. Urban Planners & Developers
4. Natural Resource Managers & Foresters
5. Researchers & Academics.
6. Government Agency Staff
7. Development Practitioners
8. Data Scientists

Course Outline

Module 1: Introduction to Time-Series Remote Sensing & LULCC Fundamentals

- Concepts: Define Land Use, Land Cover, and the significance of Land Use/Cover Change (LULCC).
- Remote Sensing Basics: Overview of electromagnetic spectrum, satellite platforms (Landsat, Sentinel, MODIS), and image characteristics (spatial, spectral, temporal resolution).
- Time-Series Data: Understanding the benefits and challenges of analyzing sequential satellite imagery.
- Applications: Explore diverse real-world applications of LULCC monitoring, from urban growth to deforestation.
- **Software Introduction:** Familiarization with core **geospatial software** (e.g., QGIS, ArcGIS) and introduction to **cloud-based platforms** (e.g., Google Earth Engine).
- **Case Study:** Analyzing historical agricultural expansion in a regional watershed using Landsat time series.

Module 2: Data Acquisition and Preprocessing for Multi-temporal Analysis

- Data Sources: Strategies for identifying and accessing free and commercial satellite data archives.
- Image Selection: Criteria for selecting appropriate images (seasonality, cloud cover, sensor type) for time-series analysis.
- Radiometric & Atmospheric Correction: Techniques to normalize image brightness and remove atmospheric effects for accurate comparison across time.

- Geometric Registration: Precisely aligning multi-temporal images for pixel-to-pixel comparison and minimizing positional errors.
- Cloud & Shadow Masking: Methods for identifying and removing problematic areas in time-series data to ensure data quality.
- **Case Study:** Preprocessing Sentinel-2 imagery for deforestation monitoring in a cloud-prone tropical region.

Module 3: Image Classification Techniques for LULC Mapping

- Supervised Classification: Principles and application of common algorithms
- Unsupervised Classification: Understanding clustering algorithms (e.g., K-means, ISODATA) for preliminary LULC mapping.
- Training Data Collection: Best practices for collecting accurate and representative training samples for supervised classification.
- Feature Engineering: Utilizing spectral indices (NDVI, NDWI, NDBI) and other bands to enhance classification accuracy.
- Object-Based Image Analysis (OBIA): Introduction to segmenting images into meaningful objects before classification.
- **Case Study:** Mapping urban areas and green spaces using Random Forest classification on multi-spectral Landsat imagery in a rapidly growing city.

Module 4: Core Change Detection Methodologies

- Image Differencing & Ratios: Simple yet effective techniques for identifying areas of change between two time points.
- Post-Classification Comparison: Comparing independently classified LULC maps from different dates to generate change matrices.
- Change Vector Analysis (CVA): A multi-spectral approach to quantify the magnitude and direction of change.
- Spectral Mixture Analysis (SMA): Decomposing pixel spectra into fractional cover of pure endmembers to track subtle changes.
- Advanced Techniques: Introduction to machine learning-based change detection and time-series segmentation algorithms.
- **Case Study:** Quantifying wetland loss and conversion to agriculture using post-classification comparison of LULC maps over two decades.

Module 5: Time-Series Analysis and Trend Detection

- Temporal Trajectories: Analyzing pixel-level spectral values over time to understand phenological cycles and long-term trends.
- Decomposition Methods: Separating trend, seasonality, and residual components in time-series data (e.g., Breaks For Additive Season and Trend - BFAST).
- Anomaly Detection: Identifying unusual events or deviations from normal patterns in time-series data (e.g., sudden forest disturbances).
- Statistical Significance: Testing for significant changes and trends in LULCC data.
- Harmonic Analysis (Fourier Series): Capturing cyclical patterns in vegetation indices for phenological studies.
- **Case Study:** Detecting and characterizing forest disturbances (e.g., logging, fire) using BFAST analysis on Landsat time series.

Module 6: Accuracy Assessment and Validation of LULCC Products

- Importance of Accuracy: Understanding the necessity of validating LULC maps and change detection results.
- Ground Truth Data: Strategies for collecting and using reference data for validation.
- Confusion Matrices: Calculating user's, producer's, and overall accuracy, and the Kappa coefficient.
- Sampling Strategies: Designing effective sampling schemes for accuracy assessment.
- Error Analysis: Identifying sources of error and strategies for improving classification and change detection accuracy.
- **Case Study:** Performing a comprehensive accuracy assessment of a large-area urban growth map using high-resolution imagery and field observations.

Module 7: Cloud-Based Geospatial Platforms for LULCC (Google Earth Engine)

- Introduction to GEE: Overview of Google Earth Engine's capabilities for large-scale geospatial data analysis.
- Data Catalog: Accessing and filtering vast archives of satellite imagery and other geospatial datasets.
- JavaScript API (Code Editor): Writing and executing scripts for image processing and analysis.
- Time-Series Operations: Performing complex time-series operations, including median compositing, trend analysis, and change detection.
- Visualization & Export: Creating interactive maps and exporting results for further analysis in desktop GIS.
- **Case Study:** Monitoring glacier retreat and snow cover changes over several decades using Google Earth Engine and MODIS data.

Module 8: Advanced LULCC Applications and Reporting

- Integrated Monitoring Systems: Designing and implementing continuous LULCC monitoring frameworks.
- Socio-economic Linkages: Exploring the relationships between LULCC and socio-economic factors (e.g., population growth, policy).
- Environmental Impact Assessment: Applying LULCC analysis to assess environmental impacts of development projects.
- Scenario Modeling: Using LULCC data to model future land change scenarios.
- Communication & Storytelling: Creating compelling maps, dashboards, and reports to effectively communicate LULCC findings to diverse audiences.
- **Case Study:** Developing an interactive dashboard in Google Earth Engine to showcase long-term urban sprawl and its impact on agricultural land.

Training Methodology

- Interactive Lectures & Discussions.
- Software Demonstrations
- Step-by-Step Tutorials.
- Practical Case Studies.
- Hands-on Projects.
- Individualized Support
- Knowledge Checks & Quizzes
- Collaborative 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

Start Date	End Date	Location	Price
23 Nov 2026	27 Nov 2026	Physical	$6,000
23 Nov 2026	27 Nov 2026	Physical	$6,000

Ready to enroll or request a customized program? Book online or contact us:

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