University of Zagreb Faculty of Agriculture
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Meta-analysis in Agricultural and Environmental Research (296628)

Course coordinator

Asst. Prof. Jelena Horvatinec Isaković, PhD

Course description

Introduce students to the basic principles of meta-analysis as a method of synthesizing scientific evidence in the fields of agriculture, environment and resource management.

Enable students to plan and conduct simple meta-analysis, including a systematic literature review and calculation of basic effect sizes.

Develop the ability to critically interpret meta-analysis results and assess heterogeneity and potential bias.

Encourage the application of meta-analytic results in the context of evidence-based decision making, especially in the formulation of sustainable agriculture and environmental management policies.

Develop analytical competencies necessary for the integration of scientific knowledge into the processes of planning and management of natural resources at the national and international levels.

ECTS: **3.00**

Teaching hours: 30
Lectures: 20
Practicum: 10

Lecturer

- Asst. Prof. Jelena Horvatinec Isaković, PhD

Associate teacher for exercises

- Asst. Prof. Jelena Horvatinec Isaković, PhD

Associate teacher for seminars

- Asst. Prof. Jelena Horvatinec Isaković, PhD

Grading

Sufficient (2): 60–70%
Good (3): 71–80%
Very good (4): 81–90%
Excellent (5): 91–100%

Description

Project (mini meta-analysis): 50%
Presentation: 20%
Final exam (written or oral exam): 30%

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Type of course

- Graduate studies / Environment, agriculture and resource management (Elective course, 4 semester, 2 year)

Types of instruction

- Lectures
- Other forms of group or individual learning
- Practicum
- Design exercises

Learning outcomes

Learning outcome	Evaluation methods
1. Explain the basic principles of meta-analysis and systematic literature review. 2. Define a research question suitable for a meta-analytic approach. 3. Calculate basic effect sizes. 4. Apply a basic meta-analysis model (fixed and random effects). 5. Interpret heterogeneity and forest plot results. 6. Critically evaluate meta-analysis results in the context of environmental and agricultural research.	

Working methods

Students' obligations

Regular class attendance

Completion of a mini meta-analysis (project)

Presentation of results

Taking a final exam or evaluating the project

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Weekly class schedule

1. Introduction to meta-analysis - Method development and application in the agriculture and environment
2. Systematic review framework - Structured process and methodology, including formulating research questions, literature search strategies, risk-of-bias assessment, data extraction, synthesis, and reporting
3. Effect sizes - Effect sizes – Convert study outcomes (e.g., means, SDs, p-values) into a common metric like Cohen's d or Pearson's r, compute weighted mean calculations; visual dana representation (forest plot)
4. Effect sizes - Effect sizes – Convert study outcomes (e.g., means, SDs, p-values) into a common metric like Cohen's d or Pearson's r, compute weighted mean calculations; visual data representation (forest plot)
5. Meta-analysis models - Practice both fixed and random-effects models to understand how they handle between study variance
6. Meta-analysis models - Practice both fixed and random-effects models to understand how they handle between study variance
7. Heterogeneity assessment between studies - Examine the similarity in the methodology of the studies (study design, dana quailty) and statistics used (e.g., Q-test, I2), to evaluate whether studies can be combined
8. Heterogeneity assessment between studies - Examine the similarity in the methodology of the studies (study design, dana quailty) and statistics used (e.g., Q-test, I2), to evaluate whether studies can be combined
9. Moderator analysis - Examining specific study characteristics and their influence on the strength or direction of that effect
10. Publication bias - Funnel plot interpretation and basic statistical tests to detect data asymmetry
11. Individual work - Mini meta-analysis on relevant studies performed following a step-by-step approach to collect, evaluate, and combine research evidence
12. Individual work - Mini meta-analysis on relevant studies performed following a step-by-step approach to collect, evaluate, and combine research evidence
13. Individual work - Mini meta-analysis on relevant studies performed following a step-by-step approach to collect, evaluate, and combine research evidence
14. Individual work - Mini meta-analysis on relevant studies performed following a step-by-step approach to collect, evaluate, and combine research evidence
15. Individual work - Mini meta-analysis on relevant studies performed following a step-by-step approach to collect, evaluate, and combine research evidence

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Obligatory literature

1. Borenstein, M., Hedges, L. V., Higgins, J. P. T., & Rothstein, H. R. (2009). Introduction to meta-analysis. New York: Wiley - https://www.agropustaka.id/wp-content/uploads/2020/04/agropustaka.id_buku_Introduction-to-Meta-Analysis.pdf
2. Koricheva, J., Gurevitch, J., Mengersen, K. (2013). Handbook of Meta-analysis in Ecology and Evolution. - https://share.google/PpgHPlsOeVZsyDNpI
3. Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., et al. (2021). The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ, 372. - http://doi.org/10.1136/bmj.n71
4. Horvatinec, J., Stipičević, S., Sigurnjak Bureš, M., Brtnicky, M., Holatko, J., Kucerik, J., Buczny, J., Ondrasek, G. (2025). Recycling fly ash from coal or biomass combustion for nutrient recovery and enhanced food production in acidic agroecosystems: A multi-level meta-analysis - https://doi.org/10.1016/j.rser.2025.115925
5. Horvatinec, J., Buczny, J., Ondrasek, G. (2024). Fly ash application impacts master physicochemical pedovariables: A multilevel meta-analysis. Journal of Environmental Management, 368, 122066. - https://doi.org/10.1016/j.jenvman.2024.122066

Recommended literature

1. Viechtbauer, W. (2010). Conducting meta-analyses in R with metafor package. Selected scientific articles in the field of environment and agronomy.

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