

Urban Remote Sensing and Impervious Surface Mapping 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

Urban Remote Sensing and Impervious Surface Mapping Training Course provides a comprehensive deep dive into **Urban Remote Sensing** and **Impervious Surface Mapping**, critical disciplines for sustainable urban development and environmental management. Participants will gain cutting-edge skills in leveraging **geospatial technologies** and **satellite imagery** to analyze urban growth, monitor environmental impacts, and inform intelligent urban planning decisions. With rapid global urbanization, understanding and quantifying **impervious surfaces** such as roads, buildings, and pavements is paramount for effective stormwater management, urban heat island mitigation, and assessing ecosystem health.

The program emphasizes practical, hands-on experience with industry-standard software and **open-source tools**, empowering participants to extract actionable insights from diverse remote sensing datasets. Through real-world **case studies** and **project-based learning**, attendees will master techniques for **land cover classification**, **change detection**, and advanced **geospatial analytics**. This course is designed to equip professionals with the expertise needed to address contemporary urban challenges, fostering data-driven approaches to build more resilient and sustainable cities.

Programme Curriculum

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Course Objectives

Upon completion of this training, participants will be able to:

- Master remote sensing fundamentals for urban applications.
- Acquire, process, and analyze diverse satellite imagery (e.g., Sentinel, Landsat, high-resolution commercial data).
- Perform accurate impervious surface extraction using advanced techniques.
- Implement machine learning and deep learning algorithms for urban mapping.
- Conduct urban sprawl analysis and monitor land use/land cover change.
- Assess urban heat islands and their mitigation strategies using thermal imagery.
- Utilize GIS integration for comprehensive spatial analysis and visualization.
- Apply remote sensing for stormwater management and hydrological modeling.
- Evaluate urban green infrastructure and its impact on ecosystem services.
- Develop skills in time-series analysis for monitoring urban dynamics.
- Understand the role of UAV (drone) data in urban mapping.
- Leverage cloud-based geospatial platforms like Google Earth Engine.
- Generate actionable insights for data-driven urban policy and planning.

Organizational Benefits

- Equip teams with data-driven insights for strategic urban planning, infrastructure development, and environmental management.
- Optimize resource allocation for stormwater control, green space development, and urban resilience initiatives.
- Reduce reliance on traditional, often expensive, field surveys by leveraging efficient remote sensing techniques.
- Implement advanced mapping techniques for more precise and timely urban data collection and analysis.
- Meet regulatory requirements and improve reporting capabilities related to urban development, environmental impact, and sustainability goals.
- Foster a culture of innovation by adopting cutting-edge geospatial technologies and analytical methodologies.
- Develop in-house expertise in a critical and rapidly evolving field, leading to long-term organizational self-sufficiency.

Target Audience

- Urban Planners and City Managers
- Environmental Scientists and Consultants
- GIS Professionals and Analysts
- Civil Engineers and Infrastructure Developers
- Researchers and Academics in Geography/Environmental Studies
- Government Officials in Land Use and Resource Management
- Hydrologists and Water Resource Managers
- Data Scientists interested in Geospatial Data

Course Outline

Module 1: Foundations of Urban Remote Sensing

- Introduction to Remote Sensing principles and electromagnetic spectrum.
- Overview of various satellite sensors and their applicability to urban areas
- Understanding different spatial, spectral, temporal, and radiometric resolutions.
- Basic concepts of **urban morphology** and how they relate to remote sensing.
- **Case Study:** Analyzing the evolution of urban footprints using multi-temporal Landsat imagery of a rapidly growing city like Nairobi.

Module 2: Impervious Surface Definition and Significance

- Definition and characteristics of **impervious surfaces (IS)**.
- Environmental impacts of IS: **stormwater runoff**, urban heat islands, habitat fragmentation.
- Importance of accurate **impervious surface mapping** for urban planning and environmental management.
- Challenges in IS mapping from remote sensing data (e.g., spectral confusion).
- **Case Study:** Quantifying the increase in impervious surfaces in a coastal city like Mombasa and its correlation with flash floods.

Module 3: Data Acquisition and Pre-processing for Urban Analysis

- Sources of **remote sensing data** for urban areas (optical, SAR, LiDAR).
- Data acquisition strategies and mission planning for **UAV imagery**.
- Radiometric and atmospheric correction techniques for satellite images.
- Geometric correction and image registration for multi-temporal analysis.
- **Case Study:** Pre-processing Sentinel-2 imagery for urban land cover classification in the greater Tokyo area, addressing cloud cover and atmospheric effects.

Module 4: Traditional Impervious Surface Mapping Techniques

- **Pixel-based classification** methods: supervised and unsupervised classification.
- Spectral indices for **built-up area extraction** (e.g., NDBI, IBI).
- **Object-Based Image Analysis (OBIA)** for impervious surface segmentation.
- Accuracy assessment and validation of classification results (confusion matrix, Kappa coefficient).
- **Case Study:** Mapping impervious surfaces in Lahore, Pakistan, comparing the accuracy of NDBI-based methods versus supervised classification techniques.

Module 5: Advanced Machine Learning for Urban Mapping

- Introduction to **machine learning algorithms** in remote sensing
- Feature engineering and selection for improved urban classification.

- **Deep learning architectures** for semantic segmentation of urban features (e.g., U-Net, FCN).
- Training and validating deep learning models with large urban datasets.
- **Case Study:** Using a Random Forest classifier to map urban land cover and impervious surfaces in major US cities, such as Los Angeles, demonstrating improved accuracy over traditional methods.

Module 6: Urban Change Detection and Growth Monitoring

- Techniques for detecting **urban growth** and **land use change** over time.
- Post-classification comparison, change vector analysis, and image differencing.
- Monitoring **urban sprawl** and its socio-economic implications.
- Quantifying the rate and direction of urban expansion.
- **Case Study:** Analyzing urban expansion in Beijing over two decades using time-series Landsat data and change detection algorithms.

Module 7: Specialized Urban Remote Sensing Applications

- Mapping **Urban Heat Islands (UHIs)** using thermal infrared imagery.
- Remote sensing for **stormwater management** and hydrological modeling.
- Identifying and assessing **urban green spaces** and their health.
- Applications in **smart city initiatives** and urban infrastructure monitoring.
- **Case Study:** Mapping urban heat island intensity in Phoenix, Arizona, and identifying strategies for mitigation using vegetation indices and thermal band data.

Module 8: Geospatial Platforms and Future Trends

- Introduction to **cloud-based geospatial platforms**
- Leveraging large-scale datasets and distributed computing for urban analysis.
- Emerging trends in **urban remote sensing**: AI integration, big data analytics, citizen science.
- Ethical considerations and data privacy in urban remote sensing.
- **Case Study:** Utilizing Google Earth Engine to monitor impervious surface changes at a regional scale, such as the Yangtze River Delta, demonstrating efficient large-scale analysis.

Training Methodology

- **Interactive Lectures:** Clear explanations of core concepts with illustrative examples.
- **Software Demonstrations:** Step-by-step guidance on using industry-standard (e.g., ArcGIS, ENVI) and **open-source software** (e.g., QGIS, Google Earth Engine Python API).
- **Practical Labs:** Guided exercises and projects where participants apply learned techniques to real-world datasets.
- **Case Study Discussions:** Analysis of successful applications and challenges in diverse urban environments.
- **Group Activities:** Collaborative problem-solving and peer learning sessions.
- **Individual Project Work:** Opportunity to apply skills to a chosen urban remote sensing challenge.
- **Q&A Sessions:** Dedicated time for clarification and deeper understanding.

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

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