



Charles University in Prague
Faculty of Science
Institute for Environmental Studies

Teaching:

BSc, MSc and PhD level education

Research areas:

- Air quality
- Decontamination and ecotoxicology
- Waste treatment
- Water quality and limnology
- Conservation biology
- Applied ecology

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Air quality

Current research plan of the air quality research group involves various areas of applied atmospheric chemistry and physics. We are particularly interested in:

- Source apportionment in urban, rural, traffic-affected and background areas with strong focus on atmospheric aerosol, its composition, mass-size and number-size characteristics, long and regional transport of pollutants.
- Indoor air quality, identification and characterization of sources of pollution, contribution of indoor and outdoor sources in home, office, public, work and transport microenvironments.
- Spatial and temporal variability in ozone concentration, with particular respect to sensitive areas of montane ecosystems and their characteristics (influence of altitude, slope exposure, elevation above terrain, etc.)
- Experimental lab-based studies aimed at deposition and resuspension of particles under various microclimatic conditions (tunnel and chamber studies).
- Effects of urban air pollution on human health (morbidity, mortality).



The Laboratory for Air Quality Research is equipped with state-of-the-art instruments allowing field and lab-based chemical and physical analysis of atmospheric compounds. For gaseous species HORIBA 360 series units are available. For aerosol characteristics the SMPS 3936 L,N 25, APS 3321, DustTrak laser photometers, beta attenuation FH 62 I-R, low and high volume single stage and cascade impactors are used. The absorbance/reflectance can be measured by a standard smoke stain reflectometer (M43D). Passive dosimetry (OGAVA, WILLEMS) is also used. An air-conditioned mobile container can be equipped with the above-mentioned instruments and used together with a meteorological station in field campaigns. A small wind tunnel of a total volume with closed air circulation and a resuspension chamber are used in deposition and resuspension laboratory experiments. Chemical analysis of samples is performed by ICP-MS, AAS, AMA and other techniques. Contact: M. Braniš (branis@natur.cuni.cz).

Decontamination and ecotoxicology

Biodegradation of various persistent organic pollutants is studied in collaboration with Institute of microbiology. For example, endocrine disrupters are known for their negative influence, particularly on aquatic organisms and potentially on public health. Many studies demonstrated that endocrine disrupters are able to mimic hormones or interfere with the action of endogenous hormones. This growing environmental and public health problem requires the development of novel approaches to eliminate these compounds from the environment, which are hardly decomposed during classical waste treatment processes. New approaches using mainly a specific group of ligninolytic fungi are under study. Contact: T. Cajthaml (cajthaml@biomed.cas.cz).

Waste treatment

The Institute carries research on municipal waste composition. We are supported by the grant of the Ministry of the Environment of the Czech Republic, SP/2f1/132/08: Research on characteristics of municipal waste and optimization of its utilization. The research is focused on municipal waste composition analyses, particularly on residual waste from households and bulky waste. The urgency of this research stems mainly in requirements to reduce landfilling of biodegradable municipal waste.



Water quality

The Institute also carries out research in the field of drinking water treatment and surface water contamination (heavy metals, persistent organic pollutants). Experimental research on drinking water treatment is mainly focused on removal of Al, natural organic matter and pesticides and efficiency of different destabilisation and aggregation reagents. The laboratory is equipped with special instruments needed for technological tests (jar tests, water softening, Fe, Mn, Al removal). Advanced analytical equipment (GC-ECD/FID) of Gas Chromatography Laboratory enables organic pollutants analyses (pesticides, PAU, PCBs, etc.).

Water treatment pilot-plant tests also take place at selected waterworks. Constructed pilot-plant installations simulate the technologies used at waterworks. Contact: L. Benešová (lbenes@natur.cuni.cz), P. Hnatuková (hnatukova@post.cz).



Limnology

The main research object of the limnology group is the study of global factor effects on sensitive mountain water ecosystems (streams and lakes) and their catchments. We are interested in three main global issues:

- The impact of climate change on hydrology, water and mass balances in the catchment of small mountain streams and high-mountain lakes.
- The influence of acidification and recovery processes on chemistry and biology of mountain streams and lakes, reconstructions and prediction of acidification using dynamic modelling MAGIC.
- Long-distance transport of pollutants and their fate in the mountain lake food chains.



The particular tasks are focused on:

water, soil and precipitation chemistry, water temperature regime of lakes, phytoplankton, zooplankton and benthos, hydrology balance, adaptation of global climate models (downscaling), paleolimnology – reconstruction of climate changes and lake history based on subfossil organisms.

The laboratory at the field station Velký Pálenec near Blatná is equipped with ion chromatography for quantification of cations and anions in water samples, alkalinity titrator, spectrophotometer and fluorimeter Turner for chl-*a* measuring, Hydrolab water quality sonde with datalogger used for

measurement of depth, temperature, dissolved oxygen, pH and conductivity in the field, microscopes and many samplers for field works including a robber boat. See www.blatna.cuni.cz.



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Conservation biology

Environmental effects of agriculture and forestry

We study effects of practices used in forestry on soil ecosystems – carbon storage, nutrient dynamic and water movement (contact: J. Frouz (frouz@natur.cuni.cz)). We also study effects of agricultural practices on biodiversity and biocontrol potential of insects, using mainly ladybirds and carabid beetles as model groups (contact: P. Kindlmann pavel.kindlmann@centrum.cz).



Management of protected areas

The effect of human activities, in particular tourism has a long history at the Institute. Long-term monitoring of tourist activities in national parks and other protected areas brings important recommendations for nature conservation authorities. Contact: M. Čihař (mcihar@natur.cuni.cz).



Restoration ecology

Research of this group is focused on ecology of heavily disturbed ecosystems and possibilities of ecosystem restoration after heavy disturbance. Special attention is paid to natural processes leading to ecosystem restoration, namely spontaneous succession and possibilities of their use in restoration practice. Also interactions of various components of ecosystems, namely soil plant interactions, receive special attention. Post mining sites, heathland reconstruction and abandoned fields belong to the most intensively studied systems. Contact: J. Frouz (frouz@natur.cuni.cz).



Applied ecology

Population dynamics and species conservation

We study evolution of life history strategies, population dynamics and stability of ecological communities, using theoretical and experimental approaches. We concentrate on prey-predator and plant-pollinator systems. At present, the main model groups include terrestrial orchids, aphids, aphidophagous insects, birds and large mammals (tiger, leopard). The results of this research find their applications in biodiversity and nature protection and in biological control. We perform our field research in South Bohemia, Nepal, Bolivia and Puerto Rico. Contact: P. Kindlmann (pavel.kindlmann@centrum.cz), J. Reif (jirireif@yahoo.com).

Landscape ecology and GIS application

GIS laboratory is focused on description of landscape dynamics over time and of various transportation processes in landscape, such as dynamics of succession vegetation in abandoned fields or post mining sites, transport of dust from coal mines or avalanche movement in mountain environment. Contact: L. Matějčiček (lmatejic@natur.cuni.cz).

