Caption text in this area.....

A modern water management system for zoos

A reliable supply of water is essential to the daily operation of a zoo, and recent droughts across the EU underline the need for effective management. We spoke to **Dr Tomáš Lederer** and **Dr Petr Kvapil** about the work of the Life4ZOO project in developing a modern water management system that enables zoos to re-use water from within the site, helping improve resource efficiency.

A reliable supply of water is essential to the day-to-day operation of a zoo, yet at the same time zoos also have to be aware of their impact on the surrounding environment, as well as wider concerns around sustainability, water scarcity and climate change. Recent droughts across Europe underlined the need for zoos to manage their water supply efficiently and effectively, an issue that Dr Tomáš Lederer and the team behind the Life4ZOO project are working to address. "Our aim is to ensure that zoos have access to a reliable supply of high-quality water," he says. The project brings together several partners to develop a loop system (circular water management system), which is designed to both provide a reliable supply of water to different areas of a zoo and also reduce wastage. "There is one loop in the system in the Zoo Liberec that circulates a large amount of relatively clean water, to protect animal welfare," explains Dr Petr Kvapil, Managing Director of the Photon Water technology group, one of the project partners. "The second loop is designed to ensure refreshment and replenishment of the water in the first circuit."

The animals will drink only treated water from the first loop, in which the amount of pollutants has been reduced by around 90 percent. Researchers have monitored water sources in the areas around animal husbandries, and relatively low concentrations of certain pollutants have been found. "We found quite low concentrations of organics (COD) phosphorus and nitrogen for example, importantly lower than in urban wastewater. We have identified the major pollutants present in the water, including microbiological and chemical contaminants," outlines Dr Lederer. These pollutants will be removed at two main stages; the first is an (artificial) engineered vertical wetland to remove the main, most important contaminants. "Organic pollutants and ammonia nitrogene will be removed in the wetland," continues Dr Lederer. "Then we have a final water treatment step based on membrane filtration, and sanitation, to remove biological contamination. With the final membrane treatment, we will be able to provide high-quality water. We also have to apply sanitation, because we plan to use this loop for many animal husbandries."

This system has been developed in collaboration with Liberec zoo in the Czech Republic where it will be installed and demonstrated, with the project team aiming to enhance water resilience and enable re-use, prominent issues not only for zoos but also many other attractions and organisations. Nature-based solutions like the engineered wetland have an important part to play in this respect, helping to optimise the efficiency of water use, which Dr Lederer says has wider positive environmental effects. "A large proportion of the water in the zoo will be reused, so the total amount of water discharged into urban sewer systems will be reduced," he explains. "The aim is to provide a reliable supply of good quality water to the different areas of a zoo."

The system is designed to help zoos effectively become self-sufficient in terms of overall consumption, enabling them to re-use water from within the zoo and avoid using valuable drinking water, in turn reducing costs. The day-to-day operation of the system will also require a reliable supply of energy, another issue that Dr Kvapil and his colleagues are addressing in the project. "We need energy to operate the water treatment plant and the pumps, to distribute water all over the zoo," he acknowledges. Researchers know how much energy the Life4ZOO system will require, and solar panels have been installed on the roof of the entrance to Liberec zoo, a partner in the project where the technology will be trialled. "We have calculated that the solar panels should provide the energy required to operate this water circulation system, with some left in reserve," continues Dr Kvapil. "The most intensive period of water use is in Summer, during the main season of the zoo, which is when we can expect to generate more energy from the solar panels."

Caption text in this area.....

A pilot system will also be installed at Barcelona zoo in 2025, another partner in the project, where the climate is very different to Liberec. The zoo in Barcelona has similar size as the one in Liberec, (13 hectares - ha), and Dr Lederer says the system will work along similar lines. "Our partners at the University of Girona and University of Barcelona have a strong interest in nature-based solutions, in using wetland systems to remove pollutants and their combination with novel membrane technologies. The first step will be developing a wetland, then the second will be membrane filtration, with sanitation," he outlines. This system will be mobile, with the possibility of moving it to different animal husbandries, while researchers are also considering how it can be adapted and modified to suit local circumstances. "Different animals produce different types of contaminated waters, with varying concentrations of pollutants. Testing the system will provide very valuable information for designing the sizing of future system in any animal husbandry area, zoo-like facility, farm, botanic park, urban area or industrial park," says Dr Kvapil. "We performed multiple pilots prior to the project, now we are working to install a full-scale system."

Caption text in this area.....

"The project **brings together several partners** to **develop** a **circular water management system**, which is designed to both provide a **reliable supply of water** to different areas of a zoo and also reduce wastage."

Full-scale system

This work is nearing its conclusion, and the project team are now looking to test and refine the system installed in Liberec, looking to optimise its effectiveness. The system has been implemented in a step-by-step process, with rigorous tests conducted at each stage, and researchers now aim to show that the water is safe for animal consumption. "We're now in an implementation phase," continues Dr Kvapil. While the project's research has been focused on zoos, Dr Kvapil believes the water management system developed in Life4ZOO could also be applied more widely, including in other visitor attractions keen to improve their resource efficiency. "The water recirculation system is a general idea for multiple types of industries. A zoo can be thought of in a way as like a city within a city, so the potential applicability is quite wide," he says. "For example farms face similar challenges to those faced by zoos. We are discussing the potential application of our research with farms, as well as some industrial parks and other organisations."

LIFE4ZOO

Water Resource Management in Visitor Attractions – FIT4USE Water Recirculation Technology

Project Objectives

Our main goal is to move from the traditional linear water consumption model to the innovative FIT4USE concept for water circulation. This method will allow for the repeated use of less polluted water instead of its single use. This "water circulation" will allow Liberec Zoo and Barcelona Zoo to use water repeatedly. This will bring operational savings, lower load on sewage systems and multiple synergies leading to better use of water and energy.

Project Funding

This transnational cooperation project is funded by the European Union LIFE program under grant agreement no. 101114509 LIFE22-ENV-CZ-LIFE4ZOO

Project Partners

- Technical University of Liberec, CXI TUL (CZ)
- University of Girona, UdG (ES)
- University of Barcelona, FSUB (ES)
- Liberec Zoo, (CZ)
- Barcelona Zoo, (ES)
- Photon Water Technology, (CZ)

Contact Details

Dr Tomáš Lederer
Lead Researcher
Technical University of Liberec
Institute for Nanomaterials, Advanced Technologies and Innovation
Department of Environmental technology
Bendlova 1409/7,
460 01 Liberec
T: +420 730 160 329
E: tomas.lederer@tul.cz
W: https://life4zoo.cz/
W: https://cxi.tul.cz/

Tomas Lederer
Petr Kvapil
Eva Doležalová

Dr Tomas Lederer is a lead researcher in the Institute for Nanomaterials, Advanced Technologies and Innovation at the Technical University of Liberec. His research interests include biotechnology, wastewater treatment and the decontamination of polluted sites.

Dr Petr Kvapil is Managing Director of Photon Water, a company based in Liberec, Czech Republic. He holds a Ph.D. in Environmental Chemistry from the University of Provence, École des Mines d'Alès in France.

Ing. Eva Doležalová obtained PhD in chemistry. Her field of interest shifted to science communication. Eva is an experienced science communication specialist with a strong background in public relations.

LIFE4ZOO

Co-funded by the European Union