**Eawag**
Swiss Federal Institute of Aquatic
Science and Technology

# CHANGES IN WATER

RESEARCH KNOWLEDGE IMPACT

eawag
aquatic research

# Contents

# Aquatic research in transformation

Eawag has long seen itself as an advocate for one of our most important resources: water. The institute has played a key role in shaping research, consulting and teaching in the fields of aquatic ecology, the environmental behaviour of substances and urban water management in Switzerland, Europe and many countries beyond Europe. However, present-day challenges are now even more complex, interconnected and diverse. Eawag's focus has changed accordingly.

**Solutions to pressing challenges**

Today, Eawag is focusing on the topics of **climate, biodiversity, health** and **cycles.** And always at the centre: water. No matter how one looks at it, these current crises and pressing challenges all revolve around water in one way or another. Humans are feeling the effects of the climate crisis mainly through too much or too little water, biodiversity is dwindling fastest in freshwater, clean water is central to human and environmental health and water is undisputedly an essential resource. Not forgetting that in countries in the Global South, some problems such as access to safe drinking water and sanitation facilities continue to be a huge challenge that countries in the Global North have already overcome.

**Research, knowledge, impact**

At Eawag, researchers from the natural, engineering and social sciences work closely together. This is because technology is often only the beginning of the solution to the problem – after that, it is political and social processes that anchor it in the long term. A distinctive culture of inter- and transdisciplinary teamwork, combined with flat hierarchies, enables Eawag researchers to focus on new strategic issues quickly and flexibly, jointly define research topics and enter into the necessary internal and external partnerships.

To this end, Eawag conducts comprehensive research and combines basic and applied research. On the one hand, Eawag develops well-founded concepts and an in-depth understanding of nature, processes and changes relating to water. On the other hand, the institute promotes knowledge, technologies and innovations in practice.

Eawag works in a network with others. As part of the ETH Domain, Eawag is closely linked to the two universities ETH Zurich and the EPFL, as well as the three federal research institutes Empa, WSL and PSI. Eawag shares various professorships with the ETH and EPFL as well as other universities, and collaborates with other national and international colleges and universities on a large number of projects.

Eawag researchers are in close dialogue with stakeholders. In Switzerland, they share their knowledge with communal, cantonal and federal authorities. They transport their results to water utility companies and wastewater treatment plant operators, engineering and environmental offices, companies and industry. Eawag also collaborates abroad with local partners and global (UN) institutions. Always with the aim of sustainably managing water resources for people and the environment.

**An integral element – teaching at Eawag**

Numerous professors and lecturers are involved in teaching at Eawag, giving lectures, organising field courses and supervising theses. The course content is based

on Eawag research and conveys the latest findings. The teaching is as broad-based as Eawag itself; the focus is always on water, the various aspects of water use and its impact on ecosystems. Students participate in projects from the outset, and doctoral students find excellent conditions for a dissertation. Eawag supports talented people with special programmes and offers them career opportunities and the chance to network in specialist circles. Students from economically developing countries are given the opportunity to conduct research at Eawag, establish contacts and pass on the expertise they have acquired in their home countries. Eawag is also internationally networked and represented in teaching, emphasising a scientific and practical orientation.

With its programme for vocational trainees, Eawag also develops the skills of young adults and thus creates the basis for a successful career start. To this end, Eawag trains several apprentices each year in the fields of chemistry, biology, ICT and business administration and imparts practical technical, methodological, social and personal skills.

**Knowledge transfer and exchange between research and practice**

Eawag passes on its research findings to specialists in the field in Switzerland and abroad through further education programmes, events, online courses and consulting. Experts from industry, administration as well as engineering and environmental offices can update their knowledge and benefit from direct dialogue. Together with partners, Eawag also operates various platforms that address challenges in the water sector. These are a central hub for exchange between research and practice and are often the first point of contact.

In these partnerships with different stakeholders on an equal footing, the focus is on solution-oriented approaches and achievable results. In addition, the researchers are involved in more than 300 national and international organisations and committees as members of scientific societies, advisory boards of renowned research institutes or in cross-border commissions.

**Prepared for the future today**

With its special combination of competences in the areas of knowledge creation and provision, Eawag contributes to solving the challenging issues of our time and thus continues the success of the past decades. As when it was founded, Eawag continues to see itself as an advocate for water as the basis for life. This makes Eawag research an effective tool for tackling current and future challenges – in Switzerland and worldwide.

# Research - knowledge - impact

From one to eleven. What are we doing differently? An example of how Eawag works to remove micropollutants from domestic wastewater.

11

**Today**

**Committed to research in the future**

Eawag is honoured for its work on the "Swiss Approach" to modern wastewater treatment. However, Eawag has no intention of resting on its laurels. The institute continuously focuses on excellent research and builds on its findings – even when new problems arise, such as due to substances in wastewater that have not yet been considered. This is because recognising problems at an early stage makes it possible to take swift action to avert negative effects early on and contain them in the long term.

We stay on topic – including in the long term.


**From 1970**

**Scientific work forms the basis**

Researchers at Eawag are investigating how undesirable colours or odours in drinking water can be removed using ozone and activated carbon. At the same time, they are continuing to develop sensitive analytics, thereby creating the scientific basis for later measuring and eliminating micropollutants in wastewater.

We talk about it.

1

2

**From 1990**

**A problem is recognised at an early stage**

Micropollutants from households, such as substances from cleaning agents and medicines, pollute ecosystems and water resources. Hormonally active substances from wastewater are shown to have proven consequences for fish. The topic is widely discussed in public – also because Eawag is addressing it and engaging in dialogue with both key players and society.

We put our own knowledge to use.

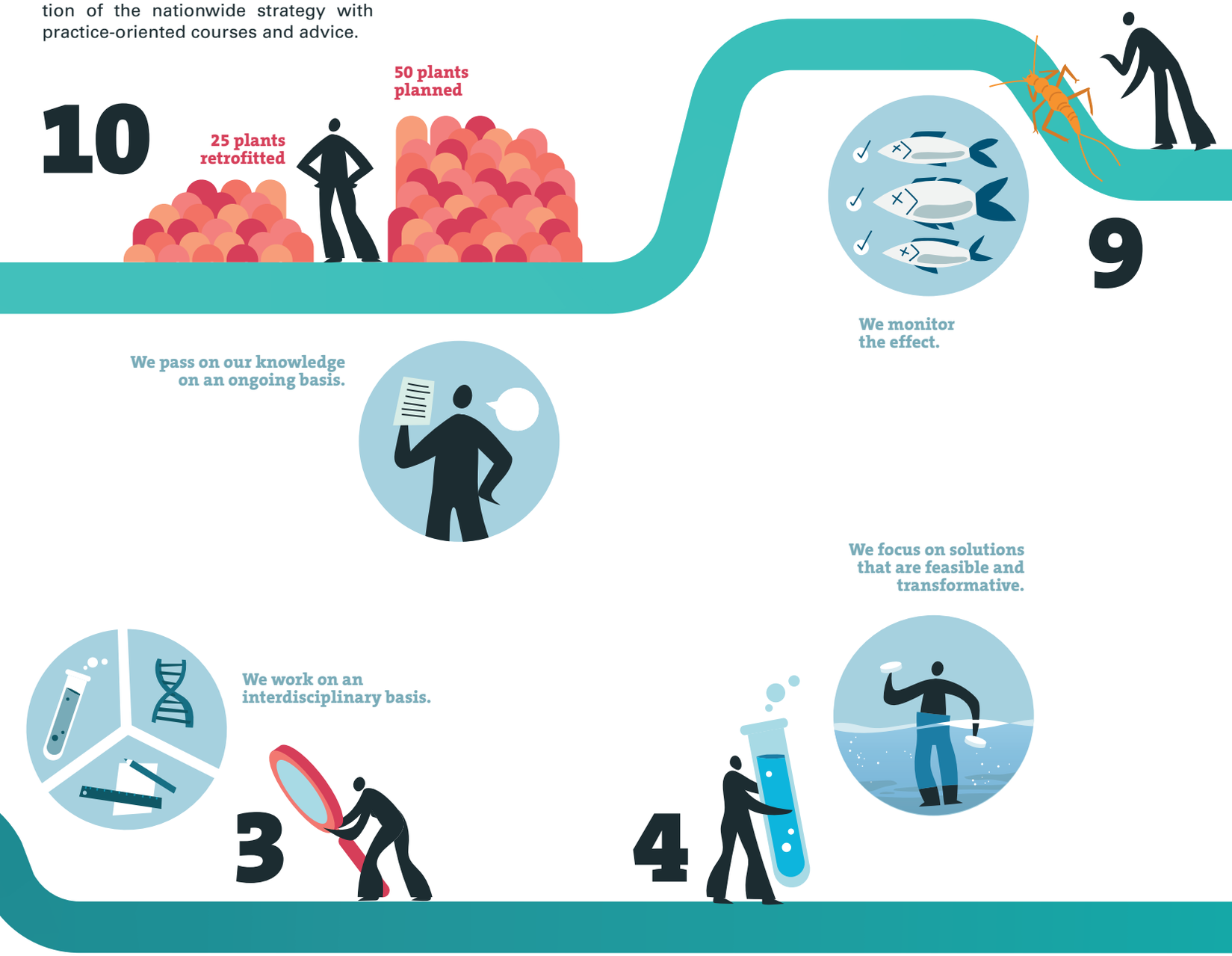
**Projects are further developed**

Further feasibility studies and technical solutions for WWTPs follow. Since 2014, 25 plants have been retrofitted and around 50 are planned or under construction. Ozonisation, powdered activated carbon, granulated activated carbon or combined processes are also used. Eawag supports the implementation of the nationwide strategy with practice-oriented courses and advice.

**From 2015**

**Expansion shows first successes**

In a specially designed project, Eawag investigates both with experiments and directly in streams whether ecological improvements can be seen as a result of the additional purification. It can indeed be established that organisms are less polluted due to reduced inputs of trace substances.




**From 2000**

**Comprehensive research work leads to a well-founded description of the problem**

The pollution of water bodies with selected micropollutants is recorded on the basis of measurement data and material flow modelling. It clearly shows the need for action. Researchers from the field of ecotoxicology, environmental chemistry and process engineering work closely together.

**Innovative solutions are developed**

This includes a concept for assessing water quality and the definition of indicators that can be used to check whether measures are effective. At the same time, work is being conducted on technologies for an additional purification stage to combat micropollutants in wastewater treatment plants (WWTPs). Care is taken to ensure that the solutions developed are practicable and do not create new problems.

**From 2005**

**Technologies a**

Technical proce
first on a small
carbon and ozo
methods are ru
too inefficient c

**New requirements anchored in law**

The new requirements for WWTPs are anchored in the Water Protection Act in 2015. As a result of the strategy, large WWTPs and those on already polluted watercourses have to be retrofitted with an additional treatment stage from 2016.

We include the social sciences in this.

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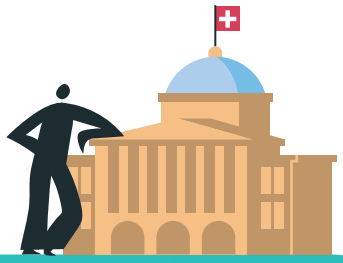


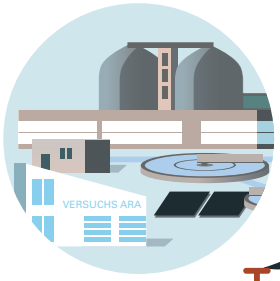
**2010**
**Social acceptance**

Eawag presents its research to a wide audience and openly communicates the costs of improving the WWTPs as determined by politicians. Eawag researchers in environmental social sciences show that the population is in favour of the WWTP expansion and is prepared to bear the costs.

We make our expertise available to everyone – including politicians.

7

We rely on a unique research infrastructure and test processes at all scales.




We continuously expand our network.

5

6

**Large-scale implementation is developed**

The destruction of pollutants with ozone and adsorption on activated carbon are investigated in large-scale tests. Both processes prove to be effective, technically feasible and economically viable for municipal WWTPs. The results lead to a report by the Federal Office for the Environment (FOEN) and to the creation of the platform "Process Engineering Micropollutants" together with the FOEN and the Swiss Water Association (VSA). Eawag promotes exchange between research, WWTP operators, the private sector and authorities.

**re tested in pilot plants**

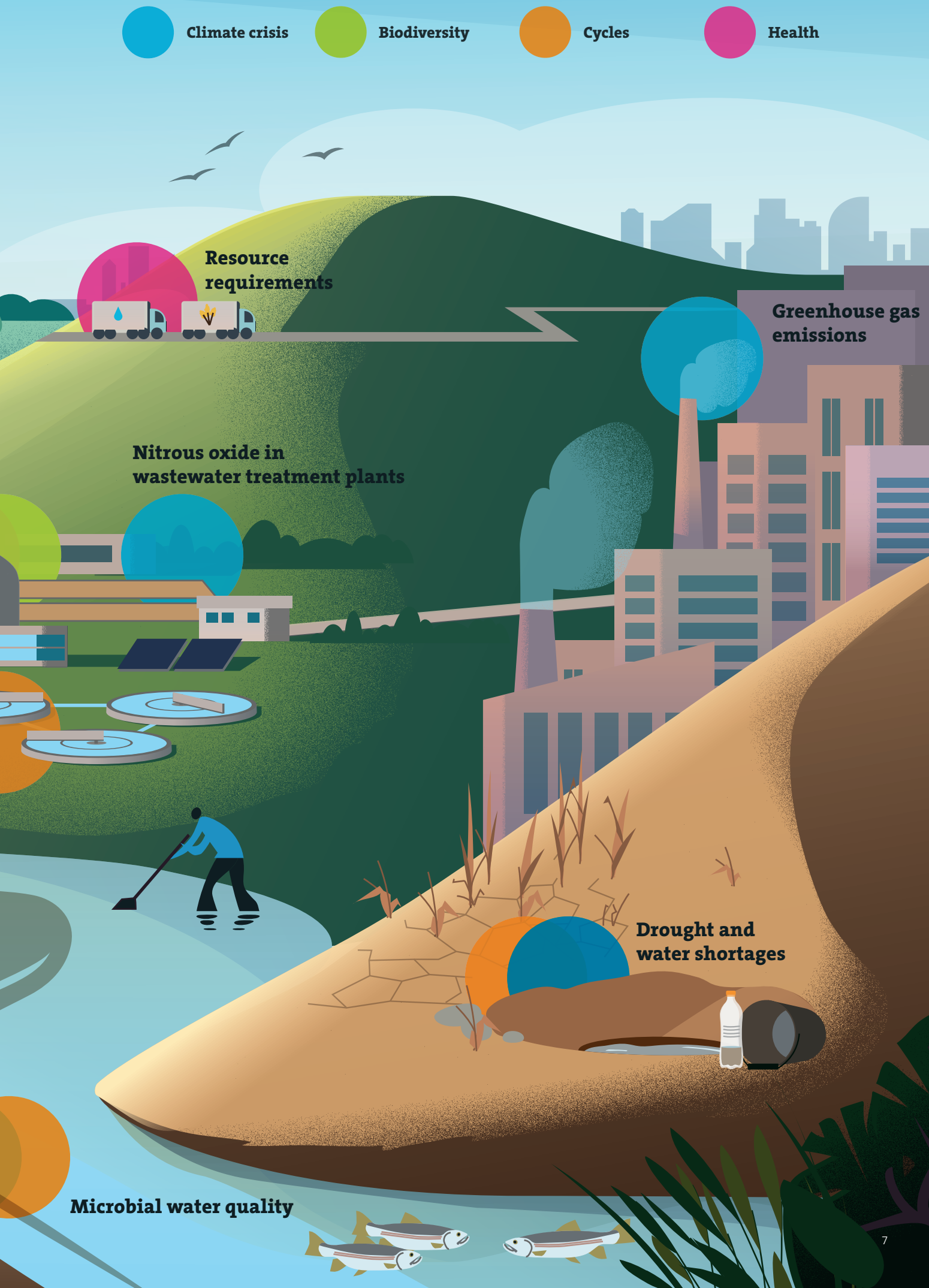
esses are tested under real conditions, scale and then in pilot plants. Activated onisation prove to be promising. Other uled out, for example because they are or too expensive.

# Eawag's field of research and activities

The climate crisis and the increasing demand for resources present us with major challenges. Eawag sees these challenges as an opportunity to have a positive impact. It analyses the far-reaching effects of global warming on ecosystems and humans, and develops innovative strategies for sustainable water use and management. Our aim is to improve resilience to weather extremes and secure water supplies at local and global level in the long term.


Decentralised wastewater systems
Compatibility of renewable energies and water protection
Heat
Climate impact on bodies of water
Aquatic life


Floods
Centralised wastewater systems
Pollutants in bodies of water
Public health
Living and recreational areas


Climate crisis
Biodiversity
Cycles
Health
Resource requirements
Greenhouse gas emissions
Nitrous oxide in wastewater treatment plants
Drought and water shortages
Microbial water quality

# Water at the centre of the climate crisis

Humanity is not on course to limit global warming. The effects of the climate crisis are already noticeable and measurable, even in our latitudes. Moreover, they manifest themselves mainly in changes to the water cycle. For Switzerland, this means that winters will be rainier and summers drier. The frequency of extreme weather events such as droughts, heatwaves, heavy rainfall and flooding will increase.

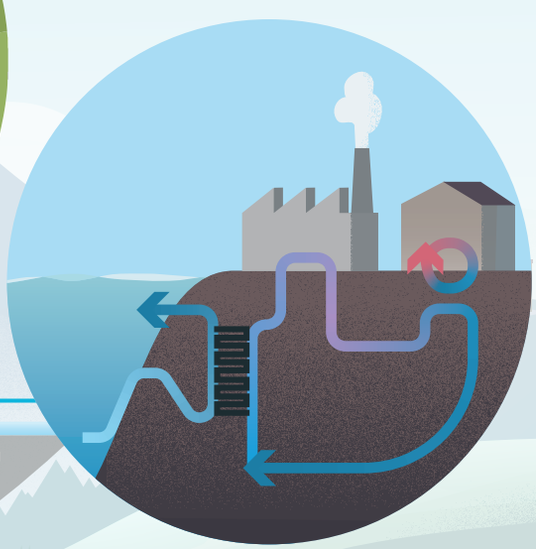
**Conflicts of use due to drought**

The effects that water shortages can also have in Switzerland were seen in agriculture in the summers of 2018 and 2022. In the lowlands, plant growth in fields was restricted and yields were significantly lower, while in alpine areas, cattle had to be supplied with fresh water by helicopter. The example of drought shows the great potential for conflict that extreme weather events bring with them. If there is a prolonged absence of precipitation, there are many conflicts of use and interest – between the protection of ecosystems and the preservation of **biodiversity** on the one hand and agricultural use, energy production, drinking water supply and artificial snow production for winter sports on the other. Solutions are therefore urgently needed as to how society and the economy can adapt to the changed conditions in the area of water availability. One possibility is to reuse water and thus close water **cycles.** Eawag is therefore working on methods for recycling water.

**Equipping infrastructure for extreme weather events**

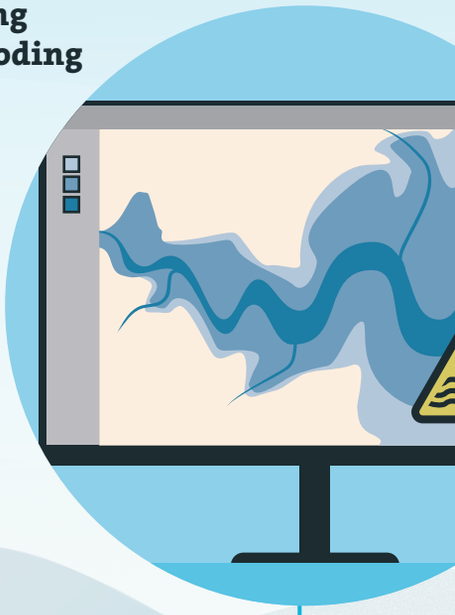
But it is not only the more pronounced dry spells with water shortages that present us with major challenges. Flooding is also becoming more frequent as a result of increasing heavy rainfall incidents. At present, urban infrastructures in many places are not designed for such extreme precipitation, and the enormous masses of water cannot drain away via the sewage system in such a short time. Eawag researchers are therefore investigating in real-world laboratories how existing infrastructures can be made fit for the future and how rainwater can be stored where it falls using retention areas. This increased retention also prevents untreated wastewater from polluting bodies of water. Among other things, state-of-the-art sensor networks are being used to record the basic hydrological and microclimatic conditions. High-resolution runoff models also make it possible to predict future floods and thus prevent damage to humans and infrastructure. At the same time, Eawag is investigating how urban infrastructures with green spaces and water features can reduce summer heatwaves, promote biodiversity and improve groundwater replenishment.

Sufficient water for stretches of residual water



Thermal use of lakes, rivers and groundwater

Forecasting urban flooding

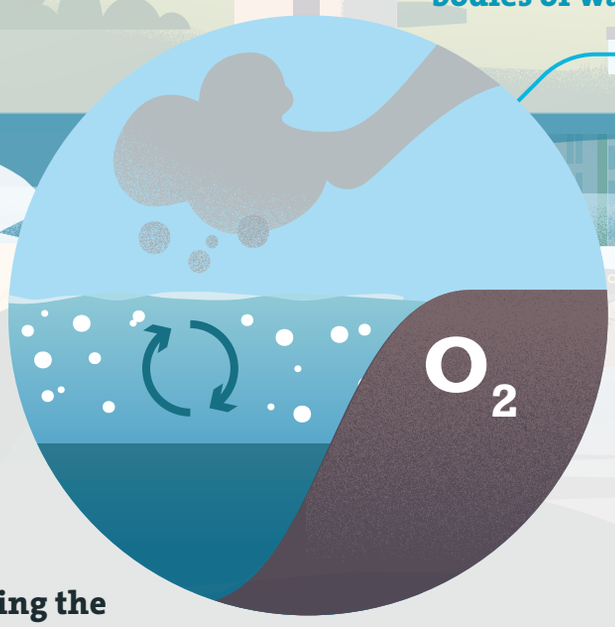


Compatibility of renewable energies and water protection

Floods

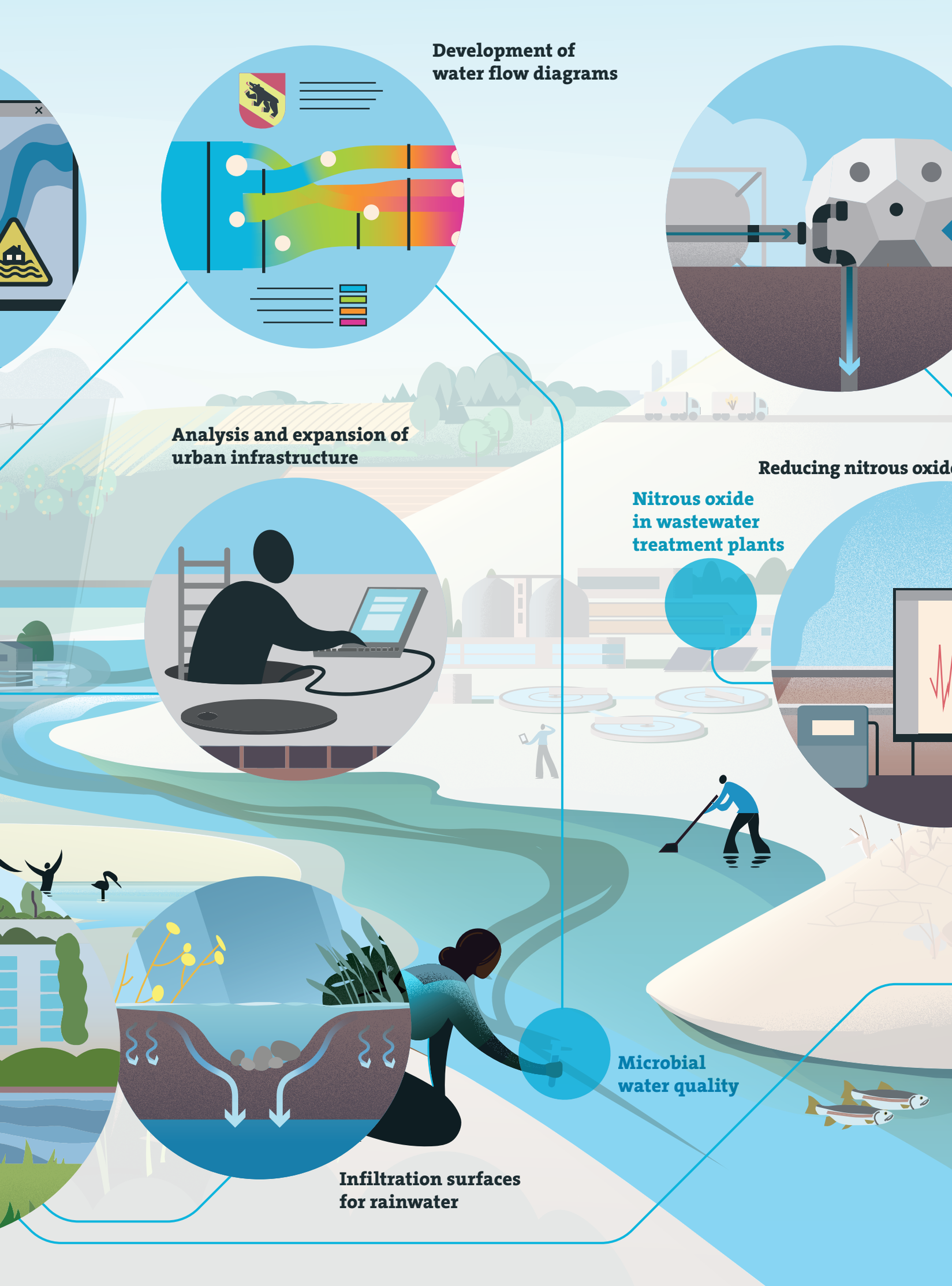
Heat

Climate impact on bodies of water




Analysing the temperature and mixing of lakes

Developing blue-green infrastructure


Development of
water flow diagrams
Analysis and expansion of
urban infrastructure
Reducing nitrous oxide
Nitrous oxide
in wastewater
treatment plants
Microbial
water quality
Infiltration surfaces
for rainwater


**Solutions for areas with developing infrastructure**

However, climate-related challenges do not occur only in Switzerland. The climate crisis is also increasingly leading to droughts and floods worldwide, which exacerbate economic crises and conflicts and cause health problems. The flooding of sanitary facilities, such as septic tanks, can pollute the environment and drinking water in areas with developing infrastructure and jeopardise people's **health.** In addition, the stagnant water that remains after flooding, combined with inadequate sanitation systems, can promote infectious diseases. In order to better protect people and the environment from the effects of the climate crisis, Eawag researchers work with the affected population to develop suitable solutions and support local and international organisations in implementing appropriate measures.

# Utilising bodies of water and the subsurface for heating and cooling

Natural resources are gaining in importance due to the energy transition. (Photo Eawag, Alessandro Della Bella)


Bodies of water have a special characteristic: they give off heat in winter and absorb heat in summer. Lakes and rivers can therefore be used for heating and cooling. They are increasingly coming into focus as a renewable energy source as part of the energy transition. In a project funded by the Federal Office for the Environment, Eawag researchers have investigated the potential for heat and cold utilisation in Switzerland's larger lakes and rivers. The calculations showed that the potential for heat utilisation in particular is huge and even exceeds regional energy requirements in many places. However, such utilisation can also have ecological effects. Cold utilisation warms the bodies of water in summer and can therefore exacerbate the effects of global warming. In a fact sheet for experts and authorities, Eawag has summarised the most important points to be considered when planning heat utilisation plants from the perspective of water protection.

Lakes and rivers are not the only natural resources that are gaining in importance as a result of the energy transition. Groundwater and the subsurface are also suitable for seasonal storage and flexible utilisation of heat and cold. Empa and Eawag have therefore built a high-temperature borehole heat reservoir on their joint campus in Dübendorf to store waste heat in summer and utilise it in winter. This minimises the $CO_2$ emissions caused by heating. The installation consists of 144 probes at a depth of 100 metres. Pipes run through the installation, in which water circulates and exchanges heat with the subsurface. Because there is a growing concern that cyclical warming could also have an effect on aquifers, Eawag and Empa have launched a research project supported by the Swiss Federal Office for Energy and several cantons. The reaction of the groundwater system is to be monitored and a model developed for long-term forecasts.

Utilisation of heat from lakes and watercourses
*Fact sheet and potential map*

**Blue-green infrastructure for liveable cities**
Solutions for adapting to heat and heavy rainfall Pictured: Eawag researchers are developing multifunctional green roofs that combine green roofs with solar photovoltaic arrays. (Photo: Eawag, Isabel Plana)

Where the ground is sealed, the consequences of the climate crisis are particularly noticeable. In summer, heat islands develop, particularly in densely built-up inner-city areas, which can hardly cool down at night. During heavy rainfall, on the other hand, the sewerage system is no longer capable of coping with the masses of water that pour down in a short space of time. Blue-green infrastructures help to alleviate the situation in urban area and make cities more climate-resilient. Green areas, ponds, green façades or multifunctional green roofs can absorb water and have a cooling effect on the surroundings.

Reallabor Bern is a lighthouse project for such blue-green adaptation measures. Over the next few years, the City of Bern is planning to build a green residential neighbourhood for 3,000 people on a 20-hectare meadow. Researchers from various institutions, including Eawag, have a unique opportunity here to analyse the situation before and during building development. The aim is to investigate the effects of urbanisation on various environmental factors such as the water balance, the heat balance and biodiversity. To this end, the Eawag researchers involved have installed a series of sensors on the site to record the hydrological and microclimatic conditions.

When setting up the sensor network, they were able to draw on the technology and experience from the Urban Water Observatory in Fehraltorf. In this Zurich commune, Eawag and the ETH Zurich have been operating a sophisticated sensor network since 2017 that provides valuable data on the urban water cycle.

Otto Jaag Prize
*Nitrous oxide research honoured*

### On the trail of harmful nitrous oxide

Around 800 wastewater treatment plants clean and treat wastewater in Switzerland. An energy-intensive endeavour – the CO2 footprint of wastewater treatment plants is therefore relatively large. Moreover, they not only emit CO2, but also nitrous oxide, a potent greenhouse gas. Eawag researchers have shown that around one fifth of all nitrous oxide emissions in Switzerland originate from wastewater treatment plants. This is an important finding for driving the reduction of greenhouse gas emissions at wastewater treatment plants, which is not so easy.

Often it is not clear where and when nitrous oxide is released and in what quantities. This is where the new Eawag spin-off Upwater comes into play. Using exhaust air measurements, Upwater can accurately measure nitrous oxide emissions and suggest targeted reduction measures to the operators of wastewater treatment plants. The measurements can also be used to determine how efficient the aeration in the biological treatment is. This is important to know in order to optimise the energy consumption of the wastewater treatment plant, as aeration accounts for a large proportion of this. In order for spin-offs like Upwater to emerge and put their knowledge to practical use, it takes not only years of basic research, but also research with a strong practical orientation – Eawag combines both.

# Swiss aquatic research at the UN Water Summit

International discourse on the most urgent water problems

We may take them for granted in Switzerland, but millions of people around the world have no access to clean water and sanitation facilities. This is about to change. The United Nations Sustainable Development Goals stipulate that everyone should have access to clean water and sanitation facilities by 2030. However, this is proving difficult in many places. All the more so because the climate crisis is exacerbating the situation. In the spring of 2023, the UN therefore organised a water conference for the first time in 50 years to address the global water crisis. Eawag researchers were also a part of the Swiss delegation in New York and contributed to the international discourse on the most urgent water problems.

Using concrete projects, they showed that the problems can only be solved if stakeholders from science, politics, practice and the population work together and are jointly committed to water management measures. One of these projects is the water flow diagram developed under the leadership of Eawag. This visualisation tool displays all the water flows of a city or municipality in an integrated diagram. This reveals both problems and opportunities in water management. Designed as a low-threshold tool for practical use, the water flow diagram helps decision-makers to quickly analyse a water system and derive measures. With such developments, Eawag is helping communities around the world to ensure that their populations have access to clean water and sanitation.


Eawag researchers took part in the 2023 UN Water Conference as part of the Swiss delegation.
(Photo: BML, Rene Hemerka)

# From the air into the subsurface

What $CO_2$ storage could look like one day

In a pilot project in Iceland, Eawag researchers are monitoring how $CO_2$ stored below ground interacts with basalt rock.
(Photo: ETH Zurich / DemoUpCARMA)

Switzerland has set itself the goal of reducing greenhouse gas emissions to net zero by 2050. On the one hand, this is to be achieved with measures that address the source – for example, by reducing consumption or improving energy efficiency in buildings. On the other hand, technologies could also be used to remove already emitted carbon dioxide from the air and store it permanently, for example below ground or in building materials such as concrete.

A pilot project at the ETH Zurich, in which Eawag researchers are involved, is testing how this could work in practice one day. $CO_2$ is captured in a biogas plant on Switzerland and transported to Iceland, where it is mixed with seawater, pressed into the basalt rock under the seabed and stored. Using geophysical and geochemical processes, the researchers are monitoring how the released $CO_2$ interacts with the seawater and basalt rock and investigating the short- and long-term consequences. With its expertise, Eawag is making a significant contribution to better assessing the potential and risks of this future technology and developing monitoring strategies for it.

Spin-off Gasometrix
*Gas analyses in the field*

# Biodiversity – threatened water habitats

Switzerland is part of the four largest river catchment areas in Europe, making it a European hotspot for fish diversity. In particular, our country is home to a high density of endemic species that do not occur anywhere else. But this diversity is threatened. Two thirds of all Swiss fish species are on the Red List; among whitefish alone, nine species that were only found here are already extinct.

However, the problem does not only affect Switzerland: one third of the world's freshwater animal species are threatened with extinction. The monitored freshwater populations have declined by 83 percent since 1970, meaning that biodiversity in freshwater is being lost much faster than on land. Many amphibians and insects that live in and around bodies of water are also highly endangered or are on the brink of extinction. In addition, many species and their endangered status are not even known, and biodiversity in groundwater, for example, has hardly been researched. The urgency to act is often underestimated.

**Utilisation of nature endangers biodiversity**

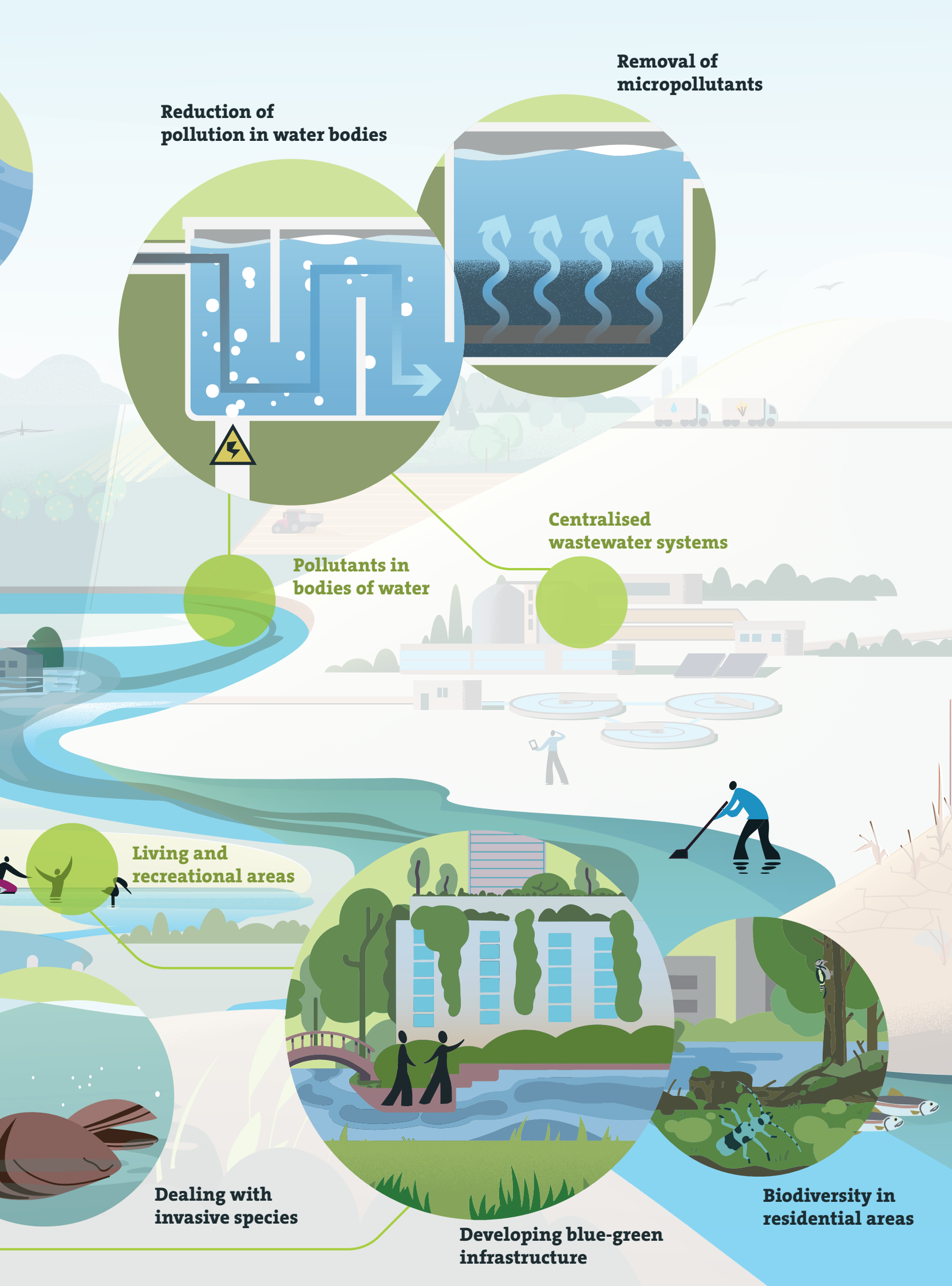
The reason for the loss of biodiversity is that, for a long time, the utilisation of natural ecosystems was not sustainable. Many bodies of water were engineered and straightened, drained and fragmented, impaired by electricity production and polluted by contaminants and fertilisers. Not all species can cope with these new living conditions. This is how biodiversity is lost – at the level of habitats, species and their genes.

This topic has been on Eawag's agenda for decades. At home and abroad, researchers are focusing on the questions of how and where biodiversity in aquatic habitats is changing and how it can be protected. After all, the preservation of biodiversity is also fundamental for the survival of humanity. Intact bodies of water – whether rivers, lakes or groundwater – are central to our health and well-being. They offer protection against natural hazards and provide food, clean air and drinking water. They are also important resources on which economic sectors such as agriculture and food production depend.

**From knowledge to implementation**

With its work, Eawag has made a decisive contribution to achieving a great deal for biodiversity in recent years. Water pollution from nutrients – one of the main causes of biodiversity loss – has decreased significantly in Switzerland, and the restoration of numerous Swiss lakes has improved the quality of habitats for many living organisms. Eawag researchers have also played a key role in the development of methods for biological and chemical water assessment. They have contributed to the inclusion of substance-specific environmental quality criteria in the Water Protection Ordinance in the area of plant protection products, which has paved the way for a more precise assessment of water quality and thus more targeted measures. Thanks to a measuring device developed at Eawag, pollutants in water bodies can be measured automatically in the field over a period of weeks and tracked in


Renaturalisation
Sufficient water for stretches of residual water
Compatibility of renewable energies and water protection
Revitalisation
Environmental DNA
Monitoring biodiversity
Aquatic life
Water protection
Biodiversity


Removal of micropollutants
Reduction of pollution in water bodies
Centralised wastewater systems
Pollutants in bodies of water
Living and recreational areas
Dealing with invasive species
Developing blue-green infrastructure
Biodiversity in residential areas

real time on a smartphone without having to be present on site. In addition, Eawag has laid the necessary foundation to enshrine the elimination of micropollutants in law with an additional purification stage in wastewater treatment plants. And together with the three research institutes of the ETH Domain and the Federal Office of the Environment, Eawag researchers have developed solutions for restoring sediment dynamics and habitat connectivity. This allows flood protection and revitalisation measures to be coordinated.

**Mastering new challenges**

Nonetheless, the challenges remain. Diffuse inputs from agriculture, particularly nitrogen, but also phosphorus and pesticides, have not yet been sufficiently reduced. Moreover, water bodies are coming under increased pressure due to the effects of climate change or the introduction of invasive species and are being contaminated by micropollutants. Eawag's commitment and expertise are therefore still urgently needed. In order to conserve, connect, restore and sustainably utilise ecosystems on a large scale, Eawag researchers work together with the relevant communal, cantonal and federal authorities as well as with experts from the field, for example from the energy sector. They are often leaders in the development of new methods and approaches. Biodiversity is increasingly being analysed using modern methods such as environmental DNA and remote sensing, supported by artificial intelligence. The findings ultimately flow into numerous practical applications and laws.

# Understanding, protecting and promoting ecosystems better

Aquatic and terrestrial ecosystems are interwoven and are viewed holistically as blue-green ecosystems.

**9**

**Nine species extinct**

Nine endemic whitefish species are extinct in Switzerland.

Researchers use water samples to collect data on the composition of algae and thus the productivity of the lake.
(Photo: Eawag, Alessandro Della Bella)

A body of water is more than just water. It is a unique ecosystem, a habitat in which numerous organisms of many different species interact with each other and with their environment. Some species are only found in a single ecosystem. For example, the whitefish *Coregonus brienzii* in Lake Brienz, one of many endemic species that Eawag researchers have been able to identify in Swiss rivers and lakes. Not only fish, plankton and mussels are also at home in bodies of water. Birds and mammals are likewise part of this community, as are insects that spend their larval stage in water. Whether with the help of artificial intelligence, genome sequencing, ecological modelling, environmental DNA or satellite or drone-based remote sensing: Eawag is developing innovative methods to assess the status and biodiversity of aquatic ecosystems and to detect invasive species such as the quagga mussel. Eawag is also a leader in the measurement of pollutants such as pesticides and PFAS (perfluorinated compounds) and investigates their effects on aquatic organisms. Eawag's research not only provides an important basis for monitoring aquatic ecosystems, but also for sustainable water management, river revitalisation and outcome evaluation of existing water protection measures. Eawag passes on its knowledge to experts in the field and develops concrete proposals for solutions, for example how to restore sediment dynamics and connectivity in watercourses.

Understanding ecosystems
*In-depth information on the topic*

# How warm water changes biodiversity

Research for the evidence-based protection of aquatic biodiversity

Temperature measuring buoy in Lake Aegeri: Eawag researchers are monitoring the temperatures of three lakes on behalf of the Federal Office for the Environment in order to better understand the impact of climate warming. (Photo: Zuger Zeitung, M. Blattmann)

Climate warming is putting pressure on aquatic ecosystems and their biodiversity. For example, it exacerbates the oxygen deficiency in Swiss lakes. Although water quality has improved significantly in recent decades, many lakes in Switzerland are still over-fertilised. This causes too much algae to grow in the summer, the decomposition of which consumes oxygen at the bottom of the lake. In winter, the water masses mix and oxygen returns to the depths. Climate change is making the summer season longer, the winter season shorter and in some places milder, so that more oxygen is used up and less is replenished. For this reason, nutrient inputs into the lakes must be reduced even more than previously expected in order to ensure good water quality in the lakes.

Cold-water organisms also suffer from warming; their habitat is disappearing. Other Eawag researchers have investigated the effects of glacial melt on cold-loving river dwellers. As the ice retreats, they increasingly migrate upstream, where the water is still cold. However, it is not only climate change itself that is putting pressure on ecosystems, but also our responses to it. The necessary expansion of hydropower, for example, leads to the destruction of further aquatic habitats, partly because a large part of the natural flow is missing in residual water stretches. Eawag is developing solutions to defuse conflicting objectives such as those in the field of hydropower.

**When the chemistry is wrong – aquatic organisms under stress** Although they only target specific pests, insecticides also affect other creatures. Investigations by Eawag have shown that even in low concentrations, these chemicals can affect the nervous system and behaviour of fish. They flee from some insecticides to unpolluted areas – possibly giving up territory with a particularly rich food supply. This has indirect consequences for the survival of the population and could be one of the reasons for the decline of fish in Switzerland. Eawag's research on the effect of chemicals on the aquatic environment also shows that different species vary in their ability to eliminate these substances. This is an important finding when it comes to assessing the effects of pesticides and other chemicals on biodiversity, for example in the context of approval procedures.

Eawag is also developing novel test methods that can be used to determine the environmental toxicity of chemicals without the need for animal testing – a first in this field. Instead, the tests are based on artificial intelligence, gene scissors and fish cells grown in the laboratory. The fish cell line test, which is based on rainbow trout gill cells, is the world's first alternative to tests with live fish for the risk assessment of chemicals and water samples. Approved by the International Organisation for Standardisation (ISO) in 2019 and by the Organisation for Economic Cooperation and Development (OECD) in 2021, companies and authorities around the world use the Eawag method for product development, chemical approval and water quality assessment. In this area, Eawag also collaborates closely with the Ecotox Centre, for example to assess the status of small bodies of water or to conduct biological-toxicological analyses of water quality before and after the upgrading of wastewater treatment plants.

Tests on the gill cells of rainbow trout (shown on the screen) are an alternative to animal testing for the risk assessment of chemicals. (Photo: ETH Board, Basil Stücheli)

A look behind the scenes
*Watch the video*

### A monitoring programme that is making history

The apprentices from Eawag's analytical and training laboratory take on important tasks. Every fortnight, for example, they help to analyse the water samples from 19 watercourses that are sent to Eawag as part of the National River Monitoring and Survey Programme (NADUF). The monitoring programme is a joint project between Eawag, the Federal Office for the Environment and the Swiss Federal Institute for Forest, Snow and Landscape Research.

Launched in 1972, the monitoring programme has made a significant contribution to improving the condition of Swiss water bodies today – with positive consequences for aquatic ecosystems and biodiversity. To keep it that way, NADUF is still needed. This means that future generations of laboratory technicians in training will also be involved in this important monitoring programme. In a video, apprentices talk about their special commitment, how they go about it and what it means to them personally to be part of this success story.

## “It is a matter close to my heart to impart knowledge about biodiversity even more widely and effectively”

Florian Altermatt is a group leader and has been a member of the Eawag Directorate since 2023 and professor at the University of Zurich since 2013.


*Florian Altermatt, you are head of the biodiversity degree programme at the University of Zurich, which was launched in 2023. What significance does this have for you?*

I am very happy about it. It is a matter close to my heart to impart knowledge about biodiversity even more widely and effectively. But it is also quite a Herculean task to set up and establish such a degree programme.

*What motivates you to teach?*

My goal is to educate students in a thematically broad and interdisciplinary way so that they can contribute their skills to research, business, society or politics.

*What fascinates you about your field of research, biodiversity?*

I find the diversity of organisms and life itself one of the most fascinating phenomena. Together with my research group, I have discovered and described various species of amphipods that were previously unknown in Switzerland. We were able to show that their distribution is characterised by the glaciation of the Ice Age and by present-day land use. For me as a biologist, such discoveries are like a kind of scavenger hunt.

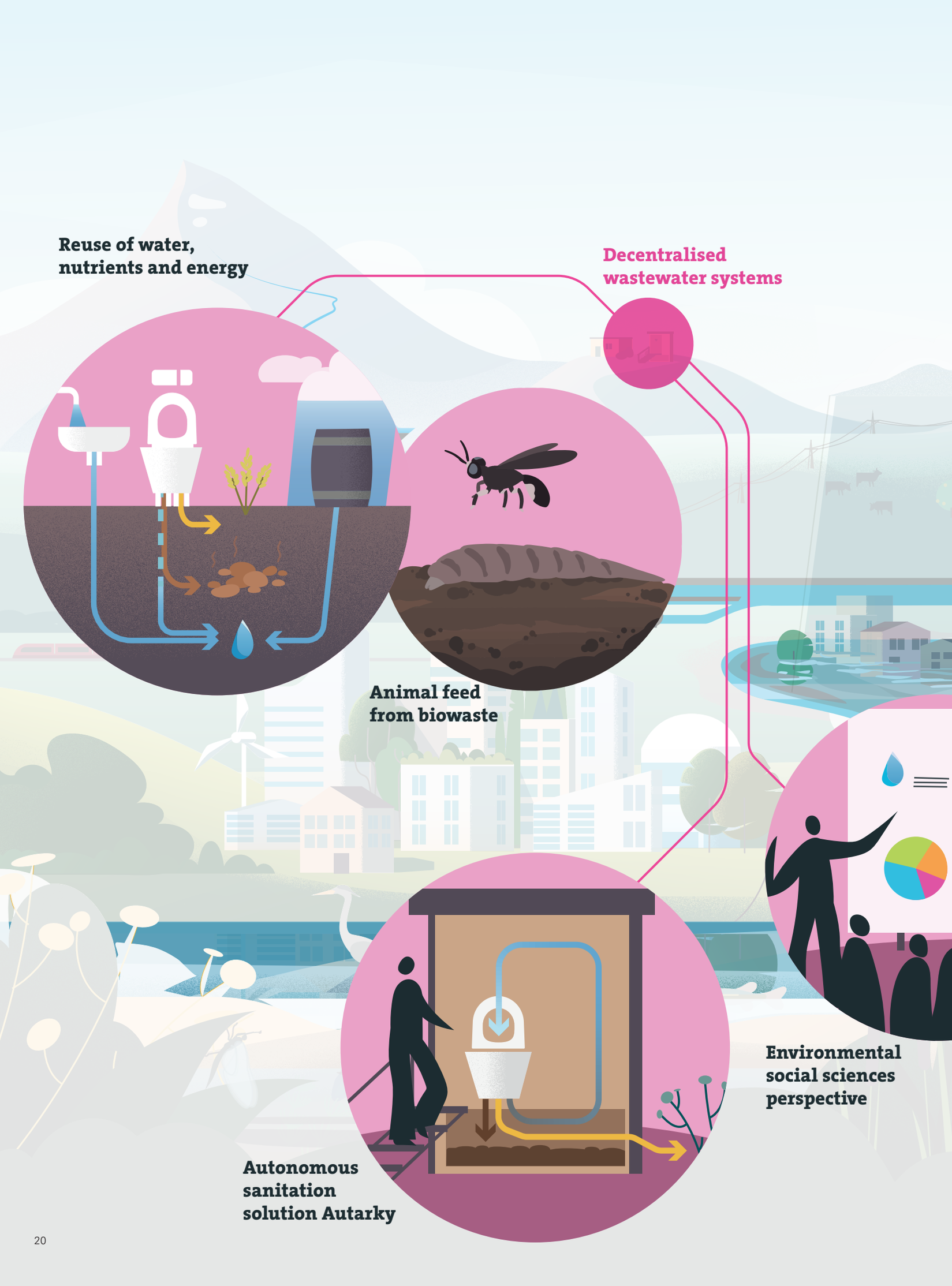
# Closing cycles sustainably

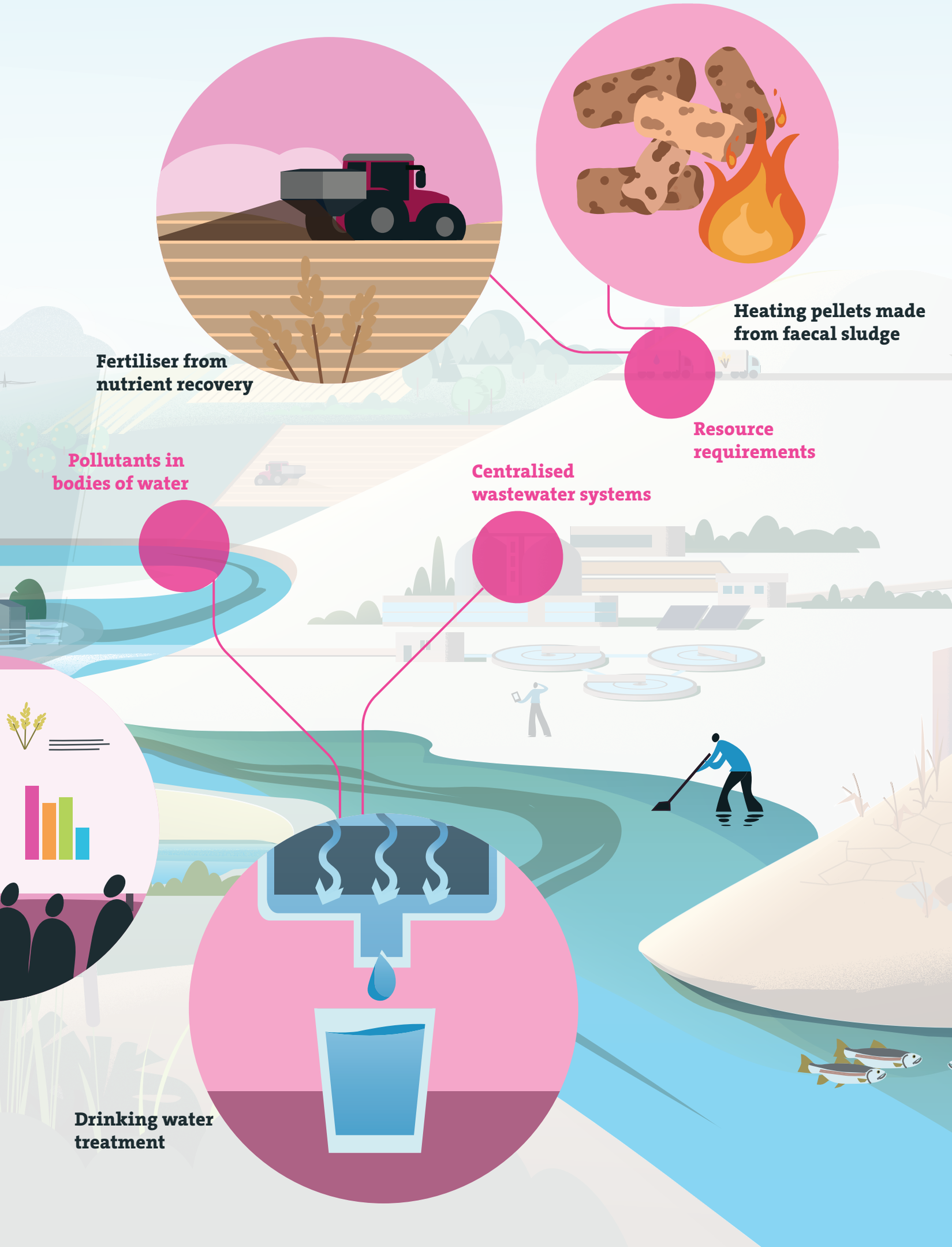
To ensure that we continue to live on a healthy planet in the future that enables us to enjoy well-being and prosperity, there is no way around using our resources more sparingly and closing material and energy cycles. This also applies to urban water management. On the one hand, wastewater contains valuable resources: water, nutrients and energy. The demand for these resources has grown increasingly in recent decades – in booming urban regions, in agriculture, in households, trade and industry. New solutions are needed worldwide to meet this increasing demand through reuse. Secondly, the wastewater that is released into the environment still contains excessive levels of pollutants and nutrients in many places. The capacity of the environment to absorb these is limited. We are seeing unprecedented levels of water pollution on a global level. Even though water quality has improved considerably in some regions, such as Switzerland, thanks to the construction of large-scale wastewater infrastructures. In order to solve the problems of water pollution and resource loss simultaneously and in the long term, new approaches must be discussed that require far-reaching systemic changes. There is a growing political will for change. This is reflected in global trends such as the promotion of a stronger circular economy, the shift towards renewable energies and the sustainable development goals. Eawag is an important player in this process and provides new solutions for recovering water, nutrients, recyclable materials and energy from wastewater and waste.

**Making the necessary adjustments**

We can already close regional water cycles in industrialised nations such as Switzerland by means of centralised wastewater treatment systems. In other words: the water used by humans is channelled via the sewage system to wastewater treatment plants, where it is purified and discharged into bodies of water, from where it is later extracted and processed to drinking water. Eawag researchers are working successfully to continuously adapt this system to new challenges. A current focus is on the question of how much potential there is in Switzerland to directly reuse water from wastewater treatment plants locally instead of discharging it into water bodies after treating it. Although treated wastewater is not of drinking water quality, it could be used as industrial process water or for irrigation in agriculture. In dry periods, which are becoming increasingly frequent as a result of the climate crisis, this could help to conserve drinking water reserves. Other researchers are working on blue-green infrastructures. Designing urban spaces to be close to nature allows rainwater to be kept where it falls by means of retention areas. This changes the local water balance, makes water an integral part of the city and mitigates the effects of drought and heat.

Eawag is also in favour of seeing nitrogen and phosphorus in wastewater more strongly as resources for agriculture and is investigating technologies to recover these from wastewater and faeces on an even larger scale. Processes to convert organic compounds in wastewater into bioplastics using microorganisms are also being investigated.


Reuse of water, nutrients and energy
Decentralised wastewater systems
Animal feed from biowaste
Environmental social sciences perspective
Autonomous sanitation solution Autarky


Heating pellets made from faecal sludge
Fertiliser from nutrient recovery
Resource requirements
Pollutants in bodies of water
Centralised wastewater systems
Drinking water treatment

**Rethinking from scratch**

Based on its decades of experience in wastewater management, Eawag is also going one step further. Researchers are working on methods that can recover water, nutrients and energy on site directly in small-scale cycles. These solutions were originally designed for regions in the Global South to provide people with urgently needed access to sufficient clean water and safe sanitation facilities without the need to build complex infrastructures such as sewage systems, water supply and wastewater treatments plants.

A whole range of innovations are being investigated, all of which have one thing in common: the waste streams are separated at source and processed specifically. Slightly polluted water from households can be reused after treatment for flushing toilets or washing laundry. Urine is collected separately from the flushing water, and the nutrients it contains are directly processed into fertiliser on site. Faeces can be recovered to produce heating pellets, biogas or compost. Rainwater can also be collected, stored and used for flushing toilets, for example. All of these measures help to close cycles and solve pressing sustainability problems in cities around the world.

The solutions developed should be quickly and flexibly adaptable to local conditions and needs – both in large cities such as Bengaluru (Bangalore) or San Francisco, where water is becoming scarce due to climate warming and population growth, and in remote locations such as alpine cabins in Switzerland. Eawag researchers are currently even working with the European Space Agency on ways to close water and nutrient cycles on board spacecraft. The researchers want to show decision-makers in politics, industry and civil society that such solutions are feasible and how a market can be created for them.

Eawag's expertise is also required in another area: in a complex world, different systems are needed for different regions and applications. We need combinations of the various recycling technologies and researchers from the natural, engineering and social sciences who are prepared to develop and coordinate them together and support their social anchoring. Anchored in Eawag's unique ecosystem, with a global vision.

# Flushing the toilet with shower water

Water recycling: new technologies, business models and standards


In the NEST building, researchers are developing flexible treatment systems for grey water that produce different water qualities, depending on the intended use. (Photo: Zooey Braun, Stuttgart)

Water is only slightly contaminated by washing hands, showering or washing dishes. Instead of feeding this grey water from the household into the central wastewater treatment plant, it could, after treatment, also be reused decentrally at the building or settlement level, for example for flushing toilets or watering gardens. New technologies, business models and standards are needed to make this possible. At the Water Hub, part of the NEST research and innovation building jointly operated by Eawag and Empa in Dübendorf, researchers are investigating how grey water from the kitchen, bathroom and laundry room can be separated from wastewater from the toilet and treated on site so that it can be reused for various applications. The quality of the treated grey water depends on how it is to be reused, i.e. whether it is to be used for washing hands or only for flushing toilets. Rainwater is also collected in the Water Hub and used to flush toilets.

However, Eawag is not only developing new technologies, but is also investigating what is needed for decentralised water treatment and reuse systems to become established in practice. In various studies, Eawag researchers are investigating the role of social acceptance for water recycling and the economic, political and social framework conditions required for this. Eawag is currently working with several stakeholders to compile an overview of the needs, opportunities and risks of water reuse in Switzerland. Another research project is under way in Bengaluru (Bangalore), India, a booming megacity with an acute water crisis and 3,000 decentralised wastewater treatment plants already in operation. Together with local researchers and practitioners, Eawag is investigating which success factors are crucial for the development and international scaling of decentralised wastewater treatment and reuse systems.

# New approaches to recovering nutrients

## Multiple awards for Eawag research

Wastewater, organic waste and human excrement contain a lot of energy and valuable nutrients such as nitrogen and phosphorus. Eawag is investigating various approaches to recovering these resources. Among other things, it has conducted several studies and pilot tests on technologies that can be used to produce biogas or solid fuels for heating such as pellets from faeces. Eawag researchers have also shown how waste utilisation and insect breeding can be combined: the larvae of the black soldier fly consume organic waste and can be used as valuable and sustainable animal feed in livestock farming.

To recover nutrients from wastewater, Eawag has developed, among other things, the Blue Diversion Autarky sanitation system, which is equipped with a urine-diverting toilet and does not require an external connection to the water and wastewater network. Wastewater, urine and faeces are separated from each other in this installation and treated according to their particular properties. On the one hand, nutrients for fertiliser can be recovered from urine and faeces. On the other hand, it is possible to reuse hand washing water and toilet flushing water. In particular, economically developing regions benefit from such systems. Eawag researchers were recently honoured with the South African Energy Globe Award for their developments in this field. The Eawag buildings in Dübendorf are also equipped with urine-diverting toilets: the nitrogen and phosphorus recovered from the urine is used to produce a plant fertiliser that is commercially available. The "save!" urine-diverting toilet won the 2021 Swiss Design Award.

The Blue Diversion toilet being field-tested in an informal settlement in Nairobi. The project is an example of successful knowledge transfer to the Global South.
(Photo: Eawag and EOOS)

# Making water systems fit for the future

Better understanding the relationships between precipitation and runoff processes in urban areas

The Urban Water Observatory enables researchers to investigate current issues in water infrastructure development. (Photo: Christian Grund/13Photoa)

Functional sewage systems are important for public health and environmental protection. Population growth and the advancing climate crisis are increasing the pressure on urban drainage. We have to continuously adapt our tried-and-tested drainage systems to change. To do this, however, we first need to understand how these systems perform under the current conditions. How much capacity does the sewage system still have today and can it withstand the increasingly heavy rainfall? Where are the hydraulic bottlenecks? How polluted is the wastewater in which neighbourhood? How much rainwater is treated in the wastewater treatment plant and how much mixed wastewater is discharged into the environment? In order to better answer such questions and to be able to record the dynamics of the urban water cycle more precisely, measurement data is needed. To this end, Eawag and the ETH Zurich have set up the Urban Water Observatory in the commune of Fehraltorf. It is a unique measuring network with over 80 modern sensors, some of which are installed above ground and some underground in the sewer system. Spatially distributed data on the condition of the drainage network is collected around the clock and transmitted wirelessly using innovative radio technology. Among other things, the sensors record precipitation, discharges and water levels at various points in the sewage system and at the outlets into the urban waterways. In addition, wastewater and water quality is analysed. Eawag then develops strategies and practical measures to ensure the sustainability of our drainage systems.

At its experimental wastewater treatment plant in Dübendorf, Eawag researchers are constantly optimising wastewater systems so that contaminants can be better removed and resources recovered. (Photo: Eawag, Alessandro Della Bella)

**Coexistence of different recycling systems** A centralised wastewater disposal and treatment system was established in Switzerland in the 20th century: wastewater and rainwater from buildings and industry are collected via the sewage system and fed into one of around 800 communal wastewater treatments plants. There, the wastewater is treated in technical processes before it is discharged into the natural water bodies. Eawag researchers are helping to continuously optimise this system so that not only are contaminants removed more effectively, but resources such as nitrogen and organic carbon can also be recovered from wastewater.

A success story in many places, but it is not the system of choice for every region. In areas with poor infrastructure or water shortages, the focus is on decentralised, circular systems: Eawag is developing and testing systems that allow wastewater to be treated on site directly and water to be reused. Nutrients and energy can also be recovered. In view of the climate crisis, decentralised systems are also gaining in importance in countries such as France, Sweden, India and the USA. Eawag is also investigating how centralised water infrastructure and decentralised elements can be combined to make the overall system more flexible, sustainable and resilient. The goal is always finding solutions that are tailored to local conditions.

Wastewater as a resource
*Information on the topic*

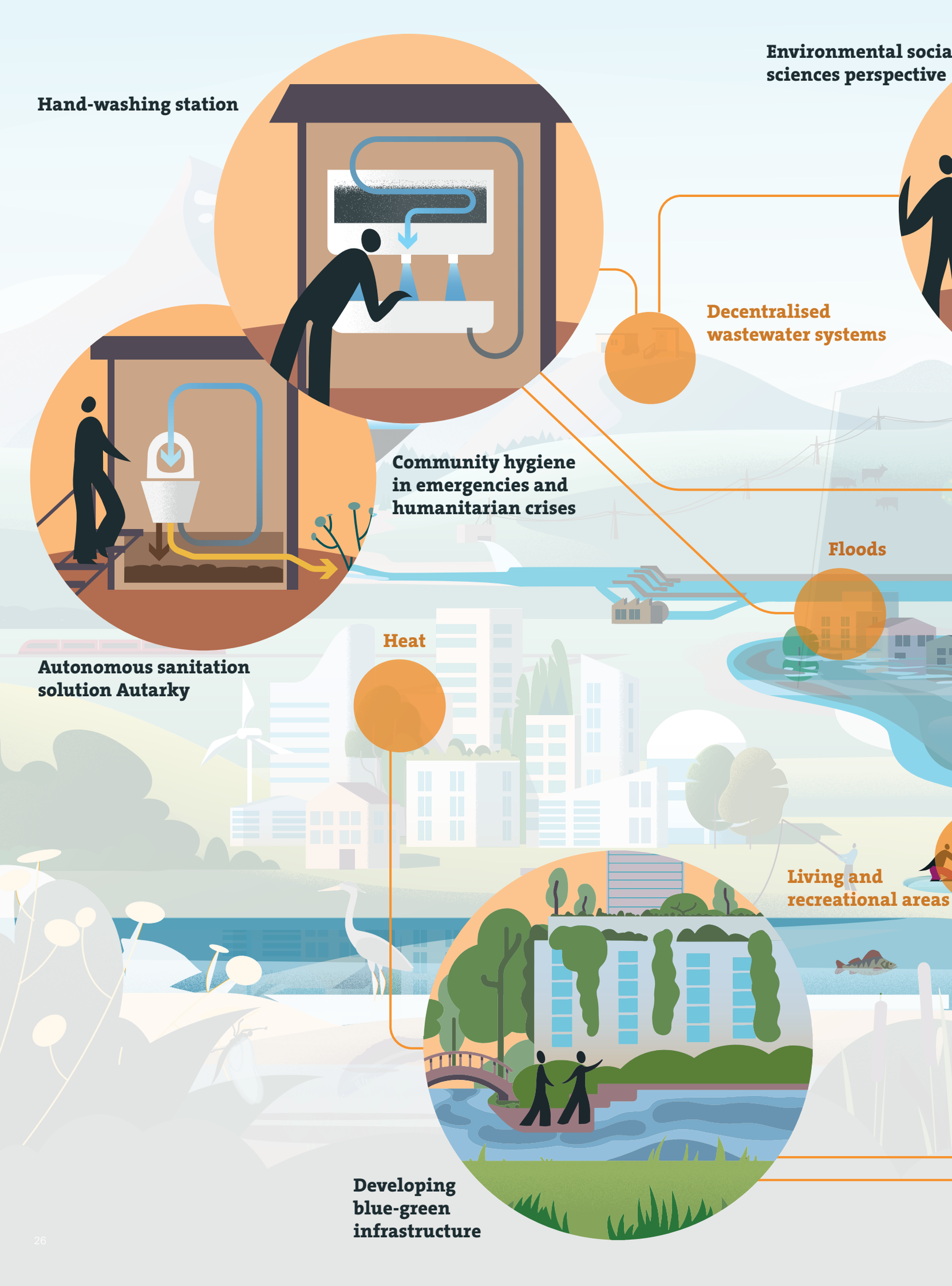
# Water, health and well-being

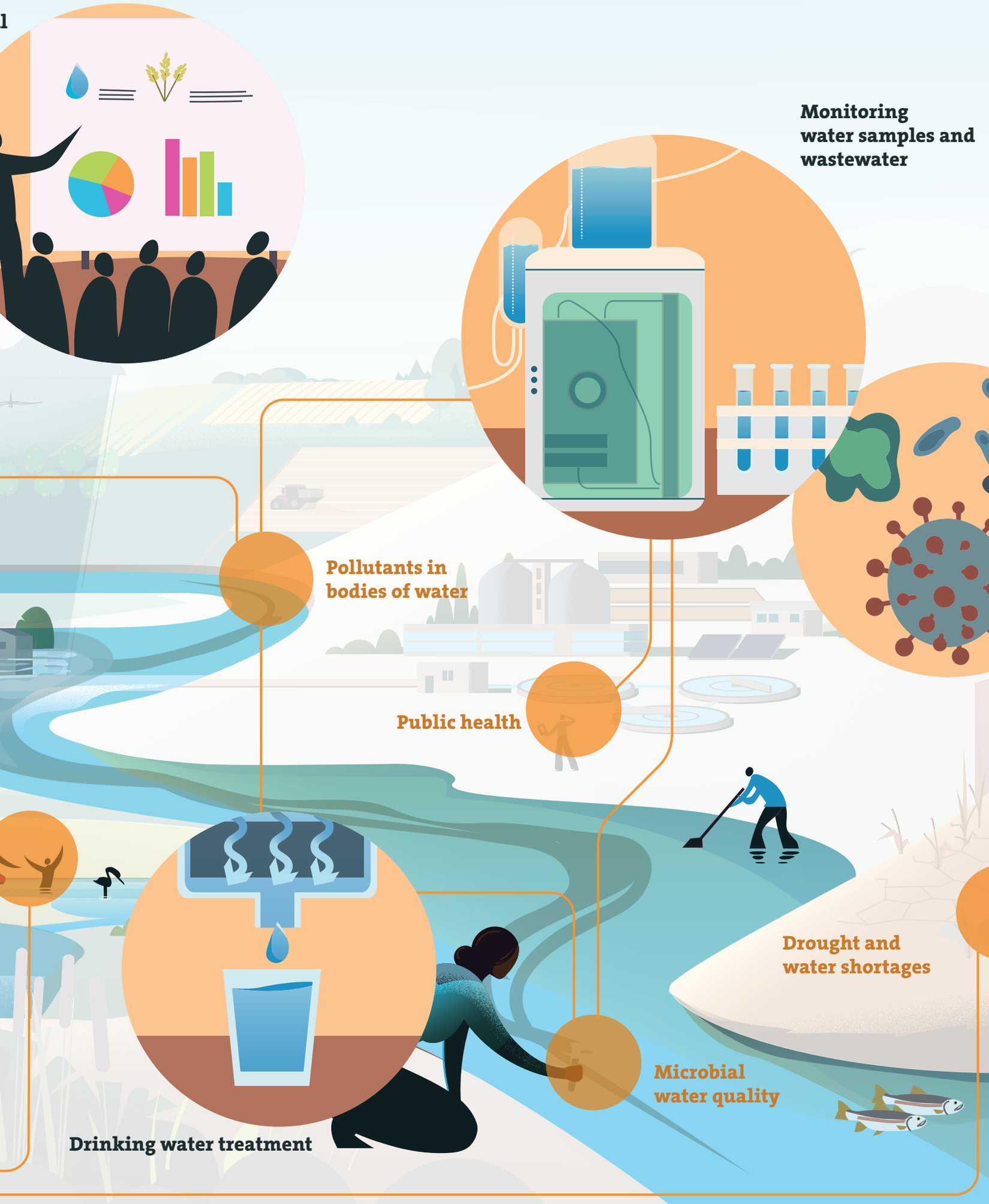
Our health and well-being depend heavily on the availability of sufficient clean water. However, around a fifth of the world's population has no clean drinking water and around a third has no access to safe sanitation facilities. Water is one of our most important resources and access to drinking water and sanitation is a human right. The changes in the global water cycle caused by the climate crisis are also exacerbating existing problems: flooding threatens human lives and in arid regions, the lack of drinking water is exacerbated as the scarce groundwater is also used for irrigation. Engineers, environmental experts and social scientists at Eawag are therefore using their expertise to make an active and targeted contribution to achieving access to clean and safe water.

**Waterborne diseases**

Hygiene measures play an important role in preventing the transmission of infectious diseases. Adequate sanitation and water infrastructures ensure that wastewater can be treated safely. Unsafe drinking water, unclean sanitation facilities and poor hand hygiene cause around one million deaths from diarrhoea every year. Eawag is therefore developing innovative solutions in the areas of water supply, wastewater treatment and waste disposal, which are also being used in the Global South. For example, in Durban in South Africa, a toilet was successfully tested that directly treats wastewater, urine and faeces on site and therefore does not require an external connection to the drinking water and wastewater network. Another focus is on the use of sanitation technologies in humanitarian crises. Such crises are to some extent exacerbated by climatic changes. Or they are caused by them in the first place, for example, when heavy rain floods settlements. In the world's largest refugee camp in Cox's Bazar, Bangladesh, Eawag researchers have been commissioned by the Swiss Humanitarian Aid Unit to plan and help set up a laboratory for analysing faecal sludge. This helps to contain the spread of waterborne diseases.

In the Global North, infectious diseases have been reduced over the last century through the implementation of sanitation infrastructure. Thanks in part to Eawag's commitment, Switzerland is now a model country for wastewater treatment. The expertise created in the process together with the infrastructure investments and operation of the plants now opens up new perspectives: for example, Eawag researchers are investigating antibiotic resistance in bacteria – currently one of the major medical threats. They are investigating how resistance spreads in bodies of water and wastewater treatment plants and what strategies could be used to better eliminate resistance in wastewater. Researchers also find a reflection of public health in wastewater, for example, drug residues or genetic material from excreted viruses. In future, a monitoring system could make it possible to recognise public health problems in wastewater at an early stage and identify correlations that might otherwise have remained undetected.


Hand-washing station
Environmental socia
sciences perspective
Decentralised
wastewater systems
Community hygiene
in emergencies and
humanitarian crises
Floods
Autonomous sanitation
solution Autarky
Heat
Living and
recreational areas
Developing
blue-green
infrastructure


Monitoring water samples and wastewater
Pollutants in bodies of water
Public health
Drought and water shortages
Microbial water quality
Drinking water treatment


**Insufficient or contaminated drinking water**

Supplying people with water of sufficient quality and quantity is another important prerequisite for health. In regions with low rainfall and without sufficient water infrastructure, water shortages occur repeatedly, resulting in a scarcity of drinking water. The climate crisis is exacerbating this situation with heatwaves. Eawag researchers are therefore working to identify the factors that impair the quality of drinking water resources. The range of pollution sources is wide and differs depending on the geographical location and existing water infrastructure. Not only can pathogens such as coli bacteria affect health, but pollutants can too. Some of them are of natural origin – in many places around the world, groundwater is contaminated with arsenic or fluoride, for example. However, many pollutants, such as pesticides or PFAS (perfluorinated compounds), are man-made.

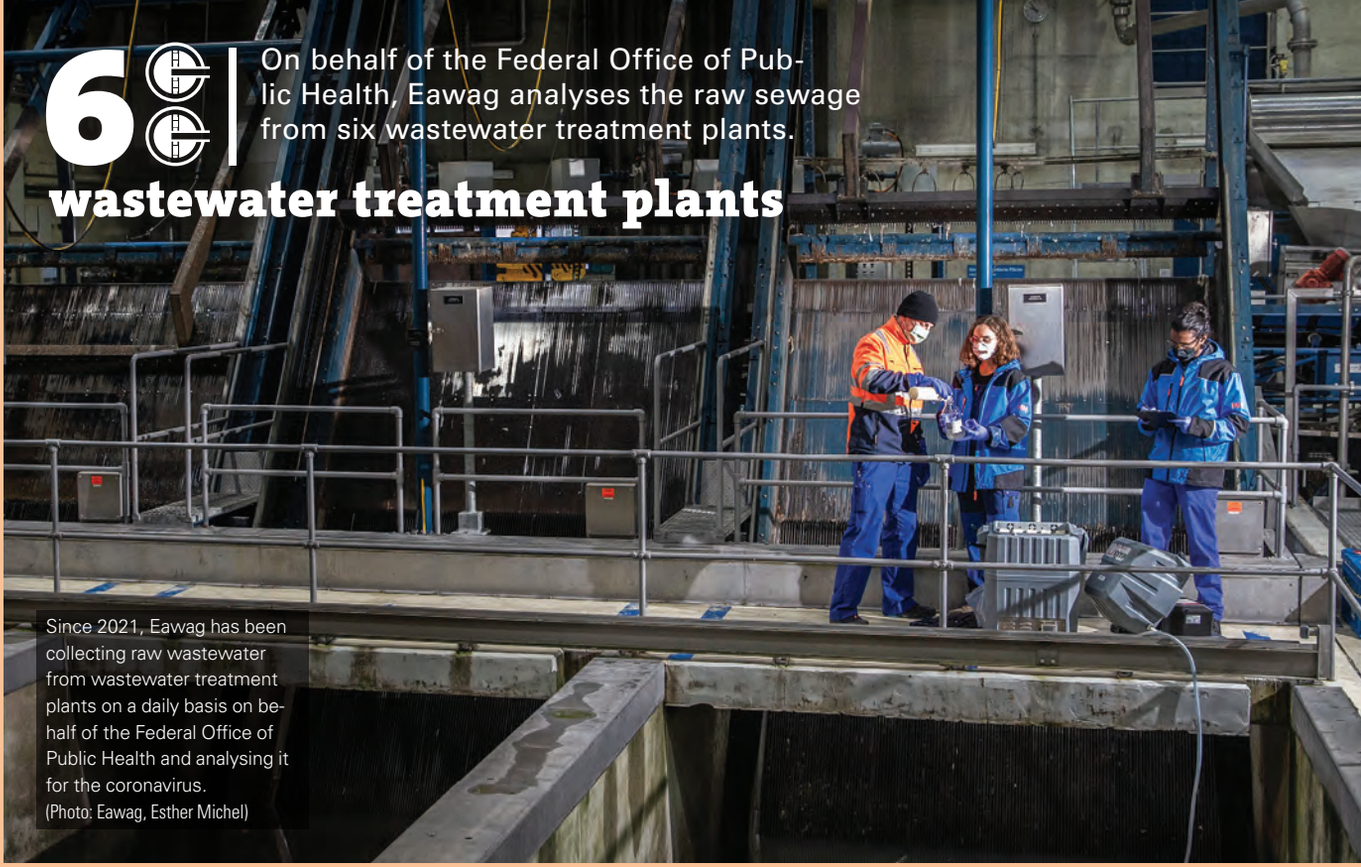
Eawag plays an important role in revealing the extent of pollution in drinking water. And it is working on optimising water treatment technologies so that pathogens and pollutants are removed as efficiently as possible. To this end, Eawag is developing simple and affordable drinking water treatment solutions that are suitable for the local conditions and can be maintained by the people themselves. For example, water filters, chlorine dosing systems and inexpensive laboratory equipment for analysing water quality suitable for use in the field. To prevent pollutants from entering the environment in the first place, Eawag is also investigating how materials can be designed and tested to make them safer for humans and the environment.

**Healthy behaviour and well-being**

Beyond the technical issues, Eawag takes a psychological view to the environmental health issue. The aim is to understand how behaviour can be promoted that has a positive impact on individual and public health. Or how health considerations can contribute to environmentally friendly behaviour. At the interface between health and the environment, the importance of near-natural urban recreational areas and intact ecosystems also becomes clear. They not only promote physical well-being and mental health, but also contribute to biodiversity and can mitigate the consequences of extreme weather events.

# What wastewater reveals about our health

Competence centre for health monitoring – beyond Covid-19



**6** wastewater treatment plants

On behalf of the Federal Office of Public Health, Eawag analyses the raw sewage from six wastewater treatment plants.

Since 2021, Eawag has been collecting raw wastewater from wastewater treatment plants on a daily basis on behalf of the Federal Office of Public Health and analysing it for the coronavirus. (Photo: Eawag, Esther Michel)

Current figures
*IInfectious diseases in wastewater*

The coronavirus pandemic has helped wastewater-based epidemiology achieve a breakthrough. In 2020, researchers at Eawag and the EPFL worked extremely hard to develop a method for measuring the genetic material of SARS-CoV-2 in wastewater. In doing so, they were able to build on a concept that Eawag had previously tested for the detection of drug and medication residues in wastewater. Since 2021, Eawag has been collecting raw wastewater from wastewater treatment plants on a daily basis on behalf of the Federal Office of Public Health and analysing it for the coronavirus. The wastewater data provides valuable insights into the incidence of infection and the health status of the population – beyond SARS-CoV-2, as the newly developed method can be applied to other pathogens. Monitoring now covers a whole range of infectious diseases, including influenza and the RS virus. In the future, an early warning system based on wastewater data could even be conceivable, which would indicate waves of infection even before they become noticeable in everyday medical practice.

However, Eawag researchers are expanding wastewater-based epidemiology even further. In future, wastewater samples could be routinely analysed for pathogens and at the same time for pharmaceutical products and allergens. This would allow crucial connections to be recognised. If, for example, the concentration of cough syrup residues increases, but none of the usual respiratory viruses appear in the samples, this could indicate a novel, previously unknown pathogen. In order to be able to pass on such findings from wastewater-based epidemiology directly to authorities and other relevant stakeholders in the future, a new competence centre is being set up at Eawag in collaboration with the ETH Zurich and the EPFL.

# Hygiene and health for an urbanised world

Innovative approaches and solutions in the areas of water supply, wastewater disposal and waste management

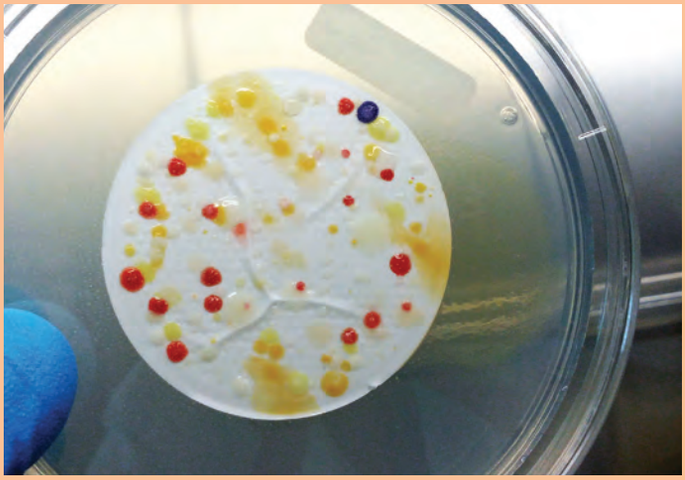
Almost 60 percent of the world's population live in cities. Urbanisation is progressing at a rapid pace, particularly in the Global South. Sanitation infrastructures are not designed for so many people. There is a lack of hygiene measures in many urban neighbourhoods, and the disposal of wastewater and waste often does not work at all or is organised informally, with devastating consequences for the environment and health. The problem is exacerbated by extreme weather events, which are occurring more frequently and are more intense as a result of the climate crisis. Eawag researchers are developing innovative approaches and solutions in the areas of water supply, wastewater disposal and waste management that are tailored to the realities of the growing cities. Eawag works closely with partners such as the World Health Organisation (WHO), the World Bank and the Bill and Melinda Gates Foundation, as well as with local institutions. In the event of humanitarian crises caused by droughts and floods, Eawag uses its expertise to support organisations such as the International Red Cross (IKRK) and the Swiss Agency for Development and Cooperation (SDC).

In addition to the involvement of local partners, knowledge is transferred to the Global South via the online course series "Sanitation, Water and Solid Waste for Development". This massive open online course (MOOC), which Eawag is offering in collaboration with the EPFL, comprises four different courses and is free of charge for participants. Since 2014, more than 200,000 people from over 190 countries have taken part. Furthermore, Eawag is organising the Certificate of Advanced Studies (CAS) in "Water Sanitation and Hygiene for Humanitarian and Developing Contexts" together with the University of Applied Sciences and Arts of Southern Switzerland (SUPSI) and the University of Neuchâtel.

Drinking water station at a school in Nepal. The microbial water quality is tested in a field laboratory. (Photo: Eawag, Ariane Schertenleib)

**Understanding and stopping the spread of antibiotic-resistant germs** Antibiotic resistance is increasing rapidly worldwide and poses a major threat to human and animal health. Eawag researchers are investigating how such resistances spread in bacterial colonies and in the environment. Resistant bacteria enter the wastewater with our excrement. Wastewater treatments plants are unable to eliminate all resistant germs. Studies conducted by Eawag have shown that the discharge of treated wastewater into the environment can lead to the spread of these bacteria in bodies of water. The resistance load usually decreases again downstream due to dilution and degradation processes. However, the results indicate that antibiotic-resistant organisms and resistant genes can indeed accumulate and multiply in river systems under certain conditions. Increasing heavy rainfall occurrences as a result of the climate crisis are exacerbating the problem. When sewage systems and wastewater treatment plants are overloaded by masses of water, untreated wastewater has to be discharged into the rivers. Researchers estimate that such events account for around half of the total annual input of antibiotic resistance in Swiss rivers.

In addition to forecasting models for predicting the resistant load in the Swiss river network, researchers are also developing strategies for improving the elimination of resistant bacteria in wastewater treatments plants. Eawag is thus making an important contribution to curbing the spread of antibiotic resistance and the associated health risks for the population. In future, a monitoring system for antibiotic resistance could be set up under Eawag's leadership, similar to the wastewater monitoring system for SARS-CoV-2.



Resistant bacteria also grow on a culture medium that has been treated with antibiotics. (Photo: Eawag, Helmut Bürgmann)

# Detecting and removing chemicals in drinking water

Ensuring the high quality of Swiss drinking water

In the water reservoir of Switzerland, groundwater or spring water flows into households in many places without elaborate treatment. This is thanks to effective water protection measures. Above all, these ensure perfect hygiene, which results in drinking water without any pathogenic germs. Where necessary, for example when using lake water, measures are supported by disinfection.

The chemical quality of the water, on the other hand, can be impaired by problematic chemicals from households, industry and agriculture. These include medicinal products, pesticides and the perfluorinated compounds (PFAS) contained in many everyday objects, which are virtually non-degradable. Thanks to research and practical implementation by Eawag, a large proportion of such micropollutants can be removed from wastewater. This relieves the burden on bodies of water, the organisms living in them and ultimately also the drinking water.

However, pesticides in particular also enter water bodies directly, for example when pesticides are washed off fields. As an example of this, researchers at Eawag have detected degradation products of pesticides such as chlorothalonil in Swiss groundwater. And they are developing concepts for the extended protection of resources and additional treatment of water should this become necessary despite all precautions and the already high standard of treatment.

Eawag is thus developing processes to remove micropollutants from drinking water and wastewater, supporting water utilities and identifying ways in which pollutant inputs can be reduced. Eawag researchers have also developed maps based on machine learning for areas in the Global South where the groundwater is regionally contaminated with naturally occurring arsenic or fluoride, but where hardly any measurement data is available. They can be used to predict the risk of groundwater contamination. In this way, Eawag helps to ensure the high quality of Swiss drinking water and to solve drinking water problems elsewhere.

In addition to reducing pollutant inputs to water bodies, Eawag is also conducting research into water treatment so the pollutants can be removed as efficiently as possible. (Photo: Eawag, Alessandro Della Bella)

# A strong crew


Photo: Eawag, Alessandro Della Bella)

536 employees from the fields of science, technical and administration work at Eawag to ensure smooth operations and keep first-class aquatic research on track (as of 2023). Together, they account for 477 full-time positions, around five percent more than in the previous year. With employees from 46 nations, Eawag's workforce is extremely international. The proportion of women has risen further and now stands at 50 percent. Vocational training is also a high priority: Eawag is currently training 24 apprentices in laboratory, ICT and administration sectors.

Eawag's personnel policy aims to maintain the skills and motivation of its employees at a high level at all times in a diverse, multicultural and changing working environment. Eawag offers attractive working conditions, such as flexible working time models, integrated health management, childcare facilities and further training opportunities, in order to attract first-class long-term employees both for research, as well as for technical and administrative positions. Whether internal further training, language courses or external individual specialised training: Eawag invests in its employees and their professional and personal development.

The new management team is continuing on this course. Director Martin Ackermann took over the helm of Eawag at the beginning of 2023 and appointed four new members to the Directorate, including two women: Sara Marks, group leader in the department of Sanitation, Water and Solid Waste for Development, and Lenny Winkel, professor and head of the Eawag research group Inorganic Environmental Geochemistry. They were joined by Florian Altermatt, group leader and professor of Aquatic Ecology, and Christian Stamm as the new deputy director of Eawag.

## Personnel

Total employees

536

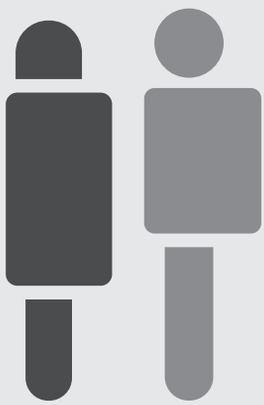
50 %

50 %

165 / 48 %

171 / 52 %

Scientific staff



The figures in all the charts refer to the year 2023.

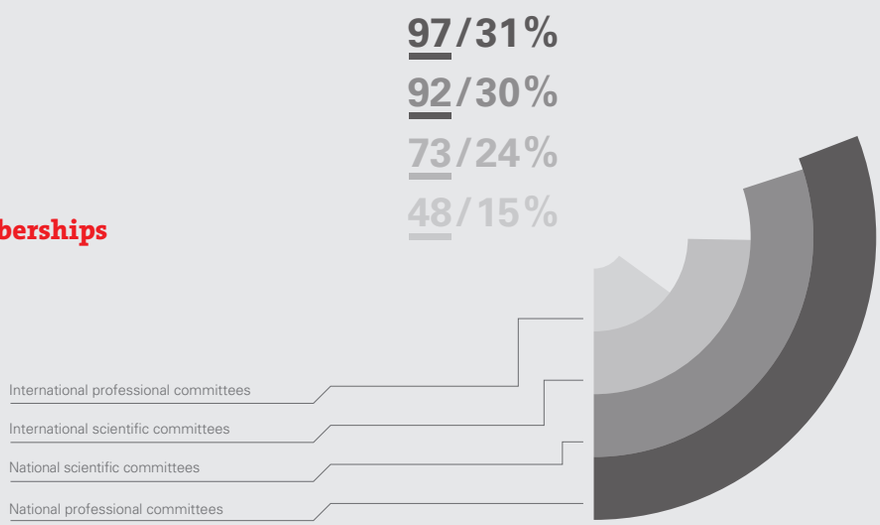
# Important partner

The great challenges of our time cannot be mastered alone. Better solutions are created when knowledge is exchanged, skills are bundled and resources are pooled. This is why Eawag has been collaborating with a broad network of national and international partners for many years. These include various universities and other research institutions. Eawag is firmly anchored in the Swiss research community and beyond. It is involved in several joint research initiatives in the ETH Domain. In addition to interdisciplinary research activities, academic training is also a high priority. Eawag researchers pass on the knowledge to young researchers through their teaching activities at the ETH Zurich and the EPFL, at national and international universities and universities of applied sciences. As part of the Eawag Partnership Programme, Eawag also awards six scholarships each year to students from Global South countries for a research placement at Eawag.

Outside the research community, Eawag's regular project partners in Switzerland include federal offices, cantonal laboratories, water utilities, wastewater treatment plant operators as well as engineering and environmental offices. With its focus on applied research and development, Eawag is also an important networker for the Swiss water sector. The Eawag Info Day, which is an exchange event aimed at experts from the field, was dedicated in 2023 to the Sustainable Development Goals of the 2030 Agenda. Eawag also takes advantage of opportunities to network internationally, for example by participating in World Water Week in Stockholm in 2023 and appearing at the last World Economic Forum in Davos. Eawag also works with partners from research and practice in 25 countries of the Global South and shares its findings with various local institutions. In this way, it makes knowledge regarding safer and more careful use of water globally available.

## Committee memberships

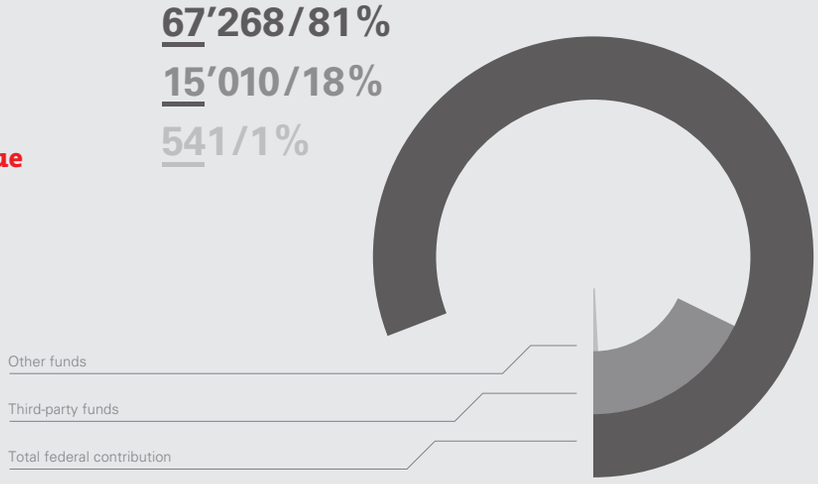
310




## Operating revenue

(in CHF thousands)

82'819



## Living diversity

Eawag's employees are as diverse as its research. In 2008, Eawag set up the Equal Opportunities Committee to meet their different needs and ensure even more diversity in their ranks. An important focus of the committee is the compatibility of family life and career. Female scientists on the tenure track receive an automatic extension of their appointment when they start a family. As part of the Tailwind programme, Eawag provides mothers with financial support to ease the burden during the first few months of motherhood. Fathers can apply for a temporary reduction in their employment level. And tenure track positions are now also being offered on a part-time basis. Together with Empa, Eawag also provides a childcare centre at the Dübendorf location and contributes substantially to the childcare costs. All these measures increase the percentage of women in the workforce, especially in the management positions: over 37 percent of them are now women.

The aim is to create an inclusive working environment in which all employees feel equally involved. The traditional male/female signs in the toilets, for example, have been replaced by a gender-neutral labelling that is more inclusive. The various dimensions of diversity should also be given greater consideration in staff recruitment – Eawag is currently revising its recruitment processes to this end.

**The history of Eawag**

**1936**
**Founded in**

as an advisory centre of the ETH Zurich. From 1946 "Federal Institute for Water Supply, Wastewater Treatment and Water Protection". Now an independent aquatic research institute that belongs to the ETH Domain.

## Digital in flux

The digital transformation has opened up new opportunities in research and established new practices. Open science – open access to scientific data and publications - has become an important principle to which Eawag has also committed itself and which it is promoting. The majority of scientific journal articles (over 90 percent) are made available free of charge by Eawag. Around 8,000 scientific posts from Eawag are freely accessible on DORA, the joint publication platform of the four research institutions in the ETH Domain. In addition, Eawag is publishing a growing proportion of its research data on ERIC, its own online platform for open research data. Other researchers, as well as authorities, companies and organisations, can access and freely use hundreds of datasets. In addition, Eawag is involved in the steering committee of the ETH Domain's "Open Research data" programme to further improve and promote open science practices. Thanks to open science, Eawag's research is becoming more visible and its benefits for science, industry and society even greater.

The digital transformation also affects organisational processes at Eawag. Payroll statements and ordering processes have already become digitalised. The next step will be the digitalisation of personnel dossiers and the introduction of electronic signatures.

Scientific publications
*Freely accessible on DORA*

# Committed to the environment

Environmental protection and sustainability are key concerns of Eawag. Measures from the energy-saving initiative of autumn 2022, such as switching off the hot water in the toilets, reducing the outdoor lighting and restricting the motion sensors of light barriers, were continued in 2023. In Kastanienbaum, the media supply for heating and process cooling in the laboratories was also modernised and a new lake water intake with a more efficient pumping system was installed. Sustainability also played a key role in the selection of a new operator for the institute's restaurant in Dübendorf.

Eawag also attaches great importance to sustainable construction. The Forum Chriesbach, Aquatikum and FLUX buildings on the Empa Eawag campus in Dübendorf were already built to the latest sustainability standards. The Limnion research building is now also being added to the Kastanienbaum site. It will be built to Minergie standards and equipped with a photovoltaic installation to further optimise the power supply from renewable energy.

In the area of mobility, Eawag has been levying internal $CO_2$ charges on air travel, car and boat kilometres since 2004. Together with parking fees for the car parking spaces, this income was also used in 2023 to subsidise employee's public transport season tickets and membership fees for bicycle-sharing services.

Eawag is also involved in projects with a focus on sustainability at the interface with research. For example, as a member of the SCENE research project launched in 2023, Eawag is collaborating with the other three research institutes of the ETH Domain to develop a science-based net-zero roadmap. In future, this can be used by other institutions and public organisations to reduce greenhouse gas emissions. Calculations to date have shown that Eawag has already been able to reduce its greenhouse gas emissions by two-thirds compared to 2006. A reduction of up to 80 percent is forecast for the year 2030. The remaining greenhouse gas emissions will be fully offset.


Photo: Eawag, Peter Penicka

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References
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The major global challenges cannot be thought about, investigated and solved without considering water as a connecting element. In our complex world, in which numerous crises interact, water-related solutions are needed.

Science that matters