Széchenyi Plan Plus Let's build Hungary together!

GOVERNMENT OF HUNGARY

Funded by the European Union NextGeneration EU

National Laboratory for Climate Change

NATIONAL MULTIDISCIPLINARY LABORATORY FOR CLIMATE CHANGE

CLIMATE CHANGE: INTEGRATED SCIENCE FOR BETTER ADAPTABILITY

The activities of the National Multidisciplinary Laboratory for Climate Change include the study of the drivers of climate change and their impacts on natural and economic systems and society, as well as research and development in the field of technological and social adaptation.

MAIN RESEARCH AREAS

- Climate change drivers and their impacts
- Climate impacts of soot particles
- Planktonic organisms and climate change
- Impact of climate change on chemical communication in living waters
- Biodiversity conservation research
- Experimental investigation of changes in ecological systems
- Clay sediments and bio-minerals
- Biobatteries

CONSORTIUM LEADER:
University of Pannonia

CONSORTIUM PARTNERS:
HUN-REN Centre for Ecological Research
HUN-REN Balaton Limnological Research Institute
Eötvös Loránd University
University of Miskolc
National Meteorological Service
Semmelweis University

PROJECT NUMBER: RRF-2.3.1-21-2022-00014

FUNDING PERIOD: 01.03.2022 - 28.02.2026

OVERALL BUDGET: 3.571.000.000 HUF

HUNGARIAN NATIONAL LABORATORY

BENEFITS TO BE EXPECTED FROM LABORATORY RESEARCH

ATMOSPHERE, AIR QUALITY, HEALTH

- To identify hitherto unregulated sources of soot particles, in particular to estimate the extent of illegal municipal waste incineration, to determine the chemical and absorption properties of the particles, to quantify their energetic contribution to climate change, and to contribute to industrial combustion technology developments to minimise soot emissions.
- Demonstration of air quality trends; exploration of the environmental consequences of climate change; effective air quality forecasting; analysis of the impacts of changing climate conditions on agriculture; public awareness.
- With the help of mathematical methods, the development of a forecasting system with which the personnel and infrastructural conditions of the care system can be appropriately planned based on the probability of occurrence of cardiovascular and neurological disease events caused by weather changes.

AQUATIC ECOSYSTEMS, LAKE BALATON

- The combined effects of climate change-induced temperature extremes and anthropogenic stressors in freshwater ecosystems, focusing, among other things, on chemical communication in trophic networks of ecosystems.
- Clarifying the potential role of biofossils (shellfish shells, fish ear bones) as environmental and climate indicators.
- Development of the Water 4.0 research infrastructure system to address the expected water supply problems in the context of climate change, enabling the automation, remote access and operation of various water treatment tasks in both new and existing water systems.
- The assessment of the effects of global warming on planktonic organisms and their communities, and the utilization of this knowledge to support decision-makers and for dissemination.
- Applying systems approach to groundwater and a complex understanding of the impacts of climate change; More effective water management and ecosystem management; Adaptation to future extreme changes in precipitation patterns and their hydrological consequences; Complex surface and groundwater recharge options and site-specific recharge methodologies.
- Examination of organic pollutants in lake sediments, analysing total organic carbon and sulfur content, laboratory analyses of biotic sediment proxies (pollen, non-biting midge larva extractions), dating with 210Pb and 137Cs methods, sedimentary DNA extraction, amplification and sequencing.

BIODIVERSITY CONSERVATION

- The assessment of the effects of global ecological problems such as climate change, land-use change, and the spread of invasive species on biological diversity, and the utilization of this knowledge to support decision-makers and for dissemination.
- Contributing to better understand of the impacts of climate change, in particular warming and heat waves, on standing waters. Investigating the interactions of climate change with other stressors (e.g. habitat fragmentation, urbanisation, invasive species) and their consequences for biodiversity and ecosystem services to society, as well as the potential role of shallow lake users in amplifying the effects of climate change. Our results will be used in higher education and will be made available to society through our science outreach activities and citizen science programmes.

INDUSTRIAL ADAPTATION, SECTORAL IMPACTS

- Bioelectrochemical systems developed today (microbial fuel cells (MFC), microbial electrolysis cells (MEC) and microbial electrosynthesis cell (MESCs)) are capable of both storing and harvesting electricity. Their integrated application helps to develop a system analogous to batteries, which can even be used for carbon sequestration.
- Reducing CO2 emissions from the combustion of fossil fuels through technological transition; research and development in the fields of coal and gas-fired power plants, construction materials, and construction technologies to reduce CO2 emissions.
- Establishing low-cost sensor networks provides precise data for precision agriculture, irrigation, and water management, contributing to improving agricultural adaptability and protecting urban environments, thereby reducing residential damages.

DECISION SUPPORT, STRATEGY DEVELOPMENT

- Provision of analyses and development of decision-support solutions using data and systems science to identify the challenges and management options of climate change to assess the climate sensitivity of communities, improve the resilience of the environment and society, and improve the adaptive, transformative and learning capacities of individuals, communities, supply networks and communities.
- Monitoring the complex impacts of climate change.
- Preparation and continuous update of high quality climate data for climate impact studies. Climate indicators for assessment of climate change impacts on the everyday life, air quality, cities, water management, agriculture and other sectors. Publication of climate information for policy makers, stakeholders, different sectors and the society.
- Extension and publication of the FORESEE climate database; Development and dissemination of the Biome-BGCMuSo biogeochemical model; Investigation of the climate modifying effects of volcanic eruptions; Investigation of the occurrence of Sahara dust in our country; Urban climate studies, investigation of extreme weather events

THE PROFESSIONAL TEAM

András Gelencsér, member of the Hungarian Academy of Sciences, head of the National Laboratory, atmospheric chemist, academician, professor, head of the HUN-REN-PE Air Chemistry Research Group since 2005. His research focuses on the sources, properties and atmospheric role of carbonaceous aerosol particles. He published a 360-page monograph titled Carbonaceous Aerosol with Springer https://www.springer.com/gp/book/9781402028861. He has been PI of 14 research projects amounting to a total of 90 million EUR. He has published 91 publications in peer-reviewed journals, cumulative IFs 208, number of SCI citations: 6100, Hirsch-index: 40. He is a member of the editorial board of Journal of Atmospheric Chemistry. He has cooperated with top researchers from Max Planck Institute for Chemistry, TU Wien, University of Antwerp, Desert Research Institute, Lawrence Berkeley National Laboratory, among others.

András Hoffer PhD, chemist, senior researcher at the HUN-REN-PE Air Chemistry Research Group. He has received his PhD in 2003. In the period between 2000 and 2006 he was a postdoc in the Max Planck Institute for Chemistry Mainz. He has published 51 publications in peer-reviewed journals, cumulative IFs 125, number of SCI citations: 2255, Hirsch-index: 27.

Béla Viskolcz PhD, professor, director of the Center for Advanced Materials and Intelligent Technologies in Higher Education and Industrial Collaboration (FIEK). His research interest covers physical chemistry, CO2 sequestration and catalysis. His research focuses on theoretical and experimental aspects of catalytic reduction processes. He is currently the professional leader of the LIFE-Climcoop climate adaptation project, and has extensive industrial contacts and significant international project experience.

Csaba Ferenc Vad PhD, community ecologist, working primarily in the field of plankton ecology. After receiving his PhD (ELTE, 2014), he held a Marie Skłodowska-Curie postdoc position at WasserCluster Lunz (Austria; 2015-2018), after which he worked as a postdoc at KU Leuven (Belgium; 2019) where he is currently a guest researcher. He is affiliated to CER since June 2019 and since April 2021 he is the leader of the Plankton Ecology Research Group of the Institute of Aquatic Ecology.

Dénes Schmera DSc, leader of the Aquatic Invertebrates and Community Ecology Research Group of the HUN-REN Balaton Limnological Research Institute. He also an editor for Limnologica and Community Ecology. His primary scientific interest is in how ecological communities are structured and what are the driving mechanisms behind, and what methods can be used for assessing them.

Edina Fejes, meteorologist, expert of the Marketing and Communication Unit at HungaroMet. In the last 3 decades, she has been an active participant and organizer of many meteorological events, among them the Night of Museums. Between 2014 and 2022, she was the executive secretary of the Hungarian Meteorological Society. Since 2018 she has been the coordinator of the meteorological session of the event series at the CSOPA Science Center. She has been the chief editor of the meteorological journal Légkör (Atmosphere) since 2021.

Enikő Magyari, member of the Hungarian Academy of Sciences, paleoecologist, professor at the Department of Environment and Landscape Geography, ELTE. Her research interest includes late Quaternary climate change and the ecosystem effects of climate change, the impact of human activities on the environment, with special emphasis on the transformation of plant cover.

Ferenc András PhD, associate professor, head of the Institute of Social Sciences of University of Pannonia, former coordinator of SROP-4.2.2.A-11/1 / KONV-2012-0064, co-editor of the volume Climate Change, Society, Ethics.

Gábor Bernát PhD, biophysicist, senior fellow in the Aquatic Botany and Microbial Ecology Research Group of the HUN-REN Balaton Limnological Research Institute. His research area includes photosynthesis- and algal research, spectroscopy, nutrient cycling, and environmental acclimation.

Gabriella Szépszó DSc, meteorologist, department head of Climate, Development and Research at the HungaroMet Hungarian Meteorological Service, coordinating activities in short-range numerical weather predictions (NWP) and climate change. Her research field focuses on adaptation of the REMO regional climate model for the Carpathian Basin. In the last 2 decades, she has committed active role in numerous activities in NWP, regional climate modelling and climate change. She participated in preparation and review of the National Climate Change Strategy; has been climate modelling expert, lead scientist in several national and international projects, as well as organizer of national and international events.

Gergely Boros PhD, biologist/ecologist, leader of the Zooplankton and Ecological Interactions Research Group of the HUN-REN Balaton Limnological Research Institute. His research area includes ecological stoichiometry, consumer-driven nutrient dynamics, mesocosm experiments, and lake restoration.

Ildikó Galambos PhD, associate professor, leader or participant both in projects and industrial R&D works. Member of domestic and international professional organizations (International Humic Substance Society, Hungarian Chamber of Commerce and Industry, Hungarian Chamber of Engineers, Hungarian Chemists Association, Secretary of the Membrane Technology Department). She specializes in membrane technology and other technological processes, groundwater treatment.

Ildikó Virág Neumann PhD, associate Professor and head of Department of International Economics (Institute of Economics) in the Faculty of Economics Sciences of University of Pannonia. She worked as a research fellow at iASK KRAFT Social Innovation Lab and also at MTA-PE (Hungarian Academy of Sciences – University of Pannonia) Networked Research Group on Regional Innovation and Development Studies. Her research fields are international economics and international trade and their statistical analysis and modelling.

János Abonyi DSc, leader of the HUN-REN-PE Complex systems Monitoring Research Group. His research focuses on engineering applications, sustainability and process management. He has authored more than 250 publications, seven books, and has received more than 2700 independent SCI citations.

Judit Mádl-Szőnyi DSc, hydrogeologist, professor, head of the Department of Geology and leader of the József Tóth and Erzsébet Tóth Hydrogeology Research Group at ELTE. Her research interest is the analysis of subsurface groundwater flow systems, hydrogeology of hypogene karsts, development of geothermal and hydrocarbon applications the impacts of climate change on groundwater, and developing innovative adaptation solutions in the form of nature-based groundwater recharge methods.

Katalin Bélafi-Bakó DSc, director of the Research Institute on Bioengineering, Membrane Technology and Energetics at University of Pannonia since 2010. Her research field covers membrane separation techniques, enzymatic and microbiological processes and integrated systems. She has authored 172 publications with cumulative impact factor of 301, and received more than 3000 citations. She also has 9 approved patent applications, and 14 PhD graduates.

Lajos Szalontai PhD., associate professor, deputy dean of education and studies of the Faculty of Earth Science and Engineering. He is the specialist of the first Climate Adaptation Training Course established at national level, he is a participant in several international (FP7) and domestic (OTKA, GINOP, TÁMOP) projects related to previously implemented renewable energy sources and utilization, climate adaptation, and the establishment of a sensor network for settlement and facility monitoring. He has developed a wide network of contacts with both interested professional and non-governmental organizations.

Mihály Pósfai, member of the Hungarian Academy of Sciences, geologist, head of the HUN-REN-PE Environmental Mineralogy Research Group. He has authored 100 peer-reviewed papers in the field of environmental mineralogy (including research on biominerals and atmospheric aerosol particles). His works have been cited more than 8000 times with a Hirsch-index of 49.

Nándor Nemestóthy DSc, professor, his research focuses on the application of membranes since 2008, mainly in energetics, like gas separation or fuel cells. He has authored 98 publications. His impact factor is 254, received 1890 citations with a Hirsch-index of 26. He has 5 successful patent applications, and has been the coordinator of numerous international and industrial research projects, as well as the supervisor of 5 PhD students.

Nora Boussoussou, M.D., Ph.D, Cardiologist and researcher, received her PhD at the Department of Vascular Surgery of Semmelweis University. Founder and instructor of the university course "Sustainability in health care". She is the ambassador of the international organization Planetary Health Alliance, and the founder of the HECATE foundation. She published numerous publications in Hungarian and international professional journals. She is the founder of cardiometeorology.

Nóra Rodek PhD, assistant professor of the University of Pannonia since 2008. Her research field focuses on responsible and sustainable corporate governance, measuring and consciously applying CSR at the management level. In 2020 she was appointed to be the head of the Sustainability Department of the Ministry of Innovation and Technology. She represented Hungary in the Agenda 2030 Council Working Group as a member, she is the member of ESDN (European Sustainable Development Network) of governmental experts on sustainability, as well as the member of EIONET - Member of the European Environmental Agency (EEA) network of experts.

Péter Bakonyi PhD, senior researcher, his research interest is membrane bioelectrochemical systems, studying the role of membranes in the microbial fuel cells, ionic liquids. He has authored 80 publications, his impact factor is 320, received more than 1200 citations, with a Hirsch-index of 21.

Péter Sótonyi M.D., Ph.D., medical researcher in surgery, vascular surgery and health insurance, and is a registered forensic expert. He is currently the head professor of the Vascular Surgery and Endovascular Department of Semmelweis University. In 2021, he was awarded the Officer's Cross of the Hungarian Order of Merit (civilian section). He is the president of the Vascular Surgery Board of Semmelweis University and the Department of Angiology and Vascular Surgery of the Health Professional College of the Ministry of the Interior. His research areas are: clinical investigation of the role of Nociceptin/Orphanin FQ in cardiovascular diseases and stress response; investigation of the role of mechanical stress in the process of thrombus formation on human samples; radiological examination and geometric modelling of aortic aneurysms; the relationship between medical meteorological factors and cardiovascular diseases; epidemiology and clinic of peripheral arterial diseases; evaluation of cerebrovascular events in patients with carotid artery stenosis in the light of morphological and hemodynamic characteristics; clinical application of vascular imaging.

Róbert Mészáros, PhD, meteorologist, associate professor, head of the Department of Meteorology, ELTE. His main research interests include modelling the dispersion and deposition of air pollutants, urban air quality, analysis of air quality in relation to climatic factors and its effects.

Tamás Felföldi PhD, microbial ecologist, he works primarily in the field of microbial ecology, environmental genomics and molecular phylogeny. He has completed his PhD at ELTE. He has broad international connections which are supported by projects supervised by him (China, Romania). Currently he is the leader of the Microbial Ecology Research Group at the Institute of Aquatic Ecology of CER and as an assistant professor he is the leader of the Genomics Lab at ELTE.

Tibor Erős DSc, ecologist, hydrobiologist, leader of the Fish and Conservation Ecology Research Groups of the HUN-REN Balaton Limnological Research Institute. His main research area is the sustainability science of freshwaters, determination of ecological status, conservation and restoration ecological research, invasion ecology, fish ecology.

Viktor Sebestyén PhD, research fellow, University of Pannonia, Faculty of Engineering, Sustainability Solutions Research Lab. He is a researcher in the field of environmental modelling since 2016. His focus is the environmental protection and sustainable development, especially modelling the causal relationships of complex systems, with special regard to the development of data-driven decision support tools related to sustainable development goals and the identification of environmental impacts.

Viktória Csizmadia-Czuppon PhD, associate professor at the Department of Business Economics, University of Pannonia, since 2014. Her research focus is on the socio-economic indicators for microregions. She is an expert in regional and rural development, exploring the possibilities of local economic development, the role of local products in increasing the supply capacity and sustainability of the countryside.

Zita Konkolyné Bihari, meteorologist, unit head of Climate Research at HungaroMet, where she coordinates the research in statistical climatology and applied meteorology as well as related services. For 3 decades she has participated in several national and international collaborations in statistical climatology, agrometeorology, and studies on the impacts of drought.

Zoltán Barcza, DSc, meteorologist, associate professor at the Department of Meteorology of ELTE. His research interest is the evaluation of the surface fluxes of atmospheric greenhouse gases and biogeochemical modelling. He has authored 77 publications and 20 book chapters, and received 1940 citations with a Hirsch-index of 29.

Zsófia Horváth PhD, community ecologist focusing on metacommunity ecology using empirical, experimental and citizen science methods. Previously, she was a researcher at the WasserCluster Lunz research institute in Austria, the iDiv (German Centre for Integrative Biodiversity Research, Halle-Jena-Leipzig) institute in Germany, and the KU Leuven University in Belgium. She is currently the head of the Biodiversity and Metacommunity Ecology Research Group at the Institute of Aquatic Ecology of the HUN-REN Centre for Ecological Research.

POSSIBLE PARTNERSHIPS

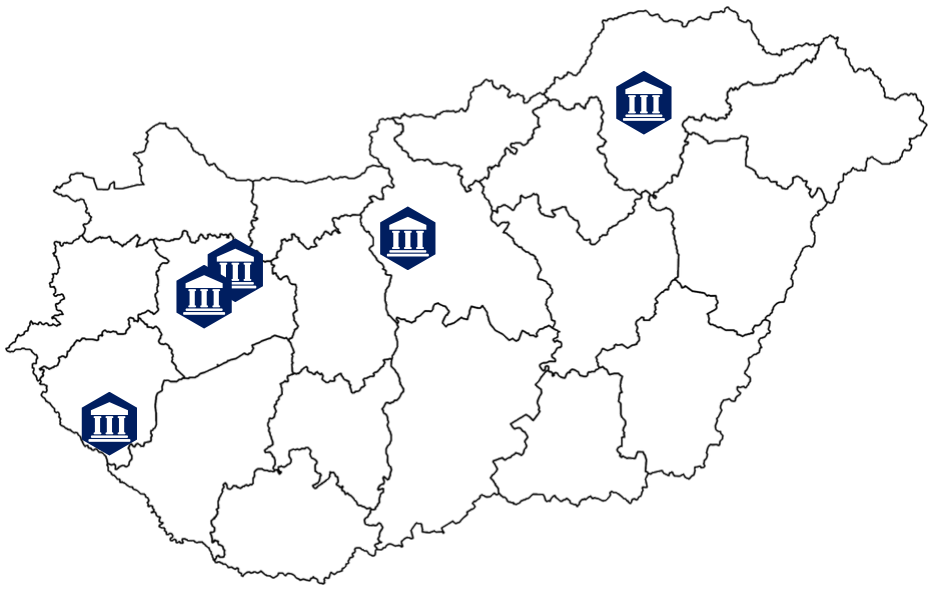
Universities and research institutions for the joint submission of proposals for and implementation of HORIZON and other R&D (e.g. LIFE IP, Biodiversa+) projects in the related professional areas of the National Laboratory.
Research and development partners, especially collaboration with industrial companies in researching and developing technologies to reduce CO2 emissions.

TARGET GROUP

- Decision makers
- Representatives of disciplines
- Research institutes, universities
- Educators, educational institutions
- Interested groups of society, Rural population
- Industry
- Companies in the agricultural sector
- Municipalities

PLACES OF IMPLEMENTATION:

- Budapest
- Miskolc
- Nagykanizsa
- Tihany
- Veszprém



PROFESSIONAL CONTACT

ANDRÁS GELENCSÉR, PHD

professional leader of the consortium

gelencser.andras@mk.uni-pannon.hu

+36 (88) 624 - 533

CONTACT

emnl@uni-pannon.hu

klimavaltozas.org