

1. LANDSCAPE PROTECTION AND CLIMATE PROGRAM

Program leader: **Péter Csorba**, DSc.

General aim of the program

Based on the close relationship between landscape and climate research the doctoral program aims to expand the scientific basis of landscape protection and extend the range of basic and applied research associated with it. Academic and research staff of the Department of Landscape Protection and Environmental Geography and the Department of Meteorology work together in the program.

Research fields associated with the program: climatology, environmental protection, environmental energetics, landscape protection.

Key-points of the program in landscape protection and in climatology

The co-operating two departments have already carried out a wide range of landscape geographical – landscape protectional and climatological research: landscape structure analyses and landscape evaluations were completed with landscape climatological studies in the form of medium- and micro-scale climatological measurements.

The primary focus of research is determined by the effects of anthropogenic activities on the natural environment together with issues of the environmentally sound utilization of landscape potential. Renewable energy resources are part of this potential and research studying the availability and utilization potentials of solar and wind energy in Hungary forms an integral part of the program. Another research focus has been added to the program recently: studying the regional effects of global environmental processes.

Key-points of the program in landscape protection

Humans inevitably modify their natural environment as a result of economic activities. The volume of the change depends on the strength of the effect and the conditions of the natural environment. This natural environment has a specific structure: landscapes are connected to each other to form a complex system in which certain elements (landscapes) react in different ways to human interference. Production results in smallest destruction-pollution effects if the utilization of the environment is adjusted to landscape conditions.

- Studying *the processes in a landscape* (soil erosion, water supply of soils and sediments, soil-plant interaction) helps to better understand the operation of a landscape. Results of such research can be used in multiple ways regarding landscape protection.

- Research focusing on the relationship of *landscape structure and utilization* is promising to yield direct results for the transition of agriculture that has been ongoing since the regime change.
Apart from the natural conditions of lowland and mountain study areas, different social conditions also influence significantly the spatial extent and method of utilization. Our studies focus on exploring such nature-society interactions.
- Studying *contamination* effects still has an immense pool of research possibilities for young scientists due to the variability of human actions. Exploration and mapping of various anthropogenic pollution sources in different landscapes, studying the primary route of pollutant movement and their spatial distribution, creating vulnerability maps are important applied science research tasks.
- Studying the conditions of waste management and waste disposal from the aspect of geography.
- Studying *tourism and its environmental* effects is made important by – apart from traditions in the institute – the fact that tourism is the most dynamically developing industrial branch not only in Hungary but in the world as well therefore its environmental effects are also increasing. Research fields include ecotourism, exploration of conflicts and co-operation possibilities between tourism and environment/nature protection, and the theory and practice of sustainable tourism.

Key-points of the program in climatology

- *Landscape climatology*: research exploring natural environmental values is part of analyses studying generation and production values and potential, and is a special meteorological analysis grounding the study of the human related environmental protectional effects of environmental planning in landscapes and settlements. Based on the results, for example, the climatological districts of a landscape can be identified that could be important from landscape utilization point of view (tourism, recreation, etc.).
- *Climate change*: Nowadays it seems doubtless that the near-surface temperature of the Earth-atmosphere system increases. The reason of this is thought to be the increase of the concentration of greenhouse gases as a result primarily of anthropogenic activities. Global warming contributes to the modification of the rest of the climatic elements as well. This, however, could be different regionally. At the same time the increasing concentration of atmospheric aerosols – as a result again of human activities – result in cooling and increased precipitation, the intensity of which, however, is much smaller than the effects of greenhouse gases. The joint effects of the above two processes are global warming and the regional-scale modification of the rest of the climatic elements. New scientific findings related to the above recent climatic change emerge every now and then. The vast majority of those are found by the science of climatology contributing to economic and social conclusions. As a result, greater emphasis is placed on the joint study of impact assessment and

greenhouse gas emission reduction issues in the doctoral program based primarily on the revision of certain climatological terms and quantitative description methods.

- *Renewable energy resources*: There are two important reasons of the fact that the attention of humankind turned (again) towards renewable energy resources in the last third of the 20th century. One of the reasons is that certain fossil energy resources are running out. The other – that can be proved easier – is that the burning of the fossil energy resources increases the concentration of certain greenhouse gases contributing to the generation of the climate change process. Other reasons include the protection of the environment in another aspect that can be ensured with the exploration of the utilization possibilities of the atmospheric sources (solar, wind and water energy) and the rest of the energy sources. The task can be solved only in the relationship of the landscape and the climate since the potential quantity of these energy resources depend on the climatic conditions of the area. Apart from developing methods for determining the potential quantity of atmospheric energy resources great emphasis is placed on the social acceptance of renewable energy resources together with their effects on landscape structure and land use.
- *Urban climatology*: In built-up areas the modified composition of the atmosphere and the different land cover compared to natural surfaces result in the modification of climatic elements and eventually in the development of urban climate. As urbanization advances around half of the population of the country and almost two thirds of the population of Hungary live in cities exposed to the disadvantageous effects of urban climate. The research focuses on studying the heat island phenomenon developed in Debrecen and in the surrounding towns due to different weather conditions using the data of mobile measurements carried out in Debrecen and in the surrounding settlements in order to work out an empirical heat island intensity prediction model. Associated with it is the formation of an urban climate measurement station network in Debrecen. The third area includes studying urban human comfort, front sensitivity and air quality.

Program courses

- Urban climatology (Sándor Szegedi)
- Statistics (Szilárd Szabó)
- Ecological landscape structure research (Péter Csorba)
- Cultural landscapes (Péter Csorba)
- Effects of investment on landscapes (Péter Csorba)
- Energy management – energy policy (István Fazekas)
- Environmental policy of the European Union (István Fazekas)
- Landscape metrics in landscape protection (Szilárd Szabó)
- Environmental condition survey, revision (Szilárd Szabó)
- Soil deterioration and protection (Attila Kerényi, Szilárd Szabó)
- Environmental protection of neighbouring countries (György Szabó)
- Urban environmental protection (György Szabó)
- Urban ecology (Péter Csorba)
- Protection of abiotic natural values (Tibor Novák)

- Field landscape evaluation methods (Tibor Novák)
- Hungarian map systems (Árpád Papp-Váry)
- Hungarian map history (Árpád Papp-Váry)
- Environmental effects of tourism (Lóránt Dávid)