University of Gdańsk

Subject card

Subject name and code	Fire Ecology and Environmental Impacts (Lecture), PG_00200868						
Field of study	Physical geography and geoinformation						
Date of commencement of studies	October 2026		Academic year of realisation of subject	2027/2028			
Education level	Master's studies		Subject group	Obligatory subject group in the field of study Optional subject group Subject group related to scientific research in the field of study			
Mode of study	full-time studies		Mode of delivery	at the university			
Year of study	2		Language of instruction	English			
Semester of study	3		ECTS credits	2.0			
Learning profile	academic		Assessment form	credit			
Conducting unit							
Name and surname of lecturer (lecturers)	Subject supervisor		dr Alicja Bonk				
	Teachers						
Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	15.0	0.0	0.0	0.0	0.0	15
	E-learning hours included: 0.0						
Learning activity and number of study hours	Learning activity	Participation in didactic classes included in study plan		Participation in consultation hours		Self-study	SUM
	Number of study hours	15		1.0		34.0	50
Subject objectives	This course aims to familiarize students with the principles of fire ecology, focusing on the role of fire as a natural ecological process and its impact on biodiversity, ecosystems, and human societies. Through a combination of theoretical introductions and practical exercises, students will examine fire behavior, fire-adapted ecosystems, and the factors influencing fire regimes, including climate change and human activity. The course will also address the ecological consequences of wildfires, post-fire regeneration processes, and methods for fire assessment and management. Students will gain knowledge of fire modeling, GIS-based wildfire analysis, and experimental approaches to studying fire dynamics.						

Learning outcomes

Course outcome	Subject outcome	Method of verification
[GFGMU2_U04] is able to analyse and interpret the causes and course of physical-geographical processes and phenomena, selects and applies advanced research methods and tools, including statistical and geoinformatics methods, and critically interprets the results obtained, drawing conclusions and formulating their own position on that basis, justified in debate.	The student is able to describe and analyze fire processes and their environmental impact, using appropriate analytical tools and interpreting research results to formulate conclusions based on empirical data.	[SU2] presentation/project/paper/ report
[GFGMU2_U07] is able to efficiently perform, present and critically interpret the results of individual or group research , using a properly understood cause-and-effect sequence of the applied research procedure, visualizing the results of spatial data analysis and reliably documenting own contribution to the conducted procedure	The student is able to conduct research, clearly present and discuss the results, apply appropriate cause-and-effect reasoning, and effectively visualize spatial data analysis outcomes.	[SU1] oral statement/conversation/ discussion
[GFGMU2_W02] knows and understands to a deepened extent issues in the field of exact sciences enabling the understanding of complex processes and phenomena occurring in the Earth's natural environment, and in their interpretations consistently relay on empirical foundations, using qualitative and quantitative methods	The student understands complex processes and phenomena in Earth's natural environment, relying on solid empirical foundations and using both qualitative and quantitative methods.	[SW2] presentation/project/paper/ report

Subject contents

1. Introduction to Fire Ecology:

- Definition of fire ecology and basic principles of fire behavior;
- Fire as a natural ecological process;
- The role of fire in forest, savanna, and peatland ecosystems;
- Introduction to fire analysis methods, including Behave and CharAnalysis software.

2. Fires, Human Activity, and Climate Change:

- The connection between climate change and the frequency and intensity of fires;
- The impact of human activity on fire frequency;
- Changes in fire regimes in a global context.

3. Ecological Effects of Fires:

- Short- and long-term effects of fires on soil, water, vegetation, and fauna;
- Ecosystem responses to fire: regeneration, succession, and landscape changes;
- GIS-based analysis of burnt areas (using the NBR method).

4. Fires and Human Health and Safety:

- Health impacts of fires: smoke toxicity, air pollution;
- Social and economic consequences of fires: community risks, material losses.

Prerequisites and co-requisites

Proficiency in English sufficient for reading, writing, and understanding classes. Basic knowledge of ArcGIS Pro software.

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Oral assessment/presentation	51.0%	34.0%
Written assessment	51.0%	33.0%
Written assessment	51.0%	33.0%

Recommended reading	Basic literature	Belcher, C. M. (Ed.). 2013. *Fire phenomena and the earth system: An Interdisciplinary Guide to Fire Science*. Wiley-Blackwell. Chichester, UK. Glasspool, I., Edwards, d., Axe, L., 2004. *Charcoal in the Silurian as evidence for the earliest wildfire*. Geology (32): 381-383. 10.1130/G20363.1 Pellegrini, A., Harden, J., Georgiou, K., at al. 2022. *Fire effects on the persistence of soil organic matter and long-term carbon storage*. Nature Geoscience (15):5-13. 10.1038/s41561-021-00867-1 Scott, J., Burgan, R. 2005. *Fire Behavior Fuel Models: A Comprehensive Set for Use with Rothermels Surface Fire Spread Model* . Gen. Tech. Rep. RMRS-GTR-153. Vitali, R., Belcher, C., Kaplan, J., Watson, A. 2022. *Increased fire activity under high atmospheric oxygen concentrations is compatible with the presence of forests*. Nature Communications (13):7285. 10.1038/s41467-022-35081-z Whitlock, C., Larsen, A. 2001. Charcoal as a fire proxy. In J. Smol, H. Birks & W. Last (Eds.), *Tracking Environmental Change Using Lake Sediments. Volume 3: Terrestrial, Algal, and Siliceous Indicators* (pp. 75-99). Kulwer Academic Publishers.
	Supplementary literature	Blarquez, O., Girardin, M. P. , Leys, B., Ali, A. A., Aleman, J. C., Bergeron, Y., Carcaillet, C. 2013. *Paleofire reconstruction based on an ensemble-member strategy applied to sedimentary charcoal*. Geophysical Research Letters (40):2667-2672. Bonk A., Makohonienko, M., Tylmann, W. 2024. *Human-induced fires and land-use change in Lubusz Land (western Poland) derived from Lake Lubińskie sedimentary record*. The Holocene (34):139-148. doi: 10.1177/09596836231211818 Bonk, A., Słowiński, M., Żarczyński, M. at al. 2022. *Tracking fire activity and post-fire limnological responses using varved sedimentary sequence of Lake Jaczno, Poland*. The Holocene (32):515-528. https://doi.org/10.1177/09596836221080755 Feurdean, A., Veski, S., Florescu, G. at al. 2017. *Broadleaf deciduous forest counterbalanced the direct effect of climate in Holocene fire regime in hemiboreal/boreal region (NE Europe)*. QSR (169):378-390. https://doi.org/10.1016/j.quascirev.2017.05.024 Higuera, P. 2009. *CharAnalysis 0.9: Diagnostic and analytical tools for sediment-charcoal analysis.* Manual available at: https://github.com/phiguera/CharAnalysis Marlon, J.R., Bartlein, P.J., Gavin, D.G., Long, C.J., Anderson, R.S., Briles, C.E., Brown, K.J., Colombaroli, D., Hallett, D.J., Power, M.J., Scharf, E.A., Walsh, M.K. 2012. *Long-term perspective on wildfires in the western USA*. Proceedings of the National Academy of Sciences doi:10.1073/pnas.1112839109
	eResources addresses	

Example issues/ example questions/ tasks being completed	1. Conduct an analysis of burnt areas using the NBR method in ArcGIS Pro. 2. Using Behave software, demonstrate how to model the approximate fire front and its behavior under specific conditions. 3. Use CharAnalysis to reconstruct fire events based on charcoal data. 4. Discuss how climate change affects fires in different parts of the globe.
Work placement	Not applicable

Document generated electronically. Does not require a seal or signature.