

Charles University, Faculty of Science, Geographical Institute

**THE PLAN
FOR THE DEVELOPMENT
OF A RESEARCH AREA
(COOPERATIO PROGRAM)
2022–2026**

GEOGRAPHY

Current state of the research area
Version 3

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Basic information

Name of the project: Program Cooperatio Geography

Time frame: 2022–2026

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1 Introduction

The presented document is the first version of the plan for developing Geography research area within the institutional programme for research support of the Charles University (COOPERATIO PROGRAM) for the period 2022–2026. The first version contains an elaboration of the current state of the research area. Within the research area of Geography, all departments of the Geographical Institute at the Faculty of Science are incorporated. A separate program for didactics of geography and other didactic disciplines was established.

The research area of Geography consists of five disciplines of the Charles University classification: Demography, Physical Geography, Cartography, Regional and Political Geography and Social Geography. Although all the departments representing these disciplines are located at the Faculty of Science, other parts of the university do not participate in the Cooperatio Geography program. However, it is expected that extensive cooperation will continue not only between representatives of scientific disciplines within the Faculty of Science, but also across the disciplines of the University and other domestic and foreign institutions. The document is based on internal materials secured by heads of geographical departments, directors of doctoral studies boards, economic and study departments of the faculty and additional materials, among them the following documents:

- Evaluation of the Research Area GEOGRAPHY at the Faculty of Sciences (international evaluation)
- Detailed evaluation of the Geography research area
- Proposal of the program Progres for the period 2017–2021
- Report of the program Progres for the period 2017–2018
- Final report of the program Progres for the period 2017–2021

2 Current state of the research area

This section describes the starting point in which the Geography research area finds itself, in terms of personnel (including doctoral students and postdocs), material and workspace conditions, internationalisation, and internal university cooperation.

The Geographical Institute employs roughly 100 academics and project founded research fellows, and 175 PhD students by the end of 2021. The structure of workloads within the geographical departments is summarised in Table 1. A relatively small proportion of international staff, visiting professors and foreign postdocs could be seen as a potential threat for most geographical disciplines. The current policy in the recruitment of new academics is mainly focused on young postdocs who graduated at the faculty with less intention to attract foreign scholars. However, recently situation improved in the case of international PhD students (STARS programme). Of the total 175 PhD students, 53 came from abroad. Although a relatively small proportion covers Slovaks (6) and students from developed countries (9), most foreign PhD students are citizens from post-socialist and developing countries. Recruitment of postdocs from abroad is a relatively new strategy of the University. Several temporal postdoc positions were financed during the last five years, with only one such position in 2021.

Department	Professors	Associate Professors	Assistant Professors (Post-docs)	Project-funded Research Fellows	PhD Students (foreign)
Physical Geography and Geoecology	3,6	5,8	9,2 (1)	6,85	48 (9)
Social Geography and Regional Development	4,8	9,65	14,55	10,65	76 (16)
Applied Geoinformatics and Cartography	0	3,6	5,6	2	16 (7)
Demography and Geodemography	1	2,25	6	2	35 (21)
Altogether	9,4	21,3	35,35 (1)	21,5	175 (53)

Table 1 The structure of workload of academic staff and PhD students in the research area Geography.

Source: Economic Department, Study Department, Faculty of Science.

Funding for the research is multi-source. Recently, the main sources were secured by the institutional programs of Charles University (Prvok and Progres) during the last decennia. Although during the previous five years, the volume of funds obtained from grant competitions and other external sources has increased significantly, their size is currently more than double compared to the Progres program. An overview is given in Table 2. However, a very small amount of funding comes from international projects (Horizon, FP), and no ERC project is currently being addressed within the research area.

Year	2012	2013	2014	2015	2016	2017	2018	2019	2020
Institutional support (Prvok, Progres)	10	16	18	20	21	21	23	24	26
External sources (projects)	NA	NA	NA	40	28	30	46	62	66

Table 2 Structure of resources for research 2012–2020 at the Geographical Institute, Faculty of Science.

Source: Economic Department, Faculty of Science. Values are in millions of CZK.

The basic parameters of scientific production include publications in journals registered in the Web of Science database. If we compare the results of members of the Geographical Institute during the last nine years based on the OBD database, there has been a gradual increase in articles in journals with IF since 2012, but since 2016 stagnation has already been evident (see Table 3). This can be considered a saturation point of the research potential of research teams in geography.

Year	2012	2013	2014	2015	2016	2017	2018	2019	2020
Number of articles in Jimp	41	54	69	81	90	85	88	98	92
Total number of outcomes in OBD database	284	274	324	412	345	358	294	316	284

Table 3 Number of articles in journal with IF during 2012–2020 at the Geographical Institute, Faculty of Science.

Source: OBD database, 24th October 2021.

Although the articles classified in the first quartile predominate in the structure of publication outcomes, the distribution among the departments is rather unbalanced as 2/3 of these quality papers were produced by the Department of Physical Geography. Moreover, a large proportion of publications are concentrated in journals in the fourth quartile (Table 4), and 2/3 of the outputs are also completely outside the WoS database (Table 3).

Quartile/Year	2016	2017	2018	2019	2020	Total
Q1	34	33	41	32	29	169
Q2	24	24	16	28	32	124
Q3	10	10	16	14	13	63
Q4	22	18	15	24	18	97
Altogether	90	85	88	98	92	453

Table 4 Number of articles in journal with IF during 2016–2020 according to 'disciplines' quartiles at the Geographical Institute, Faculty of Science.

Source: OBD database, 24th October 2021.

In addition to published articles, the achieved results include a relatively high number of published books in prestigious domestic and foreign publishers and good quality chapters in books. Overall, the number of articles written in co-authorship with external, especially foreign colleagues, and the number of chapters and books published in international publishers is growing significantly.

Geographical disciplines are among the most important producers of applied research results at Charles University. In the field of applied research, the Geographical Institute accounts for 50 per cent of the outputs of the whole Faculty of Science and applied research projects also form a significant part of revenue. Furthermore, the results achieved in the programs of the Technology Agency, NAKI, ministries and contract research play a crucial role. There are currently several hundred achieved outputs, especially certified specialised maps, methodologies, software, reports, databases, exhibitions, and other results (for example, population forecasts, decision-making materials for state and regional institutions, etc.).

2.1 Research centres and workspace conditions

Geographical and demographical research is concentrated on grant projects in 23 specialised research centres and laboratories (heads of teams in brackets):

Department of Physical Geography and Geoecology

- Research group of meteorology and climatology (Radan Huth)
- Research group of biogeography, landscape ecology and pedology (Zdeněk Lipský, Václav Tremel)
- Research group of geomorphology and geodynamics (Vít Vilímek)
- Research group of hydrology (Jakub Langhammer)

Department of Social Geography and Regional Development

- Economic geography lab (Petr Pavlínek, Jiří Blažek)
- Centre for urban and regional research (Luděk Sýkora)
- Regional and political geography research centre (Libor Jelen)
- Research centre for cultural and historical geography (Pavel Chromý, Tomáš Havlíček)
- Centre for geographic and environmental education (Dana Řezníčková)
- Research centre on health, quality of life and lifestyle in a geodemographic and socioeconomic context (Dagmar Dzúrová)
- Geographic migration centre (Dušan Drbohlav)
- Urban and regional laboratory (Martin Ouředníček)
- Transportation geography centre (Miroslav Marada)
- Geography of leisure research centre (Dana Fialová, Jiří Vágner)
- Rural geography research centre (Radim Perlín)
- LUCC Czechia research centre (Ivan Bičík)

Department of Demography and Geodemography

- Centre for demographic analysis, models, and methods (Klára Hulíková Tesárková)
- Centre for population forecasting and applied demography (Boris Burcin)
- Centre for fertility study (Jiřina Kocourková)
- Centre for historical demography (Alice Velková)

Department of Applied Geoinformatics and Cartography

- Research group for airborne laser scanning (Markéta Potůčková)
- Research group for land use and land cover assessment from satellite imagery (Přemysl Štych)
- Research team of image and laboratory spectroscopy (Lucie Kupková)

The Geographical Institute operates several laboratories (general physical geography, ecohydrology, dendrochronology), extensive monitoring networks of meteorological and hydrological gauges in experimental catchments, and a measurement network for slope dynamics. The new laboratory for hyperspectral data processing has been built, enabling acquisition, pre-processing and analysis of multispectral and hyperspectral imagery and laboratory spectroscopic data, mobile laboratories for spatial data collection and processing by laser scanning, GPS or geodetic terrestrial methods are also available. The institute has top equipment for RPAS (DJI M600 Pro UAV with Headwall NANO-Hyperspec camera and LiDAR RIEGL MiniVUX-1 UAV scanner, VTOL Atmos Marlyn with PPK and MicaSense Altum multispectral camera, DJI Phantom Multispectral and DJI Mavic II Pro). A 3D Data Laboratory is currently being built. The institute is the administrator of the faculty ESRI license, which provides employees of the Faculty of Science and students with access to modern GIS technologies and web map services. Additionally, Geographical Library, Map Collection and newly established unit for Data management and Map server participate within the research activities.

However, workspace conditions are unsatisfactory, as laboratories and offices are overcrowded and distributed outside the main building in provisional and temporary buildings with unmodern equipment. The realisation of Globcentre is unsafe with not secured financial resources and could solve the spatial problems of the whole research area rather in a long-term perspective.

2.2 Cooperation within the University and international cooperation

The Geographical Institute cooperates with many departments of the Faculty of Science (Institute of Hydrogeology, Engineering Geology and Applied Geophysics, Institute for Environmental Studies, Department of Experimental Plant Biology, Department of Philosophy and History of Science) and others (e.g., hydrobiology, geochemistry, earth physics, plant ecology and physiology).

Long-term cooperation exists with the Czech Academy of Sciences, Sociological Institute (focus on electoral geography or local and regional governance), Institute of History (esp. historical regional geography section), Institute of Information Theory and Automation, Institute of Botany, Institute of Atmospheric Physics, Institute of Rock Structure and Mechanics, Institute of Hydrodynamics, Institute of Geophysics, Global Change research Institute.

Regarding intra-university collaboration, there are significant links to the Faculty of Social Science (knowledge exchange, submissions of joint grant proposals) and other universities (Czech Technical University in Prague, University of West Bohemia Plzeň, Czech University of Life Sciences Prague, Masaryk University in Brno), other institutions (Forest Management Institute, State Administration of Land Surveying and Cadastre, Czech Geological Survey, Czech Ministry of the Environment of the Czech Republic, Czech environmental information agency).

International research activities have two forms. First, the involvement in international research networks is developed mainly on a personal basis. Second, international

research focuses on research conducted abroad, which typically involves collaboration with local partners. Geographical research is taking place in many European countries, but also outside the continent, in India, Ethiopia, Kyrgyzstan, Peru or China. An example is permanent participation in the research program at the Czech Antarctic Station J.G. Mendel, James Ross Island. Internationalisation regarding academic personnel has been limited to visiting scholars' short-term stays. A key role plays collaboration with major foreign scientific institutions, mainly ESA - European Space Agency, NASA - National Aeronautics and Space Administration for example, in the organisation of international training courses in the field of remote sensing (Trans-Atlantic Training - TAT, since 2013) and some research projects. Further, there are established collaborations with foreign universities and institutions such as Humboldt University Berlin, Warsaw University, Heidelberg University, University of Virginia, University of Maryland, Slovak Academy of Science, Dartmouth College, Tartu University.

The members of the Geographical Institute are actively involved in the work of important international organisations such as EuroSDR (European Society for Spatial Data Research), SCERIN (an international group focused on research in land-use change and forest ecosystems in Southern, Central and Eastern Europe), IGU Commission on Land Use Land Cover Change (a commission of the International Geographical Union to research long-term land-use change), IGU Commission on Global Change and Human Mobility, EARSeL – European Association of Remote Sensing Laboratories.

Members of the Geographical Institute represent geography on the editorial boards of foreign journals, act as project evaluators for foreign grant agencies, the European Research Council - ERC Peer Review Panels and work in several international scientific organisations such as IMISCOE, UNFPA, NASA, ESA - European Space Association, ICL - International Consortium of Landslides, ICGDR - International Consortium of Geodisaster Reduction and others.

We established a new position of coordinator of internationalisation at the level of Geographical Institute to support the institutional environment for newcomers from abroad and 4EU+ activities. Furthermore, geographic departments were very active in establishing cooperation under new alliance 4EU+, where we obtained several approved projects.

2.3 Reflection of the internal evaluation

The research area obtained four general recommendations from the international team of evaluators within the Charles University internal evaluation:

Recommendation 1: to secure PhD position and strengthen PhD students' involvement in research.

There is a need to improve the success rate of PhD students in Geography compared to other areas of the Faculty of Sciences. According to the data provided by the Faculty of Sciences, the success rate in the different fields of Geography spans from 25% to 40%. In contrast, this rate is over 50% in two-thirds of the areas represented at the Faculty of Sciences. Thanks to the efforts made by CUNI, Faculty and departments to increase doctoral scholarships and avoid side jobs of PhD students, improvements are expected. Furthermore, improving full-time PhD positions will increase the success rate by securing PhD students.

The job market in Europe is supportive to young Geography graduates, the attractiveness of PhD students in Geography is to enhance but needs to rely on a sustainable system adapted to the job market. Monitoring the job market through networking PhD students and creating an alumni system needs to be encouraged. Strengthening involvement of PhD students also relies on the development of shared offices for PhD students in order to better associate them in the everyday lives of Departments and research teams and consider them as full young researchers. Enhancing special programs (doctoral studies) such as seminars and co-authored papers is of great help in this regard.

Recommendation 2: To develop interdisciplinarity

Geography is one of the rare academic fields that can be considered part of both natural sciences and social sciences. Geographers at CUNI have the ability and skills to collaborate with technical, natural, and social sciences with grounded knowledge. A shift beyond the division into departments could bring promising opportunities. For example, Cartography and Applied Geoinformatics are essential parts of any spatial research, transversal to all fields. There is a strong need in investing in that core field to build further perspective in geography. Hereby the main stimulus should be to strengthen the scientific cooperation with the other geography departments and intensify interdisciplinary and even transdisciplinary research activities in collaboration with departments from outside geography. Such possibly pursued research activities may, for instance, focus on urban environments, human health-related aspects of physical geography, climate resilience and climate change adaptation and societal impacts of environmental change. It should be considered how far the interdisciplinary Institute for environmental sciences could serve as a starting point for coordinating such collaborative research networks. Regarding human geography, collaborations with departments in social sciences (sociology, economics and finance, etc.) and with the Academy of Sciences, especially with the Institute of Sociology and Geonics, could raise new research questions.

Recommendation 3: To widen internationalisation

Geography at CUNI presents a significant level of internationalisation. Long term incoming and outgoing visiting professorships, as well as broader involvement in scientific or global international organisations, would strengthen international cooperation. It could be a lever to increase the visibility of Geography at CUNI in order to set up international education and research programmes. Internationalisation also concerns reinforcement of research at the European level, increasing the success rate of EU project applications. Closer networking with European partner universities serving as benchmarks is proposed in international research collaboration, project applications, visiting professorship, and educational programmes (joint & double degrees). Geography at CUNI offers rich scientific knowledge and could contribute to the European research area, which is of utmost importance, especially regarding Social Sciences. Participating in the 4EU+ Alliance is a major opportunity in that respect.

Recommendation 4: To propose a strategy for the area Geography

A common strategy at the level of the Institute of Geography could be a lever to better encourage edge topics and innovation incubators in Geography. This strategy could give benchmarks and goals to achieve in medium-term (5 years) or long-term perspectives in accordance with the CUNI strategy. Such a strategy could propose career guidance (for example, to young researchers and PhD students), prioritise some topics to build up interdisciplinarity, show the coherence of the international collaborations, and target financial support to edge topics. For example, in the field of Cartography, it is important to set up a long-term strategical plan. Otherwise, the Department won't be able to face the current scientific demands in GIS and remote sensing. At last, such a strategy could give more coherence and more visibility to the area Geography divided into several Departments. A Strategy advisory board partly composed of foreign scholars could be of great help to define priorities.

In the Evaluation of the Research Area Geography at the Faculty of Sciences, Physical Geography and Social Geography ranked in the category "A", i.e., the research is fully comparable to the same research areas at benchmark universities. On the other hand, demography and Regional Geography ranked in the category "B" and Cartography in category "B".

The recommendations made by the committee are relevant, particularly the first three of them that address important challenges that we are well aware of and, hence, we plan to address them in chapters 3, 4 and 5. The fourth recommendation – a strategy for the research area – would be secured by this document for the next five years.

2.4 SWOT analysis

As a conclusion of the second chapter, we prepared the SWOT analysis of the given research area, which can be used as a starting point for the following parts of the strategy stated in chapters 3 and 4.

	Helpful	Harmful
Internal origin	<p>STRENGTHS</p> <ul style="list-style-type: none"> - sound and strong tradition and experience (Faculty of Science, Charles University), - high earned reputation - friendly atmosphere, - good mix of younger and senior academics, - well established international contacts in key subdisciplines - provision of support to activities important for the development of geography (high involvement in the Czech Geographical Society and its activities, educational programs, journals, PhD and knowledge competitions etc.), - dominant disciplinary position within Czechia and strong in CEE, - well-established research areas with quality of outputs in selected disciplines, - coverage of a diversity of research topics, - close relation between pure and applied research, successful applications in the applied research context - high societal relevance of research, - age balance and intergenerational cooperation, including strong research involvement of PhD students and junior researchers in research projects 	<p>WEAKNESSES</p> <ul style="list-style-type: none"> - overload of some with too much work, - spatially dispersed offices and insufficient workplaces and laboratories for academics and esp. PhD students, with limited potential to develop progressive disciplines and larger projects, - relatively limited cooperation within the departments of the Geographical Institute, - limited cooperation with other social scientists (from the Czech Academy of Sciences, or other faculties of the University, University of Economics etc.), - lack of interdisciplinary approaches, - stagnation or even decline in the number of international research projects and related outputs, - non-existing joint/dual educational programs accredited in English, a small number of international students and researchers, - inequality in the research performance among particular subdisciplines and research streams, - small proportion of publications based on 'students' theses,
External origin	<p>OPPORTUNITIES</p> <ul style="list-style-type: none"> - enhance international cooperation and project leadership in the fields of major research strengths, - stronger reflection of contemporary key thematic social and academic challenges, - enhance mutual synergies between diverse fields of own sub-disciplinary academic expertise and research strength and build more complex conceptual, methodical and analytical approaches to key issues in contemporary research, - more intensive involvement in public presentation of research outputs, - tackling grand societal challenges such as climate change and sustainability, ageing of the population, fourth industrial revolution and related changes in economy and labour markets in terms of both research and policy advice, - mobilise and enhance international contacts – mainly via initiative 4EU+ Alliance. 	<p>THREATS</p> <ul style="list-style-type: none"> - finding a proper balance between involvement in specific local and national research issues and major international debates, - rapidly increasing good quality research outcomes of other universities and research institutes in Czechia - geography as a scientific discipline has still limited recognition in the public, which also translates in limited attention and demand for scientific (socio-geographic) results from public administration, - due to limited personnel capacities, social geographers have difficulties satisfying even the existing demand.

3 Main research objectives and future directions

The main research goals are highly differentiated within a wide range of geographic and demographic disciplines. The strategic goals include, in particular, strengthening publishing activity in prestigious journals and publishers in the field, but also the internationalisation of research. As a university, we also want to focus on improving teaching at all levels of study and linking research work with the education of students. We consider it important to increase PhD students' involvement and create conditions for attracting foreign students to doctoral studies and postdoc positions. However, the transfer of acquired knowledge into practice and participation in applied research and cooperation with the commercial, public, and non-profit sectors is also important. Main research directions and future plans are described in the following section.

3.1 Main research directions

Physical geography

The overarching topic of research in physical geography will be the response of landscape systems to climatic changes and resilience of landscape systems on various temporal (from recent to quaternary) and spatial scales (from catchment scales to continental scales). In addition, the interaction of landscape changes with society is also taken into account. Research activities will be conducted within four research groups (climatology, hydrology, geomorphology, and biogeography & landscape ecology), which will closely collaborate with each other and naturally also with other groups both within and outside the Cooperatio project.

Research in **atmospheric sciences** (meteorology and climatology) will focus on detecting and projecting climate change in Europe, with a particular emphasis on measures of short-term variability and extremes. Analyses will use up-to-date statistical approaches, including testing for field significance. They will be based on a range of various observation-based data sources (station data, gridded databases, reanalyses, satellite data) and the latest outputs from global and regional climate models, produced for the 6th IPCC Report. We will also investigate atmospheric circulation using various methods (teleconnection analysis and classifications) and hydrometeorological extremes, especially from the perspective of their dynamical precursors.

Research within the **hydrology** group will focus on the (i) hydrological responses to climate change, (ii) dynamics of runoff generation and hydrological processes in headwater areas, (iii) dynamics of extreme hydrological processes in montane areas, (iv) hydrological hazards in high-altitude mountains, (v) nature-based solutions for mitigation of extreme hydrological processes, (vi) hydromorphological and ecological status of streams, and (vii) water pollution, sediment pollution and transport processes. We aim to use novel monitoring, surveying, and modelling techniques to gain a deeper insight into the changing aspects of hydrological processes in a vulnerable environment. The research will stem from established research activities and own monitoring infrastructure in experimental catchments located in Czech mountain ranges (Bohemian Forest, Ore Mts., Giant Mts.) and high mountain ranges (Tien-Shan in Central Asia, Peruvian Andes).

Geomorphological research will focus on tectonic and climate-driven changes of the Earth's surface during the Quaternary. Modern geomorphological methods based on a combination of remote sensing and field research, quantification of geomorphological processes by direct field monitoring and laboratory methods, geochronological dating, and mathematical modelling will be applied to characterise past and present landscape processes and their temporal changes. The research will focus primarily on Quaternary landscape evolution, natural hazards, and past and present glacial and periglacial environments.

Within the **biogeography and landscape ecology** group, research will focus on the response of forest ecosystems to climate change, interactions of landscape changes and soil properties, and the effects of landscape fragmentation on biodiversity. Key methods will include dendrochronology, remote sensing, soil-analytical methods (soil chemistry, soil hydrology) and modelling (process-based models of, e.g., tree growth, vertebrate dispersal across the landscape). The aim is to increase the number of studies covering a larger spatial extent (regional, continental) and to focus on work with large datasets. In addition to publishing results in scientific journals, it is also intended to produce outputs of applied research related to forestry and landscape management.

Social geography

In the field of **social geography**, we will further develop core subdisciplines, and we will concentrate our capacities on several main topics, where we are strong in the international context and where we have gained excellent research results (measured via excellent publications). So far, several of our research teams have achieved not only good domestic but especially a strong international reputation – it concerns primarily **economic geography and regional development, health geography, urban and suburban geography**. Moreover, as indicated in the international evaluation, the migration studies and rural studies, two newly emerging important specialisations with good results, are worth developing. When doing research (and, consequently, publishing research results), one of the priorities is to interconnect particular topics (and subtopics) across the defined areas – like, for example – health and migration, or urban geography or/and economic issues and quality of the environment.

It does not mean that other research domains are to be suppressed. Nevertheless, their relevance is closely interlinked with growing numbers of outstanding scientific personalities who can produce excellent research and push the subdiscipline forward. Of particular relevance is to enhance the field of development studies (in close liaison with regional and political geography and migration studies), especially in territories where the research experience of our academics has already existed (India, Ethiopia, Moldova).

When doing research, both basic and applied research perspectives will be supported. The current grand societal challenges such as global pandemics, global climate change, global economic crises, or global fight for democracy as well as other topical geographical problems burdening Central Eastern Europe, in general, and Czechia, in particular, should be tackled. In addition to our strive for scientific excellence, policy-oriented research outcomes/papers will be developed as well.

Regional and political geography

Regional geography will continue to focus on the so-called **new regional geography** and **problem-oriented regional geography**, meaning an approach that recognises and emphasises the crucial role of local and regional context for complex problems and interventions (particularly those involving human-environment interactions). Then we will focus on **traditional themes** within political geography such as electoral geography, ethno-political differentiation, local and regional governance, etc., and explore alternative approaches such as political ecology.

Our objective is to increase both the quality and quantity of research outputs, primarily publications in recognised journals. An important prerequisite for that is to improve the success rate in grant competitions in order to secure research funding. Another objective is to increase the visibility of this research area and the associated PhD study programme.

Demography

Demographic knowledge and expectations play a key role in the development management of all systems comprising human populations. Therefore, Demography will proceed with systematic activities in all main areas and directions of demographic research: Analysis, modelling and forecasting of particular reproduction processes (fertility, mortality, immigration and emigration) and resulting population changes. The further development of historical demography will also be encouraged, as comprehensive knowledge of the population and its reproduction history is crucial to understanding their present and future. Special attention will be paid to applied demography and the effective transfer of results into practice to achieve the broad application of research results. The main partners in applied demography development will be different governmental bodies, the United Nations Population Fund (UNFPA) and Population Europe, the network of leading demographic institutions.

Research in **mortality** will be further developed from the analytical as well as methodological perspectives. Methodological issues cover all possibilities of data reconstruction, cohort vs transversal approaches and new methods to analyse convergence or rectangularisation of the survival curve. Investigation of mortality and morbidity trends will concentrate on the impact of pandemics COVID-19 and post-pandemic changes in the structure of mortality by the cause of death. Furthermore, socioeconomic differences in cause-specific mortality will be analysed, emphasising non-communicable diseases and estimation of self-perceived health.

Fertility research will continue to address the issue of the transition of the Czech population towards the late childbearing pattern considering new perspectives. The childbearing postponement will be analysed as a complex phenomenon with a wide range of causes and consequences for both individuals and society. Specific data from the national register will be used together with survey panel data. The cohort approach to demographic analysis will be linked with the life course approach to survey data analysis. Moreover, the mixed-method life course approach to fertility analysis will be employed in future research. The attention will also be devoted to the new trend – reproductive ageing and its consequences, for example, the demographic impact of assisted reproduction.

Historical-demographic research will focus on studying changes in the population of the Czech lands in the nineteenth and twentieth centuries. In doing so, it will concentrate primarily on the specifics of demographic behaviour in different social strata, and it will also explore social mobility. The research will be based primarily on data collected in a unique database Department of Demography and Geodemography created together with Masaryk Institute and Archives of the Academy of Sciences of the Czech Republic and the Institute for the Study of Totalitarian Regimes. The methodological approaches will be oriented mainly towards the digital humanities and social network analysis.

The newly acquired knowledge in these areas and directions completed by the demographic analyses of migration movements will serve to formulate prognostic assumptions used in forecasting population development at local, regional and national levels in the Czech Republic and other countries. Population forecasting will be one of the main directions developed within **applied demography**. Territorial differentiation of population structures and processes will become another profile theme in this field. Health and social care provision will continue to be an important subject of applied research in the context of changing population size and demographic structures at the regional level. Interdisciplinary applied research focused mainly on producing the so-called derived forecasts will be performed in cooperation with specialised (sectoral) research institutions in the Czech Republic and abroad.

Cartography

The research topics of the three sub-specialisations of the field (cartography, GIS, remote sensing) address the collection, processing, analysis and synthesis of raster or vector spatial data acquired by remote sensing, development of new tools for automated spatial data processing and cartographic representation at various scale levels. In the future, emphasis will be placed on the development of all three sub-specialisations.

Cartography will focus on mathematical cartography in conjunction with historical cartography, digital cartography (computational geometry in cartography, mapping methodology and large-scale mapping, geodetic calculations and measurement), software development for automated cartographic generalisation. Recently, web and digital cartography methods have been newly included and will be further developed (especially automation/legitimation of traditional cartographic tasks). In a broader sense, it is a transition from manual to semi-automated cartographic data processing using methods of computational geometry, computer graphics or artificial intelligence, which has become one of the newly developing directions of contemporary theoretical cartography (cooperation with the Department of Informatics, University of West Bohemia in Pilsen). Emphasis will also be given to the development of methods of geospatial statistics, which allows the traditional analysis of old maps, atlases, and globes to be implemented by new methods; the synergy and collaboration with the Map Collection of the Faculty of Science, Charles University will be further supported (joined projects and publications etc.).

GIS field will specialise in modern forms of data processing, automation of GIS operations, storage, access and presentation of heterogeneous data and their metadata in spatial databases, organisation and standardisation of data, distributed Internet services,

geospatial statistics, and geodatabases. At present, the department supervises the development of data and map server services at the Faculty of Science, Charles University in some research and application-oriented projects, such as UNCE, and will further develop these activities in cooperation with other departments.

Remote sensing will further develop the department's specifics: laboratory and image spectroscopy (mainly its use to monitor valuable natural ecosystems - relict tundra, forest ecosystems, peat bogs during climate change period, analysis of vegetation state/health etc.). An important role will have employment of advanced methods (machine learning, spatial statistics etc.) for the analysis of multispectral, hyperspectral or radar data (mainly with the use of freely available satellite data), which enable land use/land cover change detection of cultural landscape including sub/urban areas. We will also focus on laser scanning and 3D technologies digital photogrammetry (e.g. for assessing natural disasters and risks in connection with climate change, mapping of rock formations, lakes, glaciers, etc.).

3.2 Future development and benchmark institutions

As benchmark institutions, we can mention, for example, the Section of Geography at the University of Copenhagen, the Department of Geography at the University of Zurich, and the Department of Physical Geography and Quaternary Geology at the University of Stockholm. However, it should be noted that the departments mentioned above have considerably more employees, so we intend to approach them mainly in terms of the structure of published outputs and the soundness of research. In the case of comparable universities, we can mention esp in the field of social and regional geography. University of Warsaw and Tartu University and their internationalisation and publication strategies approach. There is also the IMISCOE (International Migration Research Network) of 61 mostly prestigious research institutes from many European countries (including, e.g. institutes representing University of Oxford or University of Amsterdam) offering inspiration and cooperation. The Urban Big Data Centre in Glasgow can serve as a benchmark institution for data analyses, storage, and transfer of technologies. Vienna Institute of Demography, Austrian Academy of Sciences (Dr Tomas Sobotka's research team), Max Planck Institute, University of Melbourne, School of Population and Global Health (Dr T. Wilson's research group) in applied research, KU Leuven (The Leuven Institute for Healthcare Policy (LIHP) and Semmelweis University (Health Services Management Training Centre) can be stated as benchmark institutions in demographic research.

We will expand existing cooperation with research institutes of the Czech Academy of Sciences (Institute of Atmospheric Physics, Institute of Rock Structure and Mechanics, Institute of Hydrodynamics, Institute of Geophysics, Global Change Research Institute, Masaryk Institute and Archives) and with foreign institutions (i.e., Zurich University, Stockholm University, Heidelberg University, Mainz University, Warsaw University, University of Virginia, University of Maryland, University of Innsbruck, ESA, NASA, Slovak Academy of Science - Institute of Geography, Babeş-Bolyai University of Cluj-Napoca). Results will be disseminated through the platforms of existing international networks

(e.g., International Association of Geomorphologists, International Consortium on Geodisaster Reduction, International Consortium on Landslides, Association for Tree-Ring Research, COST Actions, Eurosite Remote Sensing Support Group, IGU Commission on Land Use and Land Cover Change, SCERIN - SouthCentral European Regional Informational Network).

As declared in the evaluation report, the Geographical Institute of the Faculty of Science at Charles University is "of very high quality and fits the international standard of research". "In Geography, CUNI Prague scores rather well (rank 51-100 globally), in the same tier as Heidelberg and better than Vienna or Warsaw". The main goal is, at least, to maintain this position while closely participating in the 4EU+ Alliance. All partner universities associated with the 4EU+ Alliance are relevant for us as the benchmark, obviously recognising various specifics and differences in coverage of various subdisciplines.

4 Activities and measures of development of the research area

Research activities differ in particular disciplines, departments and research teams, which use different research and publication strategies. Therefore, the following section contains detailed activities for all five research fields joined at the Geographical Institute. The last part proposes the main measures and indicators, which could be used for the evaluation of realised results.

4.1 Planned activities and measures

Physical Geography

The activities and measures we intend to adopt will mainly focus on (i) strengthening the link between departmental research and doctoral studies and (ii) further expanding international networking.

To facilitate research conditions of PhD students, we will directly include doctoral students in the Cooperatio project, guaranteeing them financial support. In the case of equally qualified applicants for PhD positions, we will give preference to foreign students or students from outside the Faculty of Science. As monitoring indicators, we can consider the number of PhD students directly involved in the Cooperatio project and the ratio between PhD students from our university and external universities/foreign countries.

Viable international cooperation must be grounded on the long-term international research experience of the project members. We will thus improve the conditions for long-term research stays abroad (mainly reducing the teaching load allowing researchers to go abroad) and support both incoming and outgoing research exchange. In addition to existing tools for facilitating international cooperation (membership in international organisations, COST actions, exchange projects), we will focus on dynamically developing activities within the framework of the 4EU+ project.

Social geography

First, we aim at making our PhD programme more attractive for foreign students (both from developed and developing countries) via more attractive curricula and lectures, better advertising, creating an international, helpful and responsive environment within the department and faculty (including a competent administrative staff instrumental in overcoming various problems).

Second, we have to acknowledge that significant differences exist among particular research teams as well as within them. Thus, we will aim at transferring know-how from successful teams to those academics that have so far been less successful in cross-cutting spheres such as preparing grant proposals, submission, review process, etc.

It is hardly possible to compare internal inbreeding in Czechia with highly developed, more populous countries, with several high-quality universities. Thus, it would make little sense to push for minimising inbreeding as the cost would be high given the dominance of Charles University in our field. Nevertheless, we are open to various forms of

cooperation with other geography departments and units in Czechia, and we already have a long list of joint publications. Based on personal experience, we know that at least some aspects of inbreeding can be effectively moderated by intensive international cooperation on particular research projects. Consequently, we are fully aware that international experience is a must for a Czech scientist/researcher. Hence, a short-term (e.g. ERASMUS programme) but also long-term stays abroad (e.g., Fulbright Scholar Program) must be highly recommended and supported. Though nearly any foreign experience in the research field is useful, study trips to the most developed countries with the highest quality and diversified scientific opportunities will be preferred above all.

Publication of research results in high-quality international journals is a top priority. On the one hand, pressure on academics is growing, especially to publish in D1 or Q1-Q2 highly appreciated journals; moreover, we support such publications by financial and other incentives. Likewise, we will support publications with foreign co-authors and our PhD students. Nevertheless, in line with universities' third mission, we will also support applied research and other policy-relevant activities. Finally, given numerous idiosyncratic and idiographic features of national and regional systems, we should not resign from researching locally (nationally) relevant issues and subsequent publication in Czech and Czech journals.

Regional and political geography

In the field of regional geography, we want to increase the visibility of the study programme both in Czechia and for foreigners – for example, by further development and regular updating of recently established website - <https://www.phdingeography.com/>. We plan to reduce administrative barriers (mostly related to language) and improve the environment for international students and support the admission of more international students (we foresee that about 20% of PhD students can be foreign students). It will need to strengthen personal capacity by integrating new tutors – in terms of new junior scholars and senior expert(s) with extensive international experience and publication track (including external ones).

There is a need to offer best students with a background in geography or related branches (both Czech and foreign) postdoctoral positions that would enable them to guarantee a stable post (with a decent wage) for several years within which they should demonstrate that they are an excellent asset for the Department (while gaining research projects, publishing in prestigious journals, teaching).

In addition to maintaining or enhancing existing international contacts, we intend to attract recognised foreign scientists for a longer-time stay (one or two terms) while teaching several courses mainly for master and PhD students. Ideally, such stays will combine teaching with research collaboration and/or consultations. Likewise, we aim at the preparation of a wider range of courses in English to attract more foreign students and at the preparation of new bilateral agreements with prestigious foreign universities about mutual cooperation where, for example, student and academic exchange programs could be accompanied by cooperation on research projects.

Demography

In the coming years, even greater emphasis will be placed on building the research capacity of the field from below to increase international cooperation and publications in high-quality journals. The main focus will be on gifted students in the master's program and continuing their studies within the doctoral study program in Demography, in particular STARS positions. These attractive positions should enable the admission of the most talented domestic and foreign applicants for PhD studies of Demography and their direct involvement in the department's pure and applied research projects and publications. In addition, the hitherto untapped potential of postdoc positions will also contribute to further internationalisation and improvement of research.

Another important area of development activities in demographic research is represented by the activities leading to the involvement of research teams in international research projects and structures. Cooperation within the network Population Europe, projects Generation and Gender Program (GGP) and European Cooperation in Science and Technology (COST) Action will be the subject of further development and expansion. One of the most important goals is building up the databases allowing the creation and evaluation of family policy, which includes the implementation of a national wave of the large-scale international Generations and Gender Survey. The obtained internationally comparable data will enable further involvement in international research, deeper and more comprehensive cooperation, and opportunities to increase publishing activity. This research will also serve as the initial step for application for the Large Research Infrastructure project titled "Czech national cluster for family research". The project will be proposed together with Masaryk University in Brno. Its implementation would allow joining the large international and interdisciplinary research infrastructure in Social Sciences (at ESFRI Roadmap since 2021) titled GGP. The GGP aims to collect, harmonise, and disseminate micro-level and macro-level high-quality quantitative data describing individuals, households, and populations of Europe and other industrialised countries.

The research area development will be stimulated, for instance, through the innovations in education. They should help enlarge, further intensify, and internationalise research in demography. In addition to the above, the innovations will focus on expanding the range of study opportunities for follow-up master's studies in Demography in English (combined form) and the involvement of international researchers and other professionals in joint teaching activities. It should happen in particular but not exclusively through the 4EU+ program, as well as broader and more intensive use of the opportunities offered by the Erasmus+ program and its sub-activities. These programs will expand the study and practical placement opportunities, including the research ones. They represent a suitable framework for integrating foreign experts into graduate and postgraduate demography studies and international supervision of master and doctoral projects.

The significant potential of cooperation in education and applied research, which provides the department's position as a UNFPA implementation partner for the region of Eastern Europe and Central Asia (since 2012), will also be further developed and its use intensified. Furthermore, its implementing role creates good conditions for the recruitment and selection of future students and submission, co-financing, and implementation of projects, especially in applied research.

Cartography

The main aim in the field of cartography and geoinformatics is to develop wide international collaboration (projects, exchange of staff and students, joint publications) and partnership in international and leadership in domestic research projects. We will support the strengthening of doctoral studies (increase in the number of doctoral students - especially foreign, emphasis on systematic work and high standard publications, internationalisation) and strengthening of international exchange of the department members and students (Erasmus, Fulbright, research internships, visiting professors, postdoc exchanges etc.).

We will support new habilitations and professorships of further department members (increasing the number of Associate Professors) and increase the number of research staff (especially in cartography and advanced GIS). From a long-term perspective, we plan an intensive involvement of members of the department in the planned Globcentrum, specifically in the following research and thematic areas: Dynamics of natural processes and landscape changes (Land use and land cover changes), monitoring of ecosystems change, vulnerability and response to natural and anthropogenic pressures using advanced remote sensing and other geoinformatics and geostatistical methods. Among other activities, we will support the development of new courses and lectures in English for all levels of studies (specifically in the framework of ESF/ERDF, Erasmus+ and 4EU+ projects) and a high standard of used technologies and instrument equipment primarily used for the data acquisition and analysis.

The main measures/indicators of the development must be focused on the core principles of evaluation in the field connected to personal qualification and development, financing of the research and various forms of national and international evaluations.

The number of quality papers in journals with an IF, chapters in a book, books and selected outputs of applied research are needed for attestation, which is mandatory for all academic employees, habilitations and professorships at the Faculty of Science. This measurement is still based on so-called "kafemlejnec", and all results are calculated into numeric values according to quantity and quality of realised results. An increase of this value is a crucial indicator for individual researchers.

International and national evaluation and internal principles of financing individual departments are based on the proportion of published results in journals ranked in D1, Q1 and Q2. An increase of this proportion is a key indicator for the financing of the Geographical Institute, four departments and even individual teams within the research field.

The ability to secure external money from national (GAČR) and international (Horizon) grant competitions and tenders seems crucial for all geographical disciplines' future development. Therefore, a considerable increase of obtained projects and financing must be the top priority of all academicians within the Geographic Institute.

The quite unique and strong position of geography and demography in applied research should be maintained or even enlarged by application to various public competitions (NAKI, TAČR) and commercial tenders. Transfer of knowledge joined with commercialisation would be measured using the amount of earned money within this sector.

Another set of indicators could be used for employment of master and PhD students, the proportion of foreign students and establishment of new postdoc positions.

- A number of publications in D1, Q1 and Q2 journals (absolute and per researcher)
- A number of participations in international and national projects (number and budgets)
- A number of international exchanges of students, postdocs and other research staff
- A number of students in doctoral and master studies

To achieve these goals, individual academics' evaluation and subsequent remuneration should be more aligned than so far with these key indicators without compromising emphasis on a provision of quality teaching. Secondly, heads of research teams should be encouraged to play a more active role in terms of strategic orientation of research and the provision of enthusiastic leadership to their team members. Third, informal seminars concerning research design and publication strategy should be organised to spread good practice across the research teams.

5 Conclusion

The future development of geographical disciplines is considerably limited by uncertain funding for science, strong dependence on acquired grant projects and high competition for financial resources within the faculty as well as in academia at large. Many future considerations about the direction of the discipline are thus largely strategically focused on adapting research to scientometric indicators, which are used to evaluate the discipline, finance institutions and measure personnel performance in the attestation procedure. The spatial situation is very difficult for the development of the discipline, with little hope for future improvement in the medium-term horizon.

The main strategies for the next five years in the research field include production of top European research, its presentation in high-ranking journals of individual fields, international cooperation in research, attracting foreign collaborators at least for short and medium-term stays at the faculty. In addition to internationalisation, we also want to support the education of our own students at the doctoral level, the improvement of financial conditions of PhD and postdocs and the attraction of quality (foreign) postdocs. An alternative is to focus some teams on applied research and knowledge transfer with possible commercialisation of results.

1st March 2022

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1st March 2022

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