

Name of the subject: MATHEMATICAL AND STATISTICAL METHODS IN BIOLOGICAL RESEARCH		
Teacher(s): Dr.Vladimir Kostić		
Status of the subject: Elective		
Number of ECTS points: 15		
Condition: -		
Goal of the subject Enabling students to independently use basic modern mathematical and statistical methods in research through the integration of theoretical knowledge and the development of programming skills to analyze empirical data and perform scientific reasoning.		
Outcome of the subject Students will master techniques of mathematical modeling with differential equations and techniques of multivariate statistical analysis, as well as their implementation on selected biological and ecological phenomena using the software package R.		
Content of the subject <i>Theoretical lectures</i> Introduction to Scientific Modeling - deterministic and statistical models. Mathematical modeling of dynamic processes via differential equations. Model of empirical food webs - model setup, analysis, simulations and conclusions. Basics of statistical modeling. Descriptive data research techniques (EDA) - descriptive statistics in biology and ecology, tables, charts. Basic tests of univariate statistical analysis. Basic tests of multivariate statistical analysis. Cluster analysis. Principal component analysis and factor analysis. <i>Practical lectures</i> Introduction to R programming language. Data preparation and processing in R Studio environment. Programming basics in R. Writing algorithms in R for scientific computation - determining the stability indicators of empirical food webs. Descriptive statistical methods in R. Univariate statistical analysis in R. Multivariate statistical analysis in R.		
Recommended literature <ol style="list-style-type: none"> 1. K. Soetaert, P. M. J. Herman, A Practical Guide Ecological Modeling: Using R as a Simulation Platform, Springer (2008) 2. D. Borcard, F. Gillet, P. Legendre, Numerical Ecology with R, Springer (2018) 3. C. Dyltham, Choosing and Using Statistics – A Biologists’s Guide, Wiley-Blackwell (2011) 		
Number of active classes	Theory: 5	Practice: 5
Methods of delivering lectures Within theoretical lectures, starting with an understanding of key mathematical and statistical models in biological research, tools for their deeper analysis are gradually introduced, and finally guidelines for independent scientific research are proposed. Practical training consists of working on a computer in the R programming language using the R Studio package.		
Evaluation of knowledge (maximum number of points 100) Knowledge assessment is in the form of presentation of a self-realized project and consists of an oral exam of theoretical knowledge (50 points) and mastered programming skills in R (50 points).		