**Syllabuses of elective courses 2021/2022 (ECTS 2/3)**

**1.**

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| Course: **An introduction to bird ringing** | |
| Course Instructor: Krzysztof Deoniziak, PhD  Email: k.deoniziak@uwb.edu.pl | |
| Language: **English** | |
| Semester: **winter** | Number of hours (total): **15**  \*Field course: **15** |
| ECTS: **3** |
| Substantive content:  • Bird ringing provides information on migration, longevity, mortality, population, territoriality, feeding behavior, and other aspects that are studied by ornithologists, which contributes to conservation of avian populations.  • This course will take place at Akcja Siemianówka, the biggest inland bird ringing station in Poland localized on the northern edge of Białowieża Forest and during a citizen science project Akcja Karmnik  • During the course students will learn about all the methods and activities connected with bird ringing, through the process from handling a bird safely to taking basic measurements  • Students will also learn about migrant and resident bird species observed and ringed in NE Poland | |
| Literature:  Balmer DE, Coiffait L, Clark J, Robinson R. 2008. Bird ringing: a concise guide. British Trust of Ornithology  Busse P, Meissner W, Cofta T. 2015. Bird ringing station manual. De Gruyter  Svensson L. 2010. Collins Bird Guide. Collins  Demongin L. 2016. Identification guide to birds in the hand. Beauregard-Vendon | |
| Forms and conditions of credit:  Participation in discussion during field course | |

**2.**

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| Course: **Animal bioacoustics in theory and practice** | |
| Course Instructor: Krzysztof Deoniziak, PhD  Email: k.deoniziak@uwb.edu.pl | |
| Language: **English** | |
| Semester: **winter/summer** | Number of hours (total): **15**  \*Lecture: **5**  \*Field course: **10** |
| ECTS: **3** |
| Substantive content:  • Animal bioacoustics covers all matters related to the production, transmission, and reception of sound in nature, as well as the investigation and use of natural sound by people and impacts of anthropogenic sounds by on animals.  • The course is divided into lectures and practicals that will focus on methods for studying animal sound communication  • During lectures students will be presented with an overview of animal acoustic communication  • Practicals aim at giving the students hands-on experience of sound recording, sound analysis, and playback experiments  • Using interactive sound analysis software we will work on acoustic signals produced by birds, amphibians and insects Poland and beyond | |
| Literature:  Bradbury JW, Vehrencamp SL. 2011 Principles of animal communication. Sinauer Associates Inc.  Charif RA, Waack AM, Strickman LM. 2010. Raven Pro 1.4 User’s Manual. Cornell Lab of Ornithology.  Specht R. 2012. Avisoft-SASLab pro. Avisoft Bioacoustics Sueur. | |
| Forms and conditions of credit:  Participation in lectures and laboratory work | |

**3.**

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| Course: **Avian Biology** | |
| Course Coordinator: Paweł Brzęk, PhD  Email: brzek@uwb.edu.pl | |
| Language: English | |
| Semester: **winter/summer** | Number of hours (total): **10**  \*Lecture: **10** |
| ECTS: **2** |
| Substantive content:  Course presents summary of avian systematics, anatomy, physiology, behaviour and reproduction. Flight adaptations, as well as similarities and differences between birds and mammals (the only two groups of extant endotherms) will be particularly emphasized. Because birds are a common subject of studies in different fields of biology, lectures will frequently refer to more general problems of evolutionary, physiological and behavioral ecology. Impact of human activity on birds and bird conservation will be also discussed.  1. General overview of modern birds. Definition of species in birds.  2. Physiology and ecology of birds. Adaptations for flight. Comparison of birds and mammals – the only two groups of extant endotherms.  3. Avian flight: feathers, types of flight, migration, navigation.  4. Avian reproduction: altricial and precocial birds, hatching asynchrony, brood parasites.  5. Human-caused threats to birds, bird conservation. | |
| Literature:  Bicudo J. E. P. W., Buttemer W. A., Chappell M. A., Pearson J. T., Bech C. 2010. Ecological and environmental physiology of birds. Oxford University Press.  McNab B.K. 2002. The physiological ecology of vertebrates. Cornell University Press, Ithaca, New York. | |
| Forms and conditions of credit:  attendance | |

**4.**

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| Course: **Aquatic Restoration** | |
| Course Instructor: Katarzyna Puczko, PhD  Email: k.puczko@uwb.edu.pl | |
| Language: English | |
| Semester: **winter/summer** | Number of hours (total): **10**  \*Seminar: **10** |
| ECTS: **2** |
| Substantive content:  The aim of this course is to present standards for ecologically successful aquatic restoration. Students will learn about differences in functioning natural and transformed freshwater ecosystems, water quality assessment using trophy indicators, habitat quality assessment using River Habitat Survey (RHS) and River Macrophyte Index (RMI).  We focus on the best practices for freshwater restoration on the example of projects implemented in Europe. The short-term and long-term effect of aquatic restorations will be analysed. | |
| Literature:  Lyu, T., Song, L., Chen, Q., & Pan, G. (2020). Lake and river restoration: method, evaluation and management.  Speed, R., Tickner, D., Naiman, R., Gang, L., Sayers, P., Yu, W., ... & Zhongnan, Z. (2016). River restoration: a strategic approach to planning and management. UNESCO Publishing.  Darby, S., & Sear, D. (Eds.). (2008). River restoration: managing the uncertainty in restoring physical habitat. John Wiley & Sons.  Walter, K., Dodds, W., & Matt, R. (2017). Freshwater ecology: concepts and environmental applications of limnology. ELSEVIER ACADEMIC Press. | |
| Forms and conditions of credit:  100% attendance  participation in discussion during class  oral presentation | |

**5.**

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| Course: **Introduction to bioinformatics** | |
| Course Instructor: Maciej Matosiuk, PhD  Email: m.matosiuk@uwb.edu.pl | |
| Language: English | |
| Semester: **winter/summer** | Number of hours (total): **15**  \*Laboratory: **15** |
| ECTS: **3** |
| Substantive content:  Main goal of the course is to prepare students for efficient work in unix (Linux) environment using command line tools. Students will also learn easy ways to automatize their multiple task work with simple scripts, even on remote servers. Large part of the course will focus on practical manipulation of text files including pattern recognition as an easy guide to prepare input files for multiple applications.  1. Introduction to Linux: GUI, documentation, file system organization, command structure in terminal. (2 hours)  2. Terminal commands every user should know. Build-in text editors (gedit, nano). Useful operators. How to connect and work on remote servers. (3 hours)  3. How to work with text files: easy way for identification of complex patterns and their modification/replacement with powerful language of regular expressions (regex). (4 hours)  4. How to create and execute a bash script. Futher automatization of scripts using loops (for, while, until). (4 hours)  5. Main molecular biology databases. (2 hours) | |
| Literature:  1. Haddock SHD, Dunn 2010. Practical computing for Biologist. Oxford University Press. | |
| Forms and conditions of credit:  1. Attendance.  2. Practical skill test on remote server. | |

**6.**

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| Course: **Evolutionary ecology** | |
| Course Coordinator: Paweł Brzęk, PhD  Email: brzek@uwb.edu.pl | |
| Language: English | |
| Semester: **winter/summer** | Number of hours (total): **10**  \*Lecture: **10** |
| ECTS: **3** |
| Substantive content:  The goal of the course is to present modern theory of evolution and its role in explaining the origin of different life history and behavioral strategies. Most examples will refer to evolution and variation observed under natural conditions.  1. Basic assumptions of modern theory of evolution. Mechanisms of trait inheritance, examples of non-genetic inheritance.  2. Selection in the wild. Factors maintaining genetic variation in nature. Adaptation and constraint – definition and examples.  3. Evolution of life history traits (age and size at reproduction, lifespan, number and size of offspring). Evolutionary trade-offs.  4. Evolution of mating systems. Sexual selection.  5. Role of kinship in evolution – kin selection, evolution of altruism and eusociality, parent-offspring conflict. | |
| Literature:  Fox, Ch.W., Roff D. A., Farbairn D.J. 2001. Evolutionary Ecology. Concepts and Case Studies. Oxford University Press.  McNab B.K. 2002. The physiological ecology of vertebrates. Cornell University Press, Ithaca, New York.  Stearns S. C., Hoekstra R. F. 2005. Evolution: an introduction. Oxford University Press. | |
| Forms and conditions of credit:  attendance | |

**7.**

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| Course: **Forensic biology** | |
| Course Instructor: Ada Wróblewska, Professor UwB (email: adabot@uwb.edu.pl)  Piotr Zieliński, Professor UwB (email: p.zielinski@uwb.edu.pl),  Krzysztof Deoniziak, PhD (email: k.deoniziak@uwb.edu.pl) | |
| Language: English | |
| Semester: **winter** | Number of hours (total): **15**  \*Lecture: **5**  \*Laboratory: **10** |
| ECTS: **3** |
| Substantive content:   * Introduction to forensic science (FS) – (History and development of FS; Organization of FS laboratories) * Crime Scene Investigation – (Crime scene investigation process; Protocol at the crime scene; Recording the crime scene; Collection of evidences) * The nature of evidence – (Classification of evidence: physical, real, known-unknown, individual class; Identification, The DNA typing situations) * Microscopy in criminology – (types of microscopes, SEM, microspectrophotometry) * Fingerprints – (Origin of fingerprints; Anatomy of Fingerprints; Detection and visualization of fingerprints; comparison of fingerprints) * DNA and RNA molecular markers in forensic biology. * STR loci and SNP characteristic and usage for forensic DNA profiling. * Human mitochondrial genome – forensic testing and interpretation. * mRNA and miRNA - potential biomarkers for distinguish bodily fluids, time and cause of death. * Plastid DNA as a molecular marker in forensic botany. | |
| Literature:  Jay A., K. Mirakovits 2010. Forensic Science – the basics, CRC Press, 557 pp.  Li. R. 2015. Forensic biology. CRC Press, Taylor & Fransis Group, London, New York.  Gunn A. Essential Forensic Biology. 2nd edition, Willey-Blackwell. England.  Goodwin W, Linacre A, Hadi S. 2011. An Introduction to Forensic Genetics. Willey-Blackwell. England. | |
| Forms and conditions of credit:  - attendance on the lecture  - final report from the laboratory | |

**8.**

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| Course: **Freshwater ecosystems** | |
| Course Coordinator: Maciej Karpowicz, PhD  Email: m.karpowicz@uwb.edu.pl | |
| Language: English | |
| Semester: **summer** | Number of hours (total): **15**  \*Field course: **10**  \*Laboratory: **5** |
| ECTS: **3** |
| Substantive content:  The aim of this course is to present different type of freshwater ecosystems in NE Poland. Students will learn about the functioning and monitoring of freshwater ecosystems, main groups of organisms in lakes (macrophyte, phytoplankton, zooplankton, macroinvertebrate), biological and hydrochemical sampling.  We especially focused on the degradation and restoration of limnic ecosystems on the example of hypertrophic Siemianówka Reservoir. The effect of this reservoir on the lowland Narew River ecosystem will be analyzed. | |
| Literature:  Lampert, W., Sommer, U. 2007. Limnoecology. Oxford University Press.  The riverine ecosystem synthesis : toward conceptual cohesiveness in river science / James H. Thorp, Martin C. Thoms and Michael D. Delong.  Key to identification of phytoplankton species in lakes and rivers: guide for laboratory classes and field research / ed. by Lubomira Burchardt ; Adam Mickiewicz University in Poznań, Faculty of Biology W. Szafer Institute of Botany, Polish Academy of Sciences.  Ekosystem zbiornika Siemianówka w latach 1990-2004 i jego rekultywacja / pod red. Andrzeja Górniaka ; [autorzy oprac.: Andrzej Stefan Górniak et al.] ; Uniwersytet w Białymstoku. Zakład Hydrobiologii. | |
| Forms and conditions of credit:  Discussion during field course, final report | |

**9.**

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| Course: **Harmful and useful algae and cyanobacteria** | |
| Course Instructor: Magdalena Grabowska, Professor UwB  Email: magra@uwb.edu.pl | |
| Language: English | |
| Semester: **summer** | Number of hours (total): **15**  \*Lecture: **8**  \*Laboratory/field courses: **7** |
| ECTS: **3** |
| Substantive content:   * Toxic algae and cyanobacteria in freshwater and marine ecosystems. * Types of toxins and their effect on other organisms and water quality. * Methods of detection of toxins. * Regulation on Cyanotoxins in Legislation. * Influence of strongly eutrophic Siemianówka dam reservoir on lowland Narew River. * Role of algae in human life and economy. * Algal indicators in the assessment of aquatic ecosystems. | |
| Literature:  Chorus I. & Welker M. 2021. Toxic cyanobacteria in water - Second edition. A guide to their public health consequences, monitoring and management. CRC Press, London  Grabowska M., Mazur-Marzec H. 2011. The effect of cyanobacterial blooms in the Siemianówka Dam Reservoir on the phytoplankton structure in the Narew River. Oceanological and Hydrobiological Studies 40 (1): 19-26.  Hindák F. 2009. [Colour Atlas of Cyanophytes](https://www.google.pl/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&cad=rja&uact=8&ved=0ahUKEwiDkNHhwMzJAhWis3IKHVVYB7MQFggfMAA&url=http%3A%2F%2Fwww.phycology.gr%2Fdownloads%2FAtlasBookOrder.pdf&usg=AFQjCNHiMj-7kvN70s_EKOundN7FNbL3xQ&sig2=9gYWJwakzb0ixcgDgy5ykA).  Lange-Bertalot H., Hofmann G., Werum M., Cantonati M., 2017. Freshwater Benthic Diatoms od Central Europe: Over 800 Common Species Used in Ecological Assessment, Koeltz Botanical Books | |
| Forms and conditions of credit:  Attendance and discussion during lectures and laboratory/field courses. | |

**10.**

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| Course**: Introduction to Geographic Information Systems** | |
| Course Coordinator: Paweł Mirski, PhD  Email: p.mirski@uwb.edu.pl | |
| Language: English | |
| Semester: **winter/summer** | Number of hours (total): **15**  \*Laboratory: **15** |
| ECTS: **3** |
| Substantive content:   * Spatial data in GIS: vector and raster models * Geographic projections in GIS * Data visualization: symbolization, labelling * Thematic maps * Digitalization and vector map editing * Geoprocessing tools * Introduction to spatial analysis | |
| Literature:  Wilson JP Fotheringham SA 2008. The Handbook of Geographic Information Science. Blackwell Publishing Ltd | |
| Forms and conditions of credit:  presence on each classes;  active participation in computer classes | |

**11.**

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| Course: **Inventory methods for ungulates** | |
| Course Instructor: prof. Mirosław Ratkiewicz  Email: ermi@uwb.edu.pl | |
| Language: English | |
| Semester: **summer** | Number of hours (total): **15**  \*Lecture: **4**  \*Field course: **11** |
| ECTS: **3** |
| Substantive content:   * The rules of research in the field. * Identification, collection and preservation of biological traces left by different species of mammals in the field. * Analysis of the collected data - estimating density of the large mammals (boar, moose, red deer, roe deer, wolf). * Observation of the large mammals interacting with their environments. * Practical application of traditional and modern methods in the field study of wild mammals. | |
| Literature:  1. Jędrzejewski W., Sidarowicz W. (2010). The art of animal tracking. ZBS PAN.  2. Rezendes P. (1999). Tracking and the Art of Seeing: How to Read Animal Tracks and Sign. HarperCollins Publishers, Inc., New York. | |
| Forms and conditions of credit: 1. Presence on all field research. 2. A research report. | |

**12.**

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| Course: **Natura 2000 network** | |
| Course Instructor: Piotr Zieliński, Professor UwB  Email: p.zielinski@uwb.edu.pl | |
| Language: English | |
| Semester: **summer** | Number of hours (total):**10**  \*Field course: **10** |
| ECTS: **2** |
| Substantive content:  During the course, students will be introduced to current EU Directives for habitats and species protection. During the fieldwork at Natura 2000 sites in Podlasie region, students on the base of their own observations will identify species and habitats important for the EU, will define the threats to these habitats and species to identify non-compliance farming on Natura 2000 sites. Students will assess the impact of various forms of human activity on the functioning of the area and indicate own proposal management of the area of Natura 2000. | |
| Literature:  Borre, Jeroen Vanden, et al. "Integrating remote sensing in Natura 2000 habitat monitoring: Prospects on the way forward." Journal for Nature Conservation 19.2 (2011): 116-125.  Söderman, Tara. "Natura 2000 appropriate assessment: Shortcomings and improvements in Finnish practice." Environmental Impact Assessment Review 29.2 (2009): 79-86. | |
| Forms and conditions of credit:  Participation in fieldwork and preparing of report after the field course. | |

**13.**

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| Course: **Natural Environment of North East Poland** | |
| Course Coordinator: prof. Andrzej Górniak  Email: hydra@uwb.edu.pl | |
| Language: English | |
| Semester: **winter/summer** | Number of hours (total): **10**  \*Lecture: **10** |
| ECTS: **2** |
| Substantive content:  NE Poland in the geologic map of Europe. Effects of pleistocen glaciation on relief, sediments and water net. Relict permafrost in NE Poland. Neotectonic activity and lakes location and kraton hydrogeology. Pleistocen, artesian groundwaters basin. Features of climate of NE Poland, climatic types in the Koeppen climate classification, continentalism advancement, the recent global changes effects. River hydrology, typology of rivers and their regimes. Artificial forms of surface water- Augustów Canal, Great Masurian Lakes System, specificity of Siemianówka Reservoir, small retention ponds. Water quality and ecological state of freshwaters in NE Poland. Effects of melioration on water cycle in catchments. | |
| Literature:  McCann T. (2008), The geology of Central Europe: Volume 1: Precambrian and Palaeozoic; Volume. 2: Mesozoic and Cenozoic. Geological Society of London.  Tockner et al. [ed.] 2009. Rivers of Europe. Elsevier, Amsterdam. 700 pp.  Website of the Polish Geological Institute: http://www.pgi.gov.pl; webpages in English related to regional geology, resources and geotourism in Poland | |
| Forms and conditions of credit: active participation in the course, preparing a presentations from themes offered by instructor. | |

**14.**

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| Course: **Novel technologies in wildlife studies** | |
| Course Coordinator: Paweł Mirski, PhD  Email: p.mirski@uwb.edu.pl | |
| Language: English | |
| Semester: **summer** | Number of hours (total): **15**  \*Field course: **15** |
| ECTS: **3** |
| Substantive content:   * Novel technologies in wildlife studies will be presented during field-working course * Field classes will contain short theoretic introduction to each topic and equipment handling * Topics raised and the field course: * The use of trail cameras in fauna monitoring and behavioral studies * GPS logging devices to use in movement ecology studies * Thermovision for night monitoring of fauna * UAV images in bird breeding surveys * Bioacoustic monitoring of birds and bats and automatic classification of sound | |
| Literature:  Silvy NJ. 2020. The Wildlife Techniques Manual: Volume 1: Research. Johns Hopkins University Press  Optional articles provided by the course instructor | |
| Forms and conditions of credit:  presence on each classes  active participation in | |

**15.**

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| Course: **Palynology** | |
| Course Instructor: Magdalena Fiłoc, PhD  Email: m.filoc@uwb.edu.pl | |
| Language: English | |
| Semester: **summer** | Number of hours (total): **10**  \*Laboratory: **8**  \*Field course: **2** |
| ECTS: **2** |
| Substantive content:  The laboratory are devoted to discussing the method of pollen analysis - a universal research tool used, among others, in palaeobotanical and palaeoclimatic research, but also in archeology, and beekeeping. The analysis is based on the qualitative and quantitative analysis (visual classification) of the composition of sporomorphs (pollen and/or spore) that are in honeys and also preserved in the fossils state in lakes and peat bogs.  The laboratory will cover learning the making of the maceration of the samples and their microscopic analysis. Pollen for classes will be come from the harvested plants during fieldwork and from honeys and lakes. | |
| Literature:  Berglund B.E., Ralska-Jasiewiczowa M., 1986. Pollen analysis. In Berglund B.E. (ed.) Handbook of Holocene Palaeoecology and Palaeohydrology, 455–484, John Wiley & Sons, Chichester-New York-Brisbane-Toronto-Singapore.  Beug HJ 2004. Leitfaden der Pollenbestimmung für Mitteleuropa und angrenzende Gebiete. München: Pfeil.  Moore P.D., Webb J.A., Collinson M.E., 1991. Pollen analysis. Second Edition. Blackwell Scientific Publications. Oxford. | |
| Forms and conditions of credit:  Participation in laboratory | |

**16.**

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| Course: **Physiological ecology** | |
| Course Coordinator: Paweł Brzęk, PhD  Email: brzek@uwb.edu.pl | |
| Language: English | |
| Semester: **winter/summer** | Number of hours (total): **10**  \*Lecture: **10** |
| ECTS: **2** |
| Substantive content:  The main goal of the course is to present physiological traits and features of animals as an evolutionary adaptation to challenges posed by environmental conditions. Both variation and evolution of physiological traits will be particularly emphasized.  1. What is ‘physiological ecology’? Natural variation of physiological traits and its importance for fitness under natural conditions. Research methods used in physiological ecology, particularly artificial selection.  2. Energy metabolism of animals under natural conditions, its limits and importance for fitness. Ecto- and endothermy. Energetics of activity. Scaling of metabolic rate.  3. Evolutionary physiology of digestive system.  4. Gas exchange in animals, including adaptation to life at high altitude and for diving.  5. Water and salt physiology of animals living in different habitats. | |
| Literature:  Hill R., Wyse G., Anderson M. 2004. Animal physiology. Sinauer Associates, Sunderland, USA.  Karasov W.H., Martinez del Rio C. 2007. Physiological ecology. Princeton University Press, Princeton, USA.  McNab B.K. 2002. The physiological ecology of vertebrates. Cornell University Press, Ithaca, New York. | |
| Forms and conditions of credit:  attendance | |

**17.**

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| Course: **Plant breeding systems** | |
| Course Instructor: Edyta Jermakowicz, PhD  Email: edytabot@uwb.edu.pl | |
| Language: English | |
| Semester: **summer** | Number of hours (total):**15**  \*Field course: **15** |
| ECTS: **3** |
| Substantive content:  The main goal of the course is to present biological and ecological aspects of plant breeding system as an evolutionary adaptation to challenges posed by pollinators limitation.  Field works will focused on the primary subjects:  1) What is “plant breeding system”?  2) Evolutionary consequences of self- and cross-pollination. Why plants are self-compatible?  3) How floral architecture protects against self-pollination?  4) Why clonal plants are more self-pollination vulnerable?  5) Is pollination specialization, representing by orchids, improves reproductive success?  6) How plant community shapes breeding system of the particular plant species?  Place: Turczyński and Zwierzyniecki Forests (Białystok). | |
| Literature:  1.Charlesworth, Deborah. "Evolution of plant breeding systems." *Current Biology* 16.17 (2006): 726-735.  2.Jersáková, Jana, and Pavel Kindlmann. "Reproductive success and sex variation in nectarless and rewarding orchids." *International Journal of Plant Sciences* 165.5 (2004): 779-785.  3.Goodwillie, Carol, Susan Kalisz, and Christopher G. Eckert. "The evolutionary enigma of mixed mating systems in plants: occurrence, theoretical explanations, and empirical evidence." *Annu. Rev. Ecol. Evol. Syst.* 36 (2005): 47-79.  4.Willmer, Pat. *Pollination and floral ecology*. Princeton University Press, 2011. | |
| Forms and conditions of credit: Participation in lectures and preparing of report after the field course. | |

**18.**

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| Course: **Plant-pathogen interactions** | |
| Course Coordinator: Violetta Macioszek, PhD | |
| Email: v.macioszek@uwb.edu.pl | |
| Semester: **winter/summer** | Number of hours (total): **10**  \*Lecture: **10** |
| ECTS: **2** |
| Substantive content:  Topics of lecture focus on mechanisms on plant resistance against pathogens and molecular interactions of plant and pathogens molecules during signal transduction of defense reactions in host cells. Concepts of classical and modern plant pathology will be presented. Also examples of the most devastating diseases caused by viruses, bacteria and fungi in the crop plants mostly in Europe will be described. | |
| Literature:  Matthew Dickinson, Molecular Plant Pathology, 2003, BIOS Scientific Publication, Taylor and Francis Group  Kumar Sanjeev, Plant Pathogens and Principles of Plant Pathology, 2015, New India Publishing Agency- NIPA  Jeremy J. Burdon, Anna-Liisa Laine, Evolutionary Dynamics of Plant-Pathogen Interactions, 2019, Cambridge University Press | |
| Forms and conditions of credit:  Attendance | |

**19.**

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| Course: **Plant population ecology** | |
| Course Instructor: Edyta Jermakowicz, PhD  Email: edytabot@uwb.edu.pl | |
| Language: English | |
| Semester: **summer** | Number of hours (total): **15**  \*Field course: **15** |
| ECTS: **3** |
| Substantive content:  The aim of this field course is to introduce students with the primary concepts and methods used in plants population ecology. Students will carry out the research from framing the questions, through design and conducting the study in the field, to data visualization and interpretation. Exercises will focused on collecting the data about plants size structure and reproduction and spatial patterns of plant populations in context of different environmental conditions and plants communities. The field works will be performed on common and rare plants species in the areas of urban green areas as well in national parks in north-east Poland. | |
| Literature:  1.Gibson D.J. 2002. Methods in comparative plant population ecology. Oxford University Press.  2. Falińska K. 1998. Plant Population Biology and Vegetation Processes. W. Szafer Institute of Botany, Polish Academy of Science, p. 368. | |
| Forms and conditions of credit: 1) 100% attendance, 2) active participation in the course, 3) preparing a protocol of field studies according to scheme prepared by instructor. | |

**20.**

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| Course: **Road ecology** | |
| Course Instructor: Adam Hermaniuk, PhD  Email: adamher@uwb.edu.pl | |
| Language: English | |
| Semester: **summer** | Number of hours (total):**15**  \*Field course: **15** |
| ECTS: **3** |
| Substantive content:  Background and aim of the course:  Traffic is now one of the most important factors impacting upon wildlife. Furthermore, as road infrastructure is developing steadily, its negative effect can only be expected to increase. The aim of the course is to analyse mortality of vertebrates due to traffic on Carska Road in the Biebrza National Park.  Course contents:  - the impacts of roads and traffic on terrestrial animal populations;  - field methods to evaluate the impact of roads on wildlife;  - mortality assessment on the Carska Road;  - identification of the killed vertebrates using identification keys;  - traffic intensity assessment;  - determination of the road sections with the highest mortality on the basis of the collected results;  - road-wildlife mitigation planning, how to reduce the negative effects of traffic road. | |
| Literature:  Forman, R. T.T., D. Sperling, J. A. Bissonette, A. P. Clevenger, C. D. Cutshall, V. H. Dale, L. Fahrig, R. France, C. R. Goldman, K. Heanue, J. A. Jones, F. J. Swanson, T. Turrentine, & T. C. Winter. 2003. Road Ecology; Science and Solutions. Island Press, Covelo, CA. | |
| Forms and conditions of credit:  oral presentation | |

**21.**

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| Course: **Scientific methodology and experimental design** | |
| Course Coordinator: Julita Sadowska, PhD  Email: julita.sadowska@uwb.edu.pl | |
| Language: English | |
| Semester: **winter/summer** | Number of hours (total): **10**  \*Seminar: **10** |
| ECTS: **2** |
| Substantive content:  The aim of this course is to familiarize students with steps of the Scientific Method. Students will learn about the role and correct hypothesis formulation in research, experimental design and research planning with particular focus on the ecological/ecophysiological studies (including the definition of a sample, correct sample unit identification and collection methods, replications and pseudoreplications, techniques of taking notes). Discussed topics also include data processing an ethical issues in science and scientific writing/publications (data manipulation, plagiarism, authorship issues, duplicate or concurrent publications, conflicts of interest, frauds, animal use and local law). | |
| Literature:  Lampert, W., Sommer, U. 2007. Limnoecology. Oxford University Press.  Quinn, G.P., Keough, M.J. 2002. Experimental design and data analysis for biologists. Cambridge University Press.  Sand-Jensen, K. 2007. How to write consistently boring scientific literature. Oikos, 116: 723 – 727.  Hurlbert, Stuart H., 1984, Pseudo-replication and the design of ecological field experiments, Ecological Monographs, 54:187-211. | |
| Forms and conditions of credit:  100% attendance  Participation in discussion during class  Student project: students design a study/project in accordance with the scientific method | |

**22.**

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| Course: **Selected data analysis techniques for biologists** | |
| Course Coordinator: Piotr Jadwiszczak, PhD  Email: piotrj@uwb.edu.pl | |
| Language: English | |
| Semester: **summer** | Number of hours (total): **5**  \*Laboratory: **5** |
| ECTS: **2** |
| Substantive content:   * Fisher’s and Neyman-Pearson’s approaches to verification of statistical hypotheses * Selected parametric and randomization tests. Monte Carlo simulations * Elements of Bayesian methodology – Bayes’ rule in practice | |
| Literature:  Quinn G. and K. Keough. 2008. Experimental Design and Data Analysis for Biologists. Cambridge University Press | |
| Forms and conditions of credit: evaluation of the results of problem solving exercises during classes | |

**23.**

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| Course: **Social insects** | |
| Course Coordinator: Tomasz Włodarczyk, PhD  Email: t.wlodar@uwb.edu.pl | |
| Language: English | |
| Semester: **winter/summer** | Number of hours (total): **15**  \*Lecture: **5**  \*Laboratory/field trip: **10** |
| ECTS: **3** |
| Substantive content:  Social insects are one of the most intriguing organisms on our planet. The sacrifice of own reproduction in favour of fitness of other individuals posed a serious challenge to the Darwinian view of evolution. Moreover, advanced insect societies add a new level to the organisation of living things, called superorganisms. During the course students are introduced into the theoretical background explaining social phenomena in insects and other animals. The emphasis is made on the peculiarities of hymenopteran insects (ants, wasps, bees) in that respect. The general rules are exemplified with the natural history of socially primitive and advanced species. During laboratory courses students prepare experiments demonstrating the communication systems in ants. They also use experimental setups to study division of labour and competition between alien ant colonies. Students also practice techniques useful in the field studies of ants and learn how to recognize selected species during the trip to the nearby meadow and pine forest. | |
| Literature:  Hölldobler, B., Wilson, E. O. 2009. The superorganism: The beauty, elegance, and strangeness of insect societies. New York: W.W. Norton.  Bourke A. F. G. 1995. Social Evolution in Ants, Franks N. F. Monographs in Behavior and Ecology. Princenton University Press  Czechowski W., Radchenko A., Czechowska W. 2002. The ants of Poland. Museum and Institute of Zoology Polish Academy of Sciences. | |
| Forms and conditions of credit:  - attendance on the lecture  - tasks completion | |

**24.**

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| Course: **Soils and landscape** | |
| Course Coordinator: prof. Andrzej Górniak  Email: hydra@uwb.edu.pl | |
| Language: English | |
| Semester: **winter/summer** | Number of hours (total): **10**  \*Lecture: **5**  \*Field course: **5** |
| ECTS: **2** |
| Substantive content:  Soil pedon development. Natural factors of soil genesis. FAO classification of soils; diagnostic horizons, horizons features and relations in the main soil profiles in Europe. Differentiation of soil landscapes on the Earth, with special attention of Polish soil catena in the physiographic regions. Relationships between plant communities, water, climatic conditions and type of soils. Agricultural and forest soils values, specific plantation and forest types. Field study of soil pedons in the lowland valley, mineral soil catena in the old glaciation highland, soils of morains and kems. Methods of descriptions of soil profile in the field, filed measurement of pH and CaCO3 content, sampling, texture and soil aggregation. | |
| Literature:  Album of Polish Soils. PTGleb. Warszawa  Polish classification of Soils (English resume). Rocz. Glebozn. 2011, 62,3. | |
| Forms and conditions of credit: active participation in the course, preparing a protocol of field study of 5 soil profiles according to scheme prepared by instructor. | |

**25.**

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| Course: **Techniques in plant physiology** | |
| Course Coordinator: Violetta Macioszek, PhD  email: v.macioszek@uwb.edu.pl | |
| Language: English | |
| Semester: **winter/summer** | Number of hours (total): **15**  \*Laboratory: **15** |
| ECTS: **3** |
| Substantive content:  Techniques in Plant Physiology - The exercises are an introduction to the methods and techniques commonly used in plant physiology - measurements of primary and secondary metabolism parameters during plant growth and development as well as during abiotic and biotic stress. Laboratory classes in the field of primary metabolism use standard methods, such as e.g. measurements of the content of assimilation pigments or reducing and non-reducing sugars in plant tissues, as well as modern methods, e.g. with the use of devices for measuring the kinetics of chlorophyll a fluorescence. The exercises also use methods related to the measurements of secondary metabolism, which are aimed at showing its changes during stress, e.g. drought or temperature, when an increase or decrease in the content of e.g. phenolic compounds is induced. Arabidopsis mutants, defective at various points of metabolic pathways, are also used, which allows for phenotypic assessment of the influence of various metabolites on plant development. We will use different techniques e.g. measurement of photosynthetic efficiency, phenolic compounds content and DNA isolation to explore several important processes which help plants to survive in their environment. Students also will be acquainted with basics of plant cell *in vitro* culture.  Upon completing this course, student should be familiar with contemporary methods used in plant physiology, especially used in research connected with plant stress physiology. | |
| Literature:  A. & Vijaya Luxmi Bhattacharya, 2015. Methods and Techniques in Plant Physiology. NIPA  Cornelio Losa, 2016. Methods and Techniques in Plant Physiology. Scitus Academics LLC  B.K. Garg, 2012. Plant Analysis: Comprehensive Methods and Protocols. Scientific Publishers  Modern Methods in Plant Physiology, 2009. red. Sirvastava GC, New India Publishing  papers in scientific journals: Journal of Plant Physiology, Plant Physiology, Physiologia Plantarum, Acta Physiologiae Plantarum | |
| Forms and conditions of credit:  Attendance in all laboratory  Brief lab report after each laboratory | |

**26.**

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| Course: **Thermal biology** | |
| Course Coordinator: Julita Sadowska, PhD  Email: julita.sadowska@uwb.edu.pl | |
| Language: English | |
| Semester: **winter/summer** | Number of hours (total): **10**  \*Lecture: **10** |
| ECTS: **2** |
| Substantive content:  Temperature is a property that affects and shapes the organisms phenotype in a vast range of ways, and has been linked to characteristics like growth rate, survival and reproduction, even spatial body size patterns or population densities. However, not all organisms will be affected equally by a change in temperature, and even the same organism in different life stages will present a different response. Moreover, anthropogenic climate change also has a biological impact on all organisms with some ecosystems warming up significantly faster than they would for thousands of years. Even human societies seem to be affected by the evolving thermal housing conditions, which may have a potential impact on the development of the obesity prevalence.  The course will cover such topics like thermal heterogeneity, thermal sensitivity and thermoregulation among different groups of organisms, as well as thermal adaptation, acclimation, life histories, and anthropogenic effects. | |
| Literature:  Angilletta, M.J. Jr. 2009. Thermal Adaptation*:* A Theoretical and Empirical Synthesis. Oxford University Press.  McNab, B. 2002. The physiological ecology of vertebrates. A view from the energetics. Comstock Pub Assoc.  Hayes, J.P., Garland, T. Jr. 1995. The evolution of endothermy: testing the aerobic capacity model. Evolution, 49: 836 – 847. | |
| Forms and conditions of credit:  100% attendance  Participation in discussion during class | |

**27.**

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| Course: **Trees and shrubs of Białystok** | |
| Course Instructor: Danuta Drzymulska, Professor UwB  Email: drzym@uwb.edu.pl | |
| Language: English | |
| Semester: **summer** | Number of hours (total): **5**  \*Field course: **5** |
| ECTS: **2** |
| Substantive content:  This field course is devoted to recognize different species of trees and shrubs occurring in the city: native and alien species. During hiking forest, park and near the street species will be named with showing their distinctive features. | |
| Literature:  Aas G., Riedmiller. 1994. Drzewa [Trees]. Muza S.A., Warszawa  Godet J.-D. 2003. Przewodnik do rozpoznawania drzew i krzewów [Guide to recognizing trees and shrubs]. Delta, Warszawa  Rutkowski L. 2004. Klucz do oznaczania roślin naczyniowych Polski niżowej [Key to marking the vascular plants of the Polish lowland] . Wydawnictwo Naukowe PWN, Warszawa | |
| Forms and conditions of credit:  Participation in field course | |