

Climate change: Rivers and lakes need better protection, says report

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Birgit Kochan. Credit: B. Kochan/IOER Media

The effects of climate change are increasingly affecting rivers and lakes

and threatening the ecological balance in these waters. Adaptation measures are needed. However, in order to implement them in a targeted manner, more knowledge is needed about the complex interactions in aquatic ecosystems.

Adaptations are also recommended for the European Water Framework Directive, which aims to achieve a "good ecological status" in bodies of water. This is the conclusion reached by researchers at the Leibniz Institute of Ecological Urban and Regional Development and the Leibniz Institute of Freshwater Ecology and Inland Fisheries on the project GewässerKlima.

Heavy rainfall and flooding, long periods of heat and extended droughts, local storms—climate change is accompanied by many [extreme events](#) that are already having a negative impact on the [ecological balance in surface waters](#) such as rivers and lakes. But gradual changes such as rising temperatures, higher solar radiation, less snowfall and ice cover in winter, and seasonal shifts in precipitation are also affecting bodies of water.

Researchers from the Leibniz Institute of Ecological Urban and Regional Development (IOER) and the Leibniz Institute of Freshwater Ecology and Inland Fisheries (IGB) have now investigated the specific consequences for rivers and lakes in the project GewässerKlima (Development of the Ecological Quality of Surface Waters in the Face of Climate Change) for the German Environment Agency.

They also investigated the question of the extent to which the assessment procedures of the European Water Framework Directive (EU WFD) still allow a reliable assessment of the ecological status of bodies of water in the face of climate change. The research was based on a comprehensive literature review on the effects of climate change that can already be predicted today, as well as on an exchange of views with experts from

water management authorities, science and practice.

Threats to water quality and biodiversity

Using various impact pathways, the researchers demonstrate the many effects that climate change can have on lakes and rivers, both directly and indirectly. For example, rising temperatures, low water levels or the drying up of waters can have a negative impact on [water quality](#), as can local [heavy rainfall](#) events, which can flush sediments and pollutants into bodies of water.

In general, the mixing regime of lakes can change dramatically. Increased stratification and reduced mixing have consequences for nutrient availability, but also for the exchange of oxygen-rich surface water with deeper water layers. Higher temperatures increase biological activity in water bodies, and thus oxygen consumption, while decreasing the solubility of oxygen.

Without sufficient oxygen, many [aquatic organisms](#) cannot survive. Low water can also lead to high concentrations of salts and phosphate compounds in the water—the pH value of the waters can become unbalanced. These developments affect the organisms living in the bodies of water in different ways. There are winners and losers. The researchers have also compiled a wide range of findings on this.

For cold-loving species, the impact of climate change on rivers and lakes can be their downfall. Heat-loving species, on the other hand, have an advantage. Changing conditions in water bodies can thus lead to significant changes in biotic communities. Climate change may likewise favor the spread of invasive species or new diseases and parasites—with unclear consequences for aquatic biodiversity.

Protecting bodies of water better: Recommendations for action formulated

"Against the backdrop of these diverse challenges, it is all the more important that we ensure that our water bodies are well protected," explains project leader Dr. Marco Neubert from IOER. "That's why we investigated in the project to what extent the methods and assessment systems of the EU Water Framework Directive prove usable under the changed climatic boundary conditions."

Since 2000, the EU WFD has formed the basis for water protection in all European member states. Its goal is, among other things, to ensure a good ecological status of water bodies. This has hardly been achieved so far. From the researchers' point of view, the directive would benefit from adaptations that take into account changes in climatic boundary conditions.

"Effective monitoring and assessment systems form the basis for determining the effects of climatic changes on the ecological condition of surface waters and for implementing appropriate management measures to achieve the objectives of the EU WFD," the researchers write.

In the report, they formulate extensive recommendations for action. The key is to have a good data basis. Gaps need to be closed here. The researchers recommend, among other things, that additional indicators that could show the effects of [climate change](#) be included in water monitoring. Examples include the depth of visibility as a measure of water transparency or turbidity in lakes, or the consistent sampling of zooplankton, i.e. the smallest animal organisms, in water bodies, which represent an important link between plant plankton and higher organisms such as fish.

To achieve higher measurement frequency, [data collection](#) could use state-of-the-art technology such as field-installed multi-parameter sensors and remote sensing data, the researchers also recommended. The researchers from IOER and IGB have published a summary of their findings and recommendations for action in the journal *KW Korrespondenz Wasserwirtschaft*. The detailed final report on the project GewässerKlima has been published as number 139/2022 in the TEXTE series of the German Environment Agency.

More information: Development of the ecological quality of surface waters in climate change. [www.umweltbundesamt.de/publika ... n-beschaffenheit-von](http://www.umweltbundesamt.de/publika...n-beschaffenheit-von)

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