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**Course: Land Cover classification and detection**

**OER Plan**

**Section 1: Introduction to the learning Unit**

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| **Title** | *Land Cover classification and detection* |
| **Duration** | **5 hours** |
| **Introduction** | Changes in land cover or changes of what's on the land, like trees or buildings show how the Earth's surface is being transformed by nature and people. In this learning Unit, you will learn the basic ideas of mapping land cover and detecting changes. Using open access software tools like QGIS for maps and RStudio for data analysis. We will work with real satellite images. The goal is to classify the land, to measure how it changes, and understand the environmental Causes behind those changes.  **Two modules will be covered during this session**   * Land cover classifiction * Geospatial technologies |
| **Learning outcomes** with this learning unit student will be able to : | By the end of this learning material, learners will be able to:   * Explain the fundamental concepts of land cover * Identify the importance of land cover classification in environmental monitoring and resource management. * Understand the principles of remote sensing and different remote sensing platform is used for land cover detection. |
| **Material** | * *Laptop/computer with internet connection* * *Sample datasets (Sentinel-2, species occurrence data of Fogo Island)* * *Handouts/slides*   ***Software***   * *QGIS (open source)*   *RStudio with packages: terra, randomForest, dplyr* |
| **Literature** | 1.   Abdulrahman, F. H., Kattan, R. A., and Gilyana, S. M. 2020. A Comparison between Unmanned Aerial Vehicle and Aerial Survey Acquired in Separate Dates for the Production of Orthophotos. *Journal of Duhok University* 23(2): 52–66. DOI:[10.26682/csjuod.2020.23.2.5](http://dx.doi.org/10.26682/csjuod.2020.23.2.5)  2.   Agustamanda, E., Nurjanah, N., and Amilia, Y. 2024. Perspektif Masyarakat terhadap Suku Togutil, Halmahera Timur, Maluku Utara. *Khatulistiwa: Jurnal Pendidikan dan Sosial Humaniora* 4(2): 245–250. DOI: 10.55606/khatulistiwa.v4i2.3329  3.   Al Muhdhar, M. H. I., Rohman, F., Tamalene, M. N., Nadra, W. S., Daud, A., and Irsyadi, H. 2019. Local Wisdom-Based Conservation Ethics of Tabaru Traditional Community on Halmahera Island, Indonesia. *International Journal of Conservation Science* 10(3): 533–542.  4.   Blanco-Sacristán, J., Panigada, C., Gentili, R., Tagliabue, G., Garzonio, R., Martín, M. P., Ladrón de Guevara, M., Colombo, R., Dowling, T. P. F., and Rossini, M. 2021. UAV RGB, Thermal Infrared, and Multispectral Imagery Were Used to Investigate the Control of Terrain on the Spatial Distribution of Dryland Biocrust. *Earth Surface Processes and Landforms* 46(12): 2466–2484. DOI: 10.1002/esp.5189  5.   Bourdouxhe, A., Duflot, R., Radoux, J., and Dufrêne, M. 2020. Comparison of Methods to Model Species Habitat Networks for Decision-Making in Nature Conservation: The Case of the Wildcat in Southern Belgium. *Journal for Nature Conservation* 58(7): 125901. DOI: 10.1016/j.jnc.2020.125901  6.   Fahlstrom, P. G., Gleason, T. J., and Sadraey, M. H. 2022. *Introduction to UAV Systems*. John Wiley and Sons. Hoboken, USA.  7.   Fajrul‘Aini, T., and Nawiyanto, S. 2021. Dari Hutan Produksi ke Kawasan Konservasi: Kajian Tentang Kawasan Gunung Ciremai Tahun 1978–2014. *Historia* 4(2): 125–138. DOI: 10.19184/jhist.v4i1.22782  8.   Faroh, E. P. I., Puspaningrani, F. C., Reinadova, G., Akbar, M. R., Anggraeni, N. D. S., Wildiyanti, O. S., Kafafa, U., and Putri, R. F. 2020. Dynamic Changes Analysis of Land Resource Balance in North Maluku Province, Indonesia. *ASEAN Journal on Science and Technology for Development* 37(2): 63–71. DOI: 10.29037/ajstd.613  9.   Li, Y., He, N., Hou, J., Xu, L., Liu, C., Zhang, J., Wang, Q., Zhang, X., and Wu, X. 2018. Factors Influencing Leaf Chlorophyll Content in Natural Forests at The Biome Scale. *Frontiers in Ecology and Evolution* 6: 64. DOI: 10.3389/fevo.2018.00064  10. Li, Z., Chen, X., Qi, J., Xu, C., An, J., and Chen, J. 2023. Accuracy Assessment of Land Cover Products in China from 2000 to 2020. *Scientific Reports* 13(1): 12936. DOI: 10.1038/s41598-023-39963-0  11. Lindenmayer, D., and Bowd, E. 2022. Critical Ecological Roles, Structural Attributes and Conservation of Old Growth Forest: Lessons from A Case Study of Australian Mountain Ash Forests. *Frontiers in Forests and Global Change* 5: 878570. DOI: 10.3389/ffgc.2022.878570 |
| **Metadata** | *Name:* ***Land cover classification and detection***  *Learning ResourceType: Open Ressource*  *Description: This course is 2 modules to Guide on Land Cover classification and detection*  *Keyword(s):* *Remote Sensing, Land Cover, QGIS, RStudio, Open Educational Resource*  *Author(s): Eric MANIRAGABA, Jothum ANYURU, Shréyan MAHARAJ, Clara AWUOR, Ari UTOMO*  *Language: English*  *License:* This work is licensed under a Creative Commons Attribution-ShareAlike 4.0 International License.  *Creation Date: September 2025* |

**Section 2: Input**

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| **Module 1 Land Cover Classification**  In this module on Land Cover Classification, we will embark on a comprehensive journey to understand how our planet's surface is mapped and monitored. We will begin with an **Introduction to Land Cover Change** exploring the critical importance of identifying different land cover types such as forests, urban areas, and water bodies and analyzing the drivers and impacts of their transformation over time. The foundation of this analysis is **Satellite Imagery**, where we will learn about the remote sensing technology that provides a vast, bird's-eye view of the Earth, including the key characteristics of different satellite sensors and data products. Finally, we will bring these concepts together by diving into the core techniques of **Land Cover Classification**, where you will learn how to process satellite images and use various methods, from traditional to machine learning, to automatically categorize pixels into a meaningful map of the Earth's surface.  **Module 2 Geospatial Technologies**  Within this second module on Geospatial Technologies will guide you through the key **concepts of remote sensing**. We will start with a basic introduction to the principles behind gathering information about the Earth from a distance. Next, we will study the different types of **remote sensing data and the platforms**, like satellites, that collect it. You will then learn how to use **software to perform land cover classification**, which is the process of creating maps from images to identify features like forests or cities. Finally, we will explore the important **applications of this technology in fields** like environmental monitoring and urban planning. |

**Section 3: Application / Learning Activities / Tasks**

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| This Unit can be reached online following this link: [Halaman Muka](https://sites.google.com/view/land-cover-detectionclass/halaman-muka)  Interested learners need to have some basic knowledge of R studio in order to complete the following activity; [R\_Basics\_for\_data\_analysis.ppt - Microsoft PowerPoint Online](https://onedrive.live.com/view.aspx?resid=10D0C4498E3100C7!sb8254c4d4fac43fa92f460d1c9e84d82&cid=10d0c4498e3100c7&redeem=aHR0cHM6Ly8xZHJ2Lm1zL2YvYy8xMGQwYzQ0OThlMzEwMGM3L0V0X0UzRzBfTHloUG56ZlB5cFpiaFU0QmpYNzd0cXR4SGEySUE1MWFrYWhPc3c_ZT0yWkNub1k&migratedtospo=true&app=PowerPoint&CT=1758888159057&OR=ItemsView)  R Scripts : <https://onedrive.live.com/?redeem=aHR0cHM6Ly8xZHJ2Lm1zL2YvYy8xMGQwYzQ0OThlMzEwMGM3L0V0X0UzRzBfTHloUG56ZlB5cFpiaFU0QmpYNzd0cXR4SGEySUE1MWFrYWhPc3c%5FZT0yWkNub1k&id=10D0C4498E3100C7%21se9ca897a1c2141db9c586d6b3e707531&cid=10D0C4498E3100C7&sb=name&sd=1> |

**Section 4: Assessment and Wrap up**

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| *After completion of each Module, everyone has take an assessment on the Following links;*  ***Module 1***  ***Assessment:*** [***https://docs.google.com/forms/d/e/1FAIpQLSfcretxt2uTmiTUR-8-WKNg8b9nMlYV0BC\_-mEk75aggA6nhQ/viewform?usp=dialog***](https://docs.google.com/forms/d/e/1FAIpQLSfcretxt2uTmiTUR-8-WKNg8b9nMlYV0BC_-mEk75aggA6nhQ/viewform?usp=dialog)  ***Check Answers:*** [***https://1drv.ms/f/c/10d0c4498e3100c7/Et\_E3G0\_LyhPnzfPypZbhU4BjX77tqtxHa2IA51akahOsw?e=2ZCnoY***](https://1drv.ms/f/c/10d0c4498e3100c7/Et_E3G0_LyhPnzfPypZbhU4BjX77tqtxHa2IA51akahOsw?e=2ZCnoY)  ***Module 2***  ***Assessment:*** [***https://docs.google.com/forms/d/e/1FAIpQLSdd8zRNqImIHjeFfFPnq0HrLRw3EkBjBoDelOPEo3FqmyW7nA/viewform***](https://docs.google.com/forms/d/e/1FAIpQLSdd8zRNqImIHjeFfFPnq0HrLRw3EkBjBoDelOPEo3FqmyW7nA/viewform)  ***Check Answers:*** [R\_Basics\_for\_data\_analysis.ppt - Microsoft PowerPoint Online](https://onedrive.live.com/view.aspx?resid=10D0C4498E3100C7!sb8254c4d4fac43fa92f460d1c9e84d82&cid=10d0c4498e3100c7&redeem=aHR0cHM6Ly8xZHJ2Lm1zL2YvYy8xMGQwYzQ0OThlMzEwMGM3L0V0X0UzRzBfTHloUG56ZlB5cFpiaFU0QmpYNzd0cXR4SGEySUE1MWFrYWhPc3c_ZT0yWkNub1k&migratedtospo=true&app=PowerPoint&CT=1758888159057&OR=ItemsView) |

**Section 5: Appendix**

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

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