UNIVERSITY OF DEBRECEN

DOCTORAL SCHOOL OF EARTH SCIENCES

TRAINING PROGRAMME

1. General characteristics of the training programme

The head and secretary of the doctoral school are responsible for preparing the training programme of the Doctoral School of Earth Sciences. During the preparation of the document,from the heads of, and information is requested thes programmes doctoral school'the persons responsible for also send in the descriptions of the courses in question. The completed document thesubjects individual is sent to the parties concerned, and the suggestions receivedthe final text, includingthe , is approved by doctoral school council. is made available to everyone on theschool's website.The document then doctoral

The training programme reviewed is everyyears. three In this context, . particular emphasis is placed on the range of subjects offered: primarily on the basis of course attendancecertain topics may be dropped and new ones added,

2. General characteristics of the Doctoral School

2.1. Mission and vision of the Doctoral School

The mission of the Doctoral School of Earth Sciences can be summarised as follows: highly skilled by monitoring natural and social processes in the geographical environment, exploring the causes of change, identifying future trends and formulating recommendationsTo trainresearchers domestic and foreign .

The vision of the Doctoral School of Earth Sciences can be summarised as follows: of Operating a high-quality scientific workshop that usesto, , modern technical tools describe, understand and predict natural and social processes taking place in the wider geographical environment theschool doctoral and in the places of residence of doctoral students coming from outside Hungarywhich builds close links with research centres operating in Europe, .

2.2. Strategic objectives of the Doctoral School

The strategic goal of the Doctoral School of Earth Sciences is to highly effective training provideto producespecialists who are capable of collecting data related to natural and social processes that can be verified at a later date analyse the collected information using mathematical and statistical methods, publish the results in high-quality journals, , and, based on the research, draw conclusions that can be applied in practice and communicate these to decision-makers. the Hungarian and foreign Due to its geographical location, school pays special attention to the study of phenomena observable east of the Danube, primarily in north-eastern Hungary, and also aims to play an important role in ensuring the supply of new scientific talent in Transcarpathia and Transylvania.doctoral

The implementation of the strategy is supported by three quality objectives, which are linked to the quality objectives of the Doctoral Council of the Scientific Field:

- maintaining the number of graduates
- maintaining the dropout rate
- internationalisation

3. The personal background of the training provided by the Doctoral School of Earth Sciences

The core members, supervisors and lecturers of the Doctoral School are primarily drawn from the staff of the Faculty of Science and Technology at the University of Debrecen , but colleagues from

other faculties and external institutions of the University of Debrecenalso participate in the supervisory and teaching tasks of the doctoral school.

Head of the doctoral school:

Dr Gábor Kozma , of the Doctor Hungarian Academy of Sciences, university professor

Core members of the doctoral school:

1. György Csomós, Doctor of the Hungarian Academy of Sciences, university professor
2. Dr. Péter Csorba, , Doctor of the Hungarian Academy of Sciences, Professor Emeritus, (DE)
3. Dr. Gábor Kozma , Doctor of the Hungarian Academy of Sciences, university professor (DE)
4. Dr. Tibor Novák, Doctor of the Hungarian Academy of Sciences , Associate Professor (DE)
5. Dr. Gergely Szabó, PhD, habil., associate professor (DE)
6. Dr. György Emőd Szabó, PhD, habil., university professor (DE)
7. Dr. Szilárd Szabó, of corresponding member the Hungarian Academy of Sciences , professor (DE)

A total of 92 people (teachers, supervisors) are involved in the work of the doctoral school .

The secretary of the doctoral school is Dr. György Emőd Szabó, PhD, habil., university professor (DE).

4. Learning outcomes (MKKR level 8) within the training programme to be achieved

The Doctoral School of Earth Sciences has set as itsgoal that by the end of the training period, doctoral students fundamental should have achieved the following learning outcomes

Knowledge

- Possess research-level knowledge of the subject area, general and specific characteristics, most important trends and precisely defined boundaries, as well as agreed and disputed connections within the given field of science.
- Creatively understand the connections, theories and conceptual systems and terminology that make up the given discipline or field of study.
- Possesses the research methodology knowledge necessary for independent research in a given science/field.

Ability

- Is capable of creative analysis of the given field, of formulating comprehensive and specific connections in a synthetic, innovative manner, and of adequately evaluating and critiquing them.
- Able to apply and further develop the specific knowledge acquisition and problem-solving methods of their field.
- Able to creatively develop novel, previously unknown practical applications of theoretical issues.
- Able to plan and implement new projects, conduct research in a given field of science, and develop new techniques and approaches.
- Able to identify unforeseen professional problems and explore the detailed theoretical and practical background necessary to solve them at a research level.
- Able to construct and communicate new relationships that are significant in terms of their field of expertise and comprehensive connections that are relevant in terms of personal and community life.

Attitude

- Represents and further develops, in relation to their own subject area, those relationships which, due to the specific nature of the field, contribute to the process of human self-creation.
- Possesses the interest and learning ability that enables the identification and resolution of research problems in the field that are currently unclear and unpredictable.
- Characterised by solid professional commitment, a constant dedication to seeking new paths, and an acceptance of the need for persistent work.

Autonomy and responsibility

- Builds and initiates new areas of knowledge and new practical solutions with creative independence.
- With a leading role and a high level of cooperation, they are able to participate in the formulation of theoretical and practical issues.
- Able to play an equal role as a discussion partner with experts in the field.
- Takes responsibility for raising and answering new ethical questions related to the theoretical and practical issues of their profession.

5. Characteristics of programmethe Doctoral School of Earth Sciences

5.1. Full-time and part-time programmes

Full-time and part-time programmes last eight semesters (48 months) and consist of a training and research phase (24 months) and a research and dissertation phase (24 months).

A total of 240 credits must be earned during the 48 months, i.e. an average of 30 per semester. A minimum of 27 credits must be earned to pass the semester, but no more than 33 credits may be earned. Students may hold university practical classes, but no credits may be awarded for this activity. In order to avoid student overload, a maximum of 4 hours per week is permitted.

Credit points can be earned through academic performance and research activities as follows.

Academic results

A minimum of 16 credits must be earned during the first four semesters, with a maximum of 20 credits. The recommended number of courses per semester during the first four semesters is 2, for a total of 4 credits. No academic credits may be earned during semesters 5-8.

Research activity

A maximum of 224 credits can be earned during the eight semesters. During the first four semesters, a maximum of 26 credits can be earned per semester for research activities, and during semesters 5-8, a maximum of 30 credits can be earned per semester. (1 credit can be earned for 30 hours of work.)

Credits can be awarded for the following activities:

- publications,
- presentations at international and domestic conferences;
- poster exhibitions at international and domestic conferences;
- fieldwork;
- external research work (questionnaires, interviews, data collection);
- laboratory work;
- documented literature review (preparation of notes or reports on the literary sources studied);
- departmental research report (presentation of research results in a 40-50 minute lecture).

All doctoral students are required to report on their results in writing every semester. In addition, once a year, at the end of the spring semester, everyone must give a short presentation to the doctoral

school council and the school's lecturers on their research activities and results. The presentation is followed by a discussion and oral assessment.

5.2. Training within the framework of individual preparation

Individual preparers are only required to complete the research and dissertation phase (24 months). The aim of individual preparation is to enable professionals who have obtained a master's degree and a certificate of professional qualification from a domestic or foreign university (or an equivalent university-level degree and certificate of professional qualification), significant teaching and/or research experience, and documented scientific achievements (a sufficient number and quality of publications). The award of a degree on the basis of individual preparation is an exceptional procedure and may only be applied in particularly justified cases. Upon acceptance of the application, the individual preparatory student shall become a self-financing student. Upon acceptance of the application, the doctoral council of the scientific field shall appoint the complex examination committee and determine the subjects of the examination. During the examination period following the acceptance of the application, the individual preparatory student shall take a complex examination.

5.3. The comprehensive examination

At the end of the fourth semester of full-time and part-time doctoral programmes, as a conclusion to the training and research phase of the programme and as a prerequisite for the start of the research and dissertation phase, students must pass a comprehensive examination, which measures and evaluates their academic and research progress.

Students must apply for the comprehensive examination in writing (see Appendix 4 of the Doctoral Regulations of the University of Debrecen). Since students enter the degree award procedure after passing the comprehensive examination, applying for the comprehensive examination also constitutes applying for the degree award procedure.

The comprehensive examination consists of two main parts: in one part, the candidate's theoretical knowledge is assessed ("theoretical part"), and in the other part, the candidate's scientific progress is evaluated ("dissertation part").

In the theoretical part of the comprehensive examination, the candidate takes an examination in at least two subjects/topics, the list of which is included in Annex 1 of the doctoral school's regulations and in the school's training programme. In the second part of the comprehensive examination the candidate gives a presentation ,on their knowledge of the literature, reports on their research results, and presents their research plan for the second stage of their doctoral training, as well as the schedule for the preparation of their dissertation and the publication of their results. in their research topic

Doctoral students may only enrol in the fifth semester of doctoral training after successfully completing the comprehensive examination.

Doctoral students must submit the final version of their doctoral thesis (after preliminary discussion) within three years of passing the comprehensive examination. This deadline may be extended by up to one year upon request, subject to the decision of the doctoral council of the scientific field, provided that the student is unable to fulfil their obligation through no fault of their own due to childbirth, accident, illness or other unforeseen circumstances.

5.4. Other specific features of the programme

In exceptional cases, legal requirementssubject to compliance with, it is also possible to tailor the programme to the individual student's progress. The supervisor shall submit the relevant request, accompanied by a detailed explanation of the reasonsthe , to doctoral school council, which shall decide on the matter.
In order to ensure the successful completion of their research, doctoral students are required to attend consultations at times agreed with their supervisor and last to report on the completion of the tasks assigned to them at themeeting. If a doctoral student consistently fails to fulfil this obligation, the supervisor has the right to refer the matter to the doctoral school council.

5.5. Acceptance of courses completed at other institutions

The Doctoral School of Earth Sciences offers the opportunity to PhD students other doctoral complete courses related to their field of research atschools. The doctoral supervisor shall submit a proposal to the head of the doctoral school for the acceptance of these courses. In order to ensurethe has been created in the NEPTUN study system smooth administration, TPGE6000 Courses completed at other institutions course .

6. Programmes of Doctoral School of the Earth Sciences

6.1. Landscape Protection – Climate Programme

Programme director: Dr Péter Csorba, Doctor of Geography, Professor Emeritus
General objective of the programme
Building on the close relationship between landscape research and climate research, the doctoral programme aims to expand the scientific foundations of landscape protection and broaden related basic and applied research. The programme involves close cooperation between the teaching and research staff of the Department of Landscape Protection and Environmental Geography and the Department of Meteorology.
Research areas related to the programme:
climatology, environmental protection, landscape protection.

Landscape protection and climatology hubs of the programme
A wide range of landscape geography, landscape protection and climatological research has already been carried out by the two cooperating departments: landscape structure research and landscape assessments have been organically linked to so-called landscape climatological studies, which have resulted in meso- and micro-scale climate measurements and analyses. The main directions of the research are the effects of human economic activities on the natural environment and issues related to the environmentally friendly utilisation of landscape potential. This potential includes renewable resources, among which research on the domestic quantity and application possibilities of solar and wind energy form part of the programme. The programme has been expanded to include a new direction compared to previous programmes: the study of the regional impacts of global environmental processes.

The programme's landscape conservation hubs
Human economic activities inevitably modify the natural environment. The extent of the change depends on the strength of the impact and the characteristics of the natural environment. The natural environment is structured in a specific way: landscapes form an interconnected complex system in

which the individual elements (landscapes) respond differently to human interventions. The production process has the least destructive and polluting effect on the landscape when the use of the environment is adapted to the characteristics of the landscape.
Research into the processes taking place in the landscape (soil erosion, soil and sediment water management, soil-plant interactions, etc.) helps to improve our understanding of how the landscape functions. The results of such research can be used in many ways for landscape conservation purposes.
- Research into the relationship between landscape structure and landscape use also promises direct practical benefits due to the transformation of agriculture since the change of regime. In addition to the different natural conditions of the lowland and mountainous sample areas, the varying social conditions also have a significant impact on the methods and extent of land use. Our studies aim to explore these natural and social interrelationships.
The study of environmental pollution offers numerous opportunities for young researchers due to the diversity of human activities. The identification and mapping of different anthropogenic pollution sources in different landscapes, the determination of the main movement routes and spatial distribution of pollutants, and the development of hazard cartograms can be important applied research tasks.
- Researching the conditions of waste management and waste disposal from a geographical perspective.
- Beyond the traditions of the department, the study of tourism and its environmental impacts is also important because tourism is the most dynamically developing economic sector both globally and in our country, and its environmental impacts are becoming increasingly significant. We identify the following areas for study: research related to ecotourism, the exploration of conflicts and opportunities for cooperation between tourism and environmental and nature conservation, and the development of the theory and practice of sustainable tourism.

The climatological focal points of the programme
- Landscape climatology: comprehensive research exploring general natural values, part of the analysis examining production and cultivation values and potential, special meteorological analysis providing a basis for examining the human environmental impact of landscape and settlement environmental planning. With its help, it is possible to designate, for example, the climatological zones of the landscape, which may be important from the point of view of landscape use (tourism, recreation, etc.).
- Climate change: It is now scientifically indisputable that the temperature of the Earth's atmosphere near the surface is rising. The main cause of this is the increasing concentration of greenhouse gases as a result of anthropogenic activities. Global warming also leads to changes in other climatic elements, which may vary from region to region. At the same time, the increasing concentration of atmospheric aerosols, also caused by human activity, has a cooling and precipitation-increasing effect, but its intensity is significantly lower than that of greenhouse gases. The result is global warming and regional changes in other weather elements. New scientific knowledge about current climate change is emerging from time to time. Much of this is revealed by climatology, which also helps to draw economic and social conclusions. In the doctoral programme, we therefore wish to place greater emphasis on the joint discussion of impact assessment and greenhouse gas emission reduction issues, primarily by reviewing basic climate concepts and quantitative characterisation methods.

- Renewable energies: There are two very important reasons why humanity's attention turned (again) to these energies in the last third of the 20th century. One is that the reserves of certain fossil fuels appear to be running out, and the other – which is more evident – is that their combustion greatly increases the concentration of certain greenhouse gases, thereby accelerating the aforementioned process of climate change. Of course, other aspects of environmental protection are also among the reasons, which can be ensured primarily by exploring the potential applications of atmospheric resources (solar, wind and water energy) and other renewable energy sources. The task can therefore only be solved in relation to the landscape and climate, as the potential amount of these energies depends on the climatic conditions of the area . In the doctoral programme, in addition to developing and applying methods for determining the potential amount of atmospheric energy, we also focus on examining the social acceptance of renewable energy sources and their impact on landscape structure and land use.
-Urban climatology: In built-up areas, changes in the composition of the atmosphere and differences in surface cover compared to natural surfaces lead to modifications in climatic elements and the formation of an urban climate. With the advance of urbanisation, approximately half of our planet's population, and nearly two-thirds of our country's population, live in cities, exposed to the mostly adverse effects of the urban climate. As part of ongoing research, we are conducting mobile measurements in Debrecen and the surrounding settlements to study the heat island phenomenon that develops in settlements of different sizes under different weather conditions, with the aim of developing an empirical heat island intensity prediction model. This is linked to the planned creation of an urban climate station network in Debrecen. The third area is the study of urban human comfort sensitivity and air quality, which has grown out of urban climate research.

Courses included in the programme
- TPGE2009_EN Overview of traditional and renewable energies from their beginnings to the present day (Tamás Tóth)
- TPGE4013_EN Urban Environmental Protection (György Szabó)

6.2. The Natural and anthropogenic processes in lithosphere and hydrosphere programme
Programme leader: Dr Szilárd Szabó, of the Hungarian Academy of Sciencescorresponding member , university professor
General objective of the programme:
To preserve the nearly century-old research and teaching traditions and achievements of the Departments of Mineralogy and Geology, Physical Geography and Geoinformatics at the University of Debrecen, as well as the intellectual legacy of the internationally recognised experts working here, to maintain and further develop these traditions and achievements by continuously following and applying modern research trends and methods . Another fundamental objective is to meet today's social expectations and EU recommendations, and to transfer modern knowledge that is compatible at an international level.
Research areas related to the programme:
physical geography, geology, hydrogeology, geophysics, geoinformatics.

Geological hubs of the programme
- With its unique approach and rich array of investigative tools, as well as its close interconnections with a wide range of natural sciences, geology is it is ideally suited to modelling the long- and short-

term processes of our increasingly unbalanced planet and habitat, exploring its developmental trends, protecting its values, and assisting in hazard prevention and mitigation.
Our fundamental task is to translate the revolutionary results of the past decades in plate tectonics, palaeoecology, geochemistry, geothermics and environmental geology into everyday applications and professional training with the help of modern theoretical and instrumental analytical apparatus.
Our programme can be divided into several closely related thematic groups that build on each other.
- Modern IT and geoinformatics methods, which are essential tools for both database construction and modelling, are indispensable for solving the above tasks.
- We seek to establish internal, domestic and international partnerships that enable us to open up to interdisciplinary fields and engage in successful cooperation (morphotectonics, energy, protection of environmental values, prevention and remediation of damage), as well as the renewal of modern methodologies for the research of essential raw materials.

The geomorphological focal points of the programme
- On the one hand, recent processes can cause quite specific dangers or damage to society, but on the other hand, a thorough understanding of them can also help to uncover their useful properties.
- In recent decades, it has also become clear that society is increasingly involved in shaping the surface, thereby creating a new environment for itself (nature-society interaction). Its activities trigger new processes that also shape the surface and strongly modify the effects of active natural processes (impact – reaction). Recent surface-shaping processes are thus becoming increasingly "anthropogenised", and their necessary study brings the field of research itself closer to society. Thus, in changing geomorphology, the basic characteristics of the traditional duality of geography (on the one hand, the study of nature, and on the other, the study of social spatial processes and the deeper exploration of their interrelationships) can naturally be reinforced.
- Today, geomorphological research cannot stop at examining the formative effects of natural and social processes, but must be complemented by an assessment of the positive (favourable conditions) and negative (hazards) outcomes of these processes, the exploration of feedback mechanisms, and the creation of process models.
- A new perspective and task in today's geomorphology, in addition to detailed genetic and qualitative mapping of the surface, is the exact quantitative measurement of processes and surface forms as conditions, because only in this way can their use or, even more so, their (justified) preservation be successfully envisaged. Cooperation with the technical sciences in the field of applied geomorphology: production of useful information for the sciences that promote spatial planning.

The geoinformatics hubs of the programme
Over the last two decades, personal computers and professional software, which have become increasingly widespread in Hungary, have opened up new possibilities in almost all areas of research in earth sciences, including data storage, processing and versatile evaluation.
- Geoinformatics and geostatistical processing of geological and geomorphological research data sets, taking into account their intended use.
- Application and development of geoinformatics models in research areas related to our doctoral programme.
- Remote sensing possibilities in geological, geomorphological, hydrological and hydrogeographical research using data from aerial (satellite, aircraft, drone) and ground-based (GPS, measuring stations, space scanners, ground photogrammetry) surveys.

- Development of geoinformatics methods, testing the accuracy of measurements, data and methods.
• Analysis of digital terrain models using geomorphometric methods for object identification/extraction.
- Solving urban geoinformatics research tasks by combining the tools of geomorphology and geoinformatics.

General topic groups undertaken, recommended and strongly supported by the doctoral programme
- Investigation of rapid climate change events in the Mesozoic era and related changes in the environment and wildlife.
- Investigation of noble gas isotope ratios (He, Ne, Ar, Kr, Xe) in rocks and minerals in order to determine the origin (crust or mantle) of fluid flow in rocks or within rocks.
- Modelling of the hydrodynamics and contaminant transport of subsurface waters. Interaction between surface and subsurface waters. Investigation of seepage processes in the three-phase zone of soils.
- Modern geodynamic, micro- and morphotectonic studies and sequence stratigraphic-based basin analysis supported by geophysics and geoinformatics; modern characterisation, inventory calculation, cultivation method optimisation and efficient exploitation of raw material reserves (water, coal, geothermal energy).
- Further volcanological research integrated with regional tectonic and macrostructural reconstructions, extending our results to comparative studies of regions with insufficient data (e.g. Tardonai Hills, Mecsek) and areas beyond the border (e.g. Carpathian Basin, Northern Transylvania).
- Complex geological, technological, environmental geological, etc. research of mineral raw materials, environmentally friendly utilisation.
- Material and origin analysis of archaeological tools, archaeometric research of the materials and technologies used in buildings and ceramics, reconstruction of the ancient environment based on archaeological excavations.
- Research into the morphological results and implications of natural landscape development still present in today's natural environment, particularly in the flat, hilly and low mountainous landscape types of north-eastern Hungary. Among these, we place particular emphasis on fluvial, aeolian and mass movement processes and their consequences.
- Characteristics and changes in landscape development due to human activity. Geomorphological hazard and disaster analyses, balance problems in river floodplains, drifting sand areas, and hill and mountain valley systems.
- Geomorphological natural (landscape) value assessment and protection, especially in landscape types that are sensitive in terms of natural balance. Development of the theoretical basis and practical system of geomorphological value protection in Hungary.
- Geomorphological modelling - model experiments, theoretical models
- Exploration of the geomorphological characteristics of anthropogenic activities (mining, industry, infrastructure development, intensive agriculture, etc.) or processes triggered by them that are particularly dangerous in their immediate and long-term effects, forecasting their consequences, and reducing their hazardous nature.
- Analysis of the geomorphological aspects of landscape planning and recultivation, integration of the role of geomorphology into landscape protection. Evaluative analysis of the natural foundations of regional development.

- Quantitative examination of the characteristics of the earth's surface (topography), incorporation of the results into geographic information systems (GIS), theoretical and methodological issues of the use of information technology in geology, geomorphology, hydrology, etc., geomorphological possibilities and tasks in digital thematic mapping.
- Extension of the application of remote sensing methods in the analysis and evaluation of surface changes.

Courses included in the programme
- TPGE0001_EN Applications of GIS in Earth Sciences (Gergely Szabó)
- TPGE1002_EN Environmental Geology (Árpád Csámer)
- TPGE1003_EN Environmental geochemistry (Árpád Csámer)
- TPGE1005_EN Hydrodynamic modelling (Tamás Buday)
- TPGE1007_EN Radiometric age determination (Zsolt Benkó)
- TPGE1009_EN Magmatic Petrogenesis (Péter Rózsa)
- TPGE1011_EN Basin analysis in raw-material research (Zoltán Püspöki)
- TPGE1016_EN Micro- and morphotectonics (Richard William McIntosh)
- TPGE1017_EN Applying thermal analysis (Árpád Csámer)
- TPGE1018_EN Historic building materials (Péter Rózsa)
- TPGE1024_EN Physical volcanology (János Szepesi)
- TPGE1026_EN Advanced analytical methods in geochemistry (Zsolt Benkó)
- TPGE1030_EN Astrogeology and Cosmochemistry (Árpád Csámer)
- TPGE1031_EN Potential of geothermal reservoirs (Tamás Buday)
- TPGE1032_EN Introduction to meteoritics (Árpád Csámer)
- TPGE1033_EN Analysis of hydrological data (Tamás Buday)
- TPGE1034_EN Extraction of ambient heat with heat pump (Tamás Buday)
- TPGE1037_EN Geology of Hungary (Richard William McIntosh)
- TPGE1041_EN Cyclostratigraphy (Zoltán Püspöki)
- TPGE1043_EN Mineralogy (Zsolt Benkó)
- TPGE1044_EN Exploring geothermal resources (Tamás Buday)
- TPGE1047_EN Geophysics (Tamás Buday)
- TPGE1051_EN Cave sediments (Temovski Marjan)
- TPGE1052_EN Speleogenesis (Temovski Marjan)
- TPGE1053_EN Stable isotope geochemistry of karst systems (Temovski Marjan)
- TPGE2002_EN Mathematical statistics in geosciences (Szilárd Szabó)
- TPGG5005_EN Research planning and publishing (Szilárd Szabó)
- TPGE5008_EN Cartography (Gergely Szabó)
- TPGE5012_EN Applications of Photogrammetry in Geosciences (Gergely Szabó)
- TPGG5022_EN GIS Hacks – from basic to advanced applications (Boglárka Bertalan-Balázs)
- TPGG5024_EN Python programming for remote sensing (Dávid Abriha)

6.3. Social Geography – Regional Development

Programme leader: Dr Gábor Kozma, university professor, Doctor of the Hungarian Academy of Sciences

General objective of the programme

To develop research that responds to the new challenges of social geography (human geography) while preserving valuable traditions. To maintain and further develop modern regional development research directions by continuously following new research methods.
Research areas related to the programme:
social geography, regional development, tourism.

The impact of research work carried out to date on the programme
The research work of the lecturers involved in the PhD programme is extremely diverse, both in terms of the sub-disciplines of geography and regional development and the geographical-regional units selected for study. Although the geographical area selected is predominantly focused on north-eastern Hungary, it nevertheless covers the whole of Hungary and, in many respects, extends to Europe and even other continents. Three distinct lines can be identified in the thematic diversity. One continues traditional social and economic geography research with new content and methods in line with the requirements of the age (population and settlement geography, village geography, studies of living conditions, the territorial connections of industry, the territorial effects of tourism), the second opens up to completely new sub-disciplines of social geography (geopolitics, cross-border relations, labour market studies), while the third serves to provide a scientific basis for regional and settlement development. In terms of methods, it can be said that, in addition to the use of officially collected statistical data (e.g. Territorial Information System, company information databases), "soft" research techniques borrowed from sociological studies in the social sciences (questionnaires, interviews, etc.) are increasingly being used. Geographic information systems and modern data processing methods are becoming increasingly important in analyses.

The research work of the PhD programme's lecturers covers the following areas in detail:
- interethnic research in the north-eastern part of the Carpathian Basin;
- Euroregions as effective participants in international cooperation;
- the transformation of rural areas in the north-eastern regions of the Carpathian Basin;
- research underpinning regional and settlement development in eastern Hungary;
- international migration and minorities;
- employment policy issues in Hajdú-Bihar County;
- examination of local government marketing policy in north-eastern Hungary;
- New trends in political geography, geopolitical analysis of Central Europe;
- The human resources situation in Eastern and North-Eastern Hungary;
- regional characteristics of industrial restructuring;
- characteristics of contemporary urbanisation;
- inequalities in socio-economic spatial processes;
- analyses of transport geography and accessibility;
- characteristics of the foreign economies of Central and Eastern European countries;
- examination of the regional effects of tourism.

Theme groups of the programme
Since the 1990s, the scientific activities of the PhD programme can be grouped around the following topics.
1. Hungary's accession to the European Union justifies the focus on the examination of different regional levels of spatial and settlement development. The department's lecturers regularly participate

in and give presentations at the Alföld Congresses. The department's research has contributed significantly to documenting the economic and social changes that have taken place in north-eastern Hungary in recent decades and to developing a methodology for identifying underdeveloped areas. The success of the department's work in this area is demonstrated by the fact that its members have participated in the preparation of several county development concepts and programmes, the development of settlement development concepts, and the writing of documentation materials for the transformation of villages into towns.
2. The programme considers it its task to conduct a multifaceted and detailed examination of Debrecen, the country's second city and the regional centre of Tiszántúl, and to provide a scientific analysis of the changes that have taken place in recent decades. The research results were presented at several conferences and published in three volumes entitled "Studies in the Urban Geography of Debrecen". The recognition of the department's lecturers is demonstrated by their participation in the development of several documents that form the basis for the development of Debrecen and its wider environment (e.g. Integrated Urban Development Strategy, Integrated Settlement Development Strategy).
3. Exploring cross-border relations and researching possible forms of cooperation is the third major area of the department's scientific research. This includes both a focus on direct cross-border relations and the goal of organising joint research programmes with other foreign universities. We have actively participated in several INTERREG projects, and in the future we aim to become an important scientific base for the main priority of EU Territorial Cooperation.
4. Human resources are a very important basis for our current development, and in this spirit, in cooperation with the Institute of Education and Cultural Studies of the Faculty of Humanities, we place great emphasis on exploring the spatial differences in the educational attainment of the population and the employment policy situation closely related to it, with a special focus on the Roma population.
5. The fifth key element of the department's scientific activity is closely linked to the reindustrialisation process that began in Central and Eastern Europe after 2000. Within this framework, we examine the emergence of global value chains in Hungary, the process of establishing a subcontracting system, and the territorial implications of the solutions applied within the framework of "Industry 4.0".

Courses included in the programme
- TPGE3005_EN Spatial development inequalities (János Pénzes)
- TPGE3009_EN Geopolitics (Zsolt Radics)
- TPGE3015_EN Development potentials in border regions (Klára Czimre)
- TPGE3017_EN Regional planninf (Gábor Kozma)
- TPGG3022_EN Introduction into the global production network research (Ernő Molnár)

The Council of the Doctoral School of Earth Sciences
Approved at its meeting on 8 September 2025