COURSE OF DOCTORAL STUDIES

Course title	Field of science (branch) code	University / Faculty	Institute / Department
Ecological meteorology	Natural Sciences (Physical Geography) N006	Vilnius University / Faculty of Chemistry and Geosciences	Institute of Geosciences / Department of Hydrology and Climatology

Study methods	Number of credits allocated	Study methods	Number of credits allocated
Lessons		Consultations	2
Individual work	8	Seminar	

Course annotation
The main aim of the course is to describe the impact of meteorological factors of different spatial and temporal scale and to determine the possible consequences of anthropogenic air pollution and climate change on ecosystems of different ranks and their components (humans, plants, animals). Course content: General knowledge of biometeorology. Plants and the atmosphere: physiology, growth, development and the environment. Biogeography and biozones. Interactions between ecosystems and the atmosphere. Animals and the atmosphere: basic principles. Interaction of small and large animals with the atmosphere. Impact and consequences of global climate change on ecosystems. Human thermal environments. Thermal comfort and stress. Biometeorological indices. Effects of UV radiation. Meteotropic and weather impacted diseases. Pollen and allergens. General knowledge of the climate of urban areas. Radiation and heat balance in urban environments. Features of the main meteorological elements in the city. Urban hydrological balance. Air composition. Anthropogenic air pollution. Global and local air pollution. Smog and acid rain. Impact of urban areas on organisms and ecosystems. Urban climate and environment in the context of global warming.

Required readings
Biometeorology for Adaptation to Climate Variability and Change. 2008. K. L. Ebi, I. Burton, G. R. McGregor (eds.), Biometeorology, vol. 1, Berlin: Springer.
Forman R. T. T. 2014. Urban Ecology: Science of Cities. Cambridge: Cambridge University Press
Jacobson M. Z. 2002. Atmospheric Pollution: History, Science and Regulation. New York: Cambridge University Press
Oke T. R., Mills G., Christen A., Voogt J. A. 2017. Urban Climates. Cambridge: Cambridge University Press
Parsons K. 2003. Human Thermal Environments. New York: Taylor&Francis

Recommended reading
Barry R. G., Blanken P. D. 2016. Microclimate and Local Climate. Cambridge University Press
Biometeorology: plant-ecosystem-atmosphere interactions. 2010. Baldocchi D. (mod.), paskaitų ciklas ESPM 129, Berkeley: University of California
Clarke A. 2017. Principles of Thermal Ecology: Temperature, Energy and Life. Oxford: Oxford University Press
Climate change and cities: First assessment report of the urban climate change research network (ARC3). 2011. C. Rosenzweig, S. A.; Hammer, W. D. Solecki, S. Mehrotra (eds.), Cambridge: Cambridge University Press
Erell E., Pearlmutter D., Williamson T. 2011. Urban Microclimate Designing the Spaces Between Buildings. London: Earthscan
Human bioclimatology. 2002. A. Auliciems (red.), Advances in bioclimatology: vol. 5, Berlin: Springer
Impacts of Climate Change on Allergens and Allergic Diseases. 2016. P. J. Beggs (ed.), Cambridge: Cambridge University Press
Isajev A. A. 2003. Ekologičeskaja Klimatologija. Maskva: Naučniy Mir
James P. 2018. The Biology of Urban Environments. Oxford: Oxford University Press
Kažys J. 2011. Biometeorologijos praktikos darbai. Mokomoji knyga, Vilnius: Vilniaus universitetas
Principles of Animal Biometeorology. 2013. R. Gomes da Silva, A. Sandro Campos Maia (eds.), Biometeorology, vol. 2, Berlin: Springer
Purkis S., Klemas V. 2011. Remote sensing and global environment change. Chichester: Wiley-Blackwell
Smith, K.R., A.Woodward, D. Campbell-Lendrum, D.D. Chadee, Y. Honda, Q. Liu, J.M. Olwoch, B. Revich, and R. Sauerborn. 2014. Human health: impacts, adaptation, and co-benefits. In: Climate Change 2014: Impacts,

Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. Field, C.B., V.R. Barros, D.J. Dokken, K.J. Mach, M.D. Mastrandrea, T.E. Bilir, M. Chatterjee, K.L. Ebi, Y.O. Estrada, R.C. Genova, B. Girma, E.S. Kissel,A.N. Levy, S. MacCracken, P.R. Mastrandrea, and L.L.White (eds.). Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, pp. 709-754.

Urban Ecology: An International Perspective on the Interaction Between Humans and Nature. 2008. J. Marzluff ir kt. (eds.), Berlin: Springer

Consulting lecturers name, surname	Degree	The most important works in the field of science (branch) have been published during the last 5 years
Justas Kažys	Dr.	Stonevičius E., Rimkus E., Štaras A., Kažys J., Valiuškevičius G. 2017. Climate change impact on the Nemunas River basin hydrology in the 21st century. Boreal Environment Research. 22, 49-65. Šarauskienė D., Akstinas V., Kriaučiūnienė J., Jakimavičius D., Bukantis A., Kažys J., Povilaitis A., Ložys L., Kesminas V., Virbickas T., Pliuraitė V. 2018. Projection of Lithuanian river runoff, temperature and their extremes under climate change. Hydrology Research. 49(2), 344–362. Stonevičius E., Rimkus E., Kažys J., Bukantis A., Kriaučiūnienė J., Akstinas V., Jakimavičius D., Povilaitis A., Ložys L., Kesminas V., Virbickas T., Pliūraitė V. 2018. Recent aridity trends and future projections in the Nemunas River basin. Climate Research. 75, 143–154. Povilaitis A., Widen-Nilsson E., Sarauskiene D., Kriauciuniene J., Jakimavicius D., Bukantis A., Kazys J., Lozys L., Kesminas V., Virbickas T., Pliuraite V. 2018. Potential impact of climate change on nutrient loads in Lithuanian rivers. Environmental Engineering and Management Journal. 17(9), 2229-2240. Kriaučiūnienė J., Virbickas T., Šarauskienė D., Jakimavičius D., Kažys J., Bukantis A., Kesminas V., Povilaitis A., Dainys J., Akstinas V., Jurgelėnaitė A., Meilutytė-Lukauskienė D., Tomkevičienė A. 2019. Fish assemblages under climate change in Lithuanian rivers. Science of the Total Environment. 661, 563-574. Dainys J., Jakubavičiūtė E., Gorfine H., Pūtys Ž., Virbickas T., Jakimavičius D., Šarauskienė D., Meilutytė-Lukauskienė D., Povilaitis A., Bukantis A., Kažys J., Ložys L. 2019. Predicted climate change effects on European perch (Perca fluviatilis L.) – A case study from the Curonian Lagoon, south-eastern Baltic. Estuarine, Coastal and Shelf Science. 221, 83–89. Rimkus E., Edvardsson J., Kažys J., Pukienė R., Lukošiūnaitė S., Linkevičienė R., Corona C., Stoffel M. 2019. Scots pine radial growth response to climate and future projections at peat and mineral soils in the boreo-nemoral zone. Theor Appl Climatol. 136, 639-650. Šidlauskaitė L., Kažys J. 2019. Changing temperate climate conditions for winter roads in the twenty-first century (Lithuanian example). Theor and Appl Climatol. 138, 1951-1960. Pukienė R., Vitas A., Kažys J., Rimkus E. 2020. Four-decadal series of dendrometer measurements reveals trends in Pinus sylvestris L. inter- and intra-annual growth response to climatic conditions. Canadian Journal of Forest Research. published on the web 27 August 2020.

Approved by the Doctoral Committee for Physical Geography (N006) on 9th of March 2021, protocol no. (4.20 E) 610000-KT-24

Committee Chairman assoc. prof. dr. D. Pupienis