

Course Title	Management and analysis of digital geospatial data				
Course Code	DLCLIMA504				
Course Type	Compulsory				
Level	MSc (Level 2)				
Year / Semester	1 st / 1 st				
Teacher's Name	Thomas Katagis				
ECTS	7.5	Lectures / week		Laboratories/week	
Course Purpose	<p>Facing modern environmental challenges and the impacts of climate change requires the use of modern and reliable tools to monitor the planet's natural and managed ecosystems. Geospatial technology is now increasingly used in the systematic observation and mapping of climate and environmental processes as it provides accurate, timely and spatially explicit information. Geospatial data and information are essential for addressing environmental challenges, making informed decisions and promoting sustainable practices for the benefit of both ecosystems and human societies. The course "Management and Analysis of Digital Geospatial Data" will introduce students to the geospatial sciences of Geographic Information Systems, Remote Sensing, and Spatial Analysis in order to understand basic concepts while acquiring basic knowledge and skills in the management and analysis of geospatial data. The individual objectives of the course include, among others, the familiarization of students with data processing software in a GIS environment, the acquisition of skills in the management of different data models (vector, mosaic) and in cartographic synthesis, the acquaintance with the use of the Internet for accessing geospatial information and Earth Observation data. Upon completion of the course modules, students will be able to solve spatial analysis problems regarding environmental issues and apply spatio-temporal mapping and monitoring methods for natural ecosystems.</p>				
Learning Outcomes	<p>Upon successful completion of the course, students will be able to:</p> <ul style="list-style-type: none"> • Define the concept of geospatial technology. • Recognize the basic principles of the disciplines of GIS and Remote Sensing and distinguish their functions. 				

	<ul style="list-style-type: none"> • Recognize the importance of using geospatial technologies and methods in monitoring the natural environment. • Distinguish the differences between vector and mosaic data, understanding their respective advantages and applications in geospatial analysis. • Classify primary and secondary data sources. • Demonstrate the ability to search and download datasets from the Internet. • Define the importance of satellite imagery and aerial photographs as key remote sensing data sources. • Perform basic data entry and preparation operations using open source software. • Identify the basic characteristics of remote sensing sensors and images. • Solve a spatial analysis problem and compose a digital thematic map by using GIS software. • Apply various change detection methods, including satellite image differencing, to detect and analyze changes. • Use web-based platforms and tools to analyze, compare and assess environmental parameters. • Apply procedures to explore and download satellite imagery and thematic land and vegetation cover products. 		
Prerequisites		Corequisites	
Course Content	<ul style="list-style-type: none"> • Introduction to geospatial technologies: basic principles and applications. • Categories and sources of geospatial data. • Remote Sensing: Principles and Systems. • Geographic and projected reference systems. • Data management and spatial analysis processes. 		

	<ul style="list-style-type: none"> • Change detection using Earth Observation data. • Online tools and services for monitoring natural ecosystems
Teaching Methodology	<p>Distance Learning.</p> <p>The course will provide the theoretical background through synchronous and asynchronous communication methods. The set of learning activities is supported by an electronic communication and learning platform.</p> <p>The main learning activities of the course are as follows:</p> <ol style="list-style-type: none"> 1. Study of the required course literature. 2. Presentations of content or main points or specific studies in various formats (PowerPoint, oral presentations, annotated presentations). 3. Formulation and resolution of questions in a specialized forum. 4. Questions, quizzes, exercises, position papers, and other self-assessments. 5. Preparation of course assignments. 6. Participation in six video conferences.
Bibliography	<p>Textbooks</p> <p>Selected chapters from:</p> <ul style="list-style-type: none"> • Bossler, J.D., Campbell, J.B., McMaster, R.B., & Rizos, C. (Eds.). (2010). Manual of Geospatial Science and Technology (2nd ed.). CRC Press. https://doi.org/10.1201/9781420087345 • Paul A. Longley, Michael F. Goodchild, David J. Maguire, David W. Rhind, 2015. Geographic Information Systems and Science, 4th ed. <p>Tutorials:</p> <ul style="list-style-type: none"> • Fundamentals of Remote Sensing, Canada Centre for Mapping and Earth Observation, http://www.nrcan.gc.ca/node/9309 • O. Huisman, and R.A. de By, 2009. Principles of Geographic Information Systems (GIS): an Introductory Textbook. (https://webapps.itc.utwente.nl/librarywww/papers_2009/general/PrinciplesGIS.pdf)

Scientific papers:

- Katagis, T.; Gitas, I.Z. Assessing the Accuracy of MODIS MCD64A1 C6 and FireCCI51 Burned Area Products in Mediterranean Ecosystems. *Remote Sens.* 2022, 14, 602.
<https://doi.org/10.3390/rs14030602>
- Wulder MA, Masek JG, Cohen WB, Loveland TR, Woodcock CE (2012) Opening the archive: How free data has enabled the science and monitoring promise of Landsat. *Remote Sensing of Environment* 122, 2–10. doi: <https://doi.org/10.1016/j.rse.2012.01.010>
- Cammerino, A.R.B.; Ingaramo, M.; Piacquadio, L.; Monteleone, M. Assessing and Mapping Forest Functions through a GIS-Based, Multi-Criteria Approach as a Participative Planning Tool: An Application Analysis. *Forests* 2023, 14, 934.
<https://doi.org/10.3390/f14050934>
- Maniatis, Y.; Doganis, A.; Chatzigeorgiadis, M. Fire Risk Probability Mapping Using Machine Learning Tools and Multi-Criteria Decision Analysis in the GIS Environment: A Case Study in the National Park Forest Dadia-Lefkimi-Soufli, Greece. *Appl. Sci.* 2022, 12, 2938.
<https://doi.org/10.3390/app12062938>
- Lu D, Mausel P, Brondizio E, Moran E (2004) Change detection techniques. *International Journal of Remote Sensing* 25, 2365–2407.
- Huete, A.R. (2012), Vegetation Indices, Remote Sensing and Forest Monitoring. *Geography Compass*, 6: 513-532.
<https://doi.org/10.1111/j.1749-8198.2012.00507.x>
- Chuvieco E, Martin MP, Palacios A (2002) Assessment of different spectral indices in the red-near-infrared spectral domain for burned land discrimination. *Remote Sensing of Environment* 112, 2381–2396.
- Veraverbeke S, Gitas I, Katagis T, Polychronaki A, Somers B, Goossens R (2012) Assessing post-fire vegetation recovery using red–near infrared vegetation indices: Accounting for background and vegetation variability. *ISPRS Journal of Photogrammetry and Remote Sensing* 68, 28-39.

	<ul style="list-style-type: none"> • Zhu, Zhe. 2017. "Change Detection Using Landsat Time Series: A Review of Frequencies, Preprocessing, Algorithms, and Applications." ISPRS Journal of Photogrammetry and Remote Sensing 130: 370–84. http://dx.doi.org/10.1016/j.isprsjprs.2017.06.013. • M. Probeck et al., "CLC+ Backbone: Set the Scene in Copernicus for the Coming Decade," 2021 IEEE International Geoscience and Remote Sensing Symposium IGARSS, Brussels, Belgium, 2021, pp. 2076-2079, doi: 10.1109/IGARSS47720.2021.9553252. • Mutanga O, Kumar L. Google Earth Engine Applications. Remote Sensing. 2019; 11(5):591. https://doi.org/10.3390/rs11050591
Assessment	<ul style="list-style-type: none"> • Final exam (50%) • 2 evaluative assignments (20% + 15% = 35%) • 2 interactive online activities (7.5% + 7.5% = 15%) <p>All assignments (except for the final exam) are assigned and submitted on the electronic platform, where they undergo plagiarism checks using the Turnitin tool. The final exam is developed by the instructor and completed by the students on a special platform exclusively used for examinations.</p> <p>Students have 2 weeks to complete each interactive online activity (total duration 4 weeks) and 3 weeks to submit each evaluative assignment (total duration 6 weeks). It is at the discretion of the instructor to decide whether to grant an extension for assignment submission.</p>
Language	English