# The river in the lab

## MOBICOS research platform combines laboratory and field experiments

The Elbe flows through Magdeburg - and also through the MOBICOS research container. Pumped into the mobile water laboratory by a submersible pump and cleared of sand in the sedimentation tank, fresh Elbe water is continuously fed into test basins such as flow channels, pelagic chambers and sediment compartments. Scientists from the Helmholtz Centre for Environmental Research (UFZ) are using this method to research biological communities and material flow in true-to-life conditions. Experiments also allow specific parameters to be changed to investigate their effect on ecosystem processes. The laboratories are part of the TERENO network of terrestrial environmental observatories and have been funded by around 3.5 million euros from the German Federal Ministry of Education and Research (BMBF) and by the federal states of Saxony and Saxony-Anhalt. The UFZ operates the mobile mesocosms at a total of eight sites in Saxony-Anhalt. They are located at natural, and at relatively unspoilt bodies of running water, and at bodies of water strongly affected by human intervention.

The aim is to improve water quality, and one aspect under investigation by scientists in the special mobile containers is how sensitive ecosystems respond to changes in water temperature and light intensity, stressors such as pesticides and micropollutants, and increased nutrient contamination. A worrying rise in humic matter at dams is of particularly important issue for the supply of drinking water. Humic matter is the breakdown products of dead plants. It enters reservoirs and rivers through precipitation and ground water and leads to significant drinking water processing costs.

As they seek to improve the Elbe's water quality and take the sensitive ecosystem a few steps closer to being balanced, scientists at the Magdeburg site are focussing their research on eutrophication, the disproportionate growth of algae. "Chlorophyll levels in the Rhine at Cologne are rarely above 50 micrograms (µg) per litre, but in the Elbe, up to 350 micrograms per litre can be measured during algal bloom," says biologist Dr. Helge Norf. Such levels are many times higher than the maximum set in the European Water Framework Directive.

Too high a level of algae growth results in extreme day-to-night fluctuations in oxygen levels in the water as a result of photosynthesis and respiration. During the day, too high a concentration of oxygen can have a toxic effect on certain organisms and damage the gills of fish, for example; a sharp drop in water oxygen levels at night can in turn also pose a serious risk to many organisms. Algal bloom is followed by the oxygen-intensive breakdown of the dead algae by bacteria. "That is why it is important for the ecosystem that we minimise eutrophication in streams and rivers," stresses Dr. Helge Norf. Work in the research container includes monitoring and testing the effects of flow, light intensity and temperature, pesticides and nutrients on the growth of algae in free water and on surfaces (biofilms).

One important factor is nutrient contamination, primarily a result of fertiliser spread on agricultural land. Requirements to observe set distances from bodies of water have had a positive effect, says Norf, but water high in nutrients is still entering the river as a result of seepage. MOBICOS experiments have shown that simultaneously high levels of nitrates and phosphates in the water in particular can stimulate massive biofilm growth.

Consumers and grazers - water organisms that feed on plankton and on the biofilm - can counteract this process. In the Rhine, 3.5-centimetre to 4-centimetre clams from Asia (*Corbicula fluminea*) provide a major filter function. One square metre of riverbed that is densely populated by these shellfish can clean hundreds of litres of water every hour of all particles. The clam also occurs in the Elbe. However, winter drops in temperature in the Elbe regularly kill off this species of clam; the Rhine is a few degrees Celsius warmer. In a new project, scientists at the Helmholtz Centre for Environmental Research are therefore investigating the conditions in which native large mussels, which occur in the branches of the Elbe but not in the main river, could successfully be re-established.

Author: Bettina Koch

Caption: In the MOBICOS container on the Elbe in Magdeburg, scientists from the Helmholtz Centre for Environmental Research (UFZ) investigate the effects on the river of climate and land use changes. Biologist Dr. Helge Norf monitors the growth of biofilms in the flow channels of the mobile laboratory

Photo: André Künzelmann, Helmholtz Centre for Environmental Research (UFZ)

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