Land Cover Classification and Land Cover Change Detection

Materials

PowerPoint presentation (Background information on LCC & LCD)

Videos: https://www.youtube.com/watch?v=QeLsMqvuLU8&list=PLt6ETIx7BnNb4cIrIwHdEfgGNeCnep7-o

Dataset source: Google Earth Engine (GEE) – https://earth.google.com/web

Earth Explorer (USGS): earthexplorer.usgs.gov (https://earthexplorer.usgs.gov)

Websites: Quiz and readings

* **Land cover classification**

**Image identification:**

1. What is the dominant land cover type you see? (Image of a dense continuous area of trees – Forest
2. Based on the colors and textures in this false-color image (where vegetation appears red), what is the main land cover type in the bright red areas? (Show a standard false-color composite - Vegetation (e.g., Forest or Crops
3. Identify the primary land cover in this aerial photograph. (Show an image of a city centre with buildings and roads) - Urban / Built-up
4. Match the land cover description on the left with the correct term on the right.

|  |  |
| --- | --- |
| Vast expanses of grasses and non-woody plants | Water Body |
| Land dominated by human structures like buildings and pavement | | Wetland |
| A natural depression filled with water | Grassland |
| Land saturated with water, like a marsh or swamp | Urban Area |

**True or False:**

1. Land cover refers specifically to how humans use the land, such as for recreation or agriculture. (False)
2. "Impervious surfaces" like concrete and asphalt are a common land cover class in urban areas. (True)
3. A satellite image cannot distinguish between a coniferous forest and a deciduous forest. (False)
4. Explain the concept of image classification in remote sensing. Image classification is a process of grouping pixels in a remote sensing image into meaningful categories based on their spectral characteristics. Each pixel is assigned to a specific land cover class (e.g., water, forest, urban areas)
5. What are the differences between supervised and unsupervised classification techniques in remote sensing? ***Supervised classification*** involves the analyst providing training samples of known land cover types. The algorithm then uses these spectral signatures to classify the rest of the image. It usually gives higher accuracy but requires reliable ground truth data whereas, ***Unsupervised classification*** groups pixels into clusters based only on spectral similarity without prior training data. The analyst assigns class labels afterward. It is faster and requires less prior knowledge but may produce less accurate results.
6. What is your understanding of the role of remote sensing in environmental monitoring? Assessing Land Cover Changes: (Tracking deforestation, urbanization, and changes in agricultural practices to understand their environmental impacts.)
7. What are the different types of image classification methods used in remote sensing?

*(Supervised Classification*: Requires training the classifier using labelled samples of known land cover classes. The classifier then uses this training data to classify unlabelled pixels in the image.

*Unsupervised Classification*: Does not require labelled samples. The classifier automatically groups pixels based on their spectral similarity, without prior knowledge of the land cover classes.

*Object-Based Image Analysis (OBIA*): Focuses on analyzing image objects (groups of connected pixels) rather than individual pixels. OBIA algorithms consider both spectral and spatial information, resulting in more accurate classifications, especially for complex landscapes.

*Deep Learning Classification:* Utilizes deep neural networks to extract features from images and classify pixels into different land cover classes. Deep learning methods have shown promise for achieving high accuracy in image classification tasks.)

* **Land cover change detection**

**Identifying causes**

1. What is the concept of “change detection” in remote sensing? (Change detection is a process of identifying and analyzing changes in the Earth's surface over time using multiple remote sensing images. It involves comparing images from different dates to identify areas that have undergone changes, such as deforestation, urbanization, or land cover modifications.)
2. Match the event on the left with the most direct land cover change it causes on the right.

|  |  |
| --- | --- |
| Building a new suburb | Forest → Bare Soil |
| A large wildfire | Forest → Urban |
| Constructing a dam on a river | Grassland → Cropland |
| Converting a prairie to grow wheat | River Valley → Water Body |

1. A satellite image shows a new, geometric grid of roads appearing in a previously forested area. What human activity most likely caused this change? (urban planning / residential or commercial zone)
2. What are some of the common methods of change detection? Common change detection methods include: *Image Differencing:*Subtracting one image from another to highlight areas of change. Areas with large differences indicate significant changes. *Image Ratioing:*Dividing two images to create a ratio image, which highlights changes in spectral characteristics. *Post-Classification Comparison:*Classifying images from different dates and then comparing the classified maps to identify areas of change. *Object-Based Change Detection:*Using object-based image analysis techniques to detect changes in image objects rather than individual pixels.