

NUMBER 1/2025 (51)

PHOTO ADRIAN CZECH

ISSN 2956-5111



WATER ISSUES

PLANS FOR WATER MANAGEMENT ARE NOT ABOUT BUILDING RESERVOIRS

ANTIBIOTIC-RESISTANT MICROORGANISMS IN WASTEWATER TREATMENT PLANTS

A CODE OF GOOD PRACTICES FOR WATER USE IN ENERGY PRODUCTION

PERMAFROST RELEASES THE GHOSTS OF THE PAST



EU WATER RESILIENCE STRATEGY – WORK COMMENCES

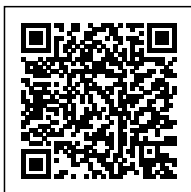
Posted on 23 January 2025 by Agata Pavlinec



In July 2024, the European Commission integrated the issue of water resilience into the EU's strategic agenda for the 2024-2029 period. Ursula von der Leyen justified this decision by highlighting the need for better water resource management, addressing increasingly frequent shortages, and enhancing the EU's competitive edge in the innovative water sector. Work on preparing the action strategy in this area will begin in the coming weeks.

Categories: [Issue 1/2025](#), [News](#)

Tags: [Water crisis](#), [water resources](#), [water sector](#)



In July 2024, the European Commission integrated the issue of water resilience into the EU's strategic agenda for the 2024–2029 period. Ursula von der Leyen justified this decision by highlighting the need for better water resource management, addressing increasingly frequent shortages, and enhancing the EU's competitive edge in the innovative water sector. Work on preparing the action strategy in this area will begin in the coming weeks.

The EU's response to Europe's water crisis

Responsibility for drafting the Water Resilience Strategy has been assigned to Jessica Roswall, Commissioner for the Environment, Water Resilience, and Competitive Circular Economy. In an interview with *Water News Europe*, the new commissioner declared that the document would be finalized by the end of 2025, emphasizing that the EU needs to change its approach to managing, utilizing, and valuing water.

Jessica Roswall also noted that only 37% of surface waters in Europe are in good ecological condition, and just 29% are in good chemical condition. Over the past 30 years, floods across the continent have caused economic damage amounting to €170 billion. Meanwhile, European societies are not adequately prepared to handle the effects of floods and droughts. Decades of unsustainable land use, urbanization, and ecosystem degradation have put immense pressure on water resources, further exacerbated by climate change and a continuous increase in water demand. The Water Resilience Strategy aims to ensure food, energy, and economic security for Europeans while preparing for future climate challenges.



photo: quintanilla / depositphotos

Step-by-step water resilience strategy

Commissioner Roswall outlined how work on the new EU initiative would progress. The European Commission will soon publish reports evaluating how effectively individual Member States are implementing EU water management regulations. Along with the report on the state

of waters published last year by the European Environment Agency, these will form the foundation for developing the Water Resilience Strategy. The process will also include extensive consultations with stakeholders from the agriculture, infrastructure, industry, energy, spatial planning, and public health sectors

Jessica Roswall quoted surveys showing that 75% of EU citizens believe the Union should do more on water issues. The Water Resilience Strategy aims to address these expectations by incorporating the opinions of local governments, the private sector, non-governmental organizations, and citizens themselves. All these groups will be invited to submit their suggestions and feedback.

Ultimately, the Water Resilience Strategy is designed to stimulate public and private investments in smart water management. Additional support will come from EU cohesion programs and agricultural development funds. Private investors will be supported by the European Investment Bank (EIB).

When asked about specific figures, the commissioner stated that joint annual investments by the EU, EIB, and national governments in the water economy currently amount to €63 billion. Additional funds are activated through the European Solidarity Fund in the case of natural disasters—since 2021, €800 million has been distributed under this framework. The Connecting Europe Facility (CEF) financial instrument has increased the overall budget by another €1.6 billion. However, a significant investment gap remains, which must be filled by public and private resources. Financing models will be an integral part of the Water Resilience Strategy, which, in turn, will open up new opportunities for business development. Europe must start capitalizing on its competitive advantage derived from its vast innovation potential in the water economy.

WINTER BIRD COUNT 2025 – JOIN THE NATIONWIDE BIRD WATCHING CAMPAIGN!

Posted on 22 January 2025 by Iwona Szyprowska-Głodzik



On the last weekend of January, from January 24 to 26, 2025, the Winter Bird Count will be held throughout Poland – an event organized by the Polish Society for the Protection of Birds (OTOP). It's a great opportunity to get out into the fresh air, learn more about the natural world and contribute to the protection of birds wintering in our country.

Categories: [Issue 1/2025](#), [News](#)

Tags: [bird](#), [winter](#)



On the last weekend of January, from January 24 to 26, 2025, the Winter Bird Count will be held throughout Poland – an event organized by the Polish Society for the Protection of Birds (OTOP). It's a great opportunity to get out into the fresh air, learn more about the natural world and contribute to the protection of birds wintering in our country.

Why count birds in winter?

The main goal of the Winter Bird Count is to check how many birds winter in Poland and how they cope. The information collected helps to better protect birds and the places where they live. Thanks to regular observations, you can also notice whether there are any disturbing changes in nature and react to them.

However, counting birds in winter is not only about research – it is also a great opportunity to learn more about birds, their diversity and role in nature. Everyone who takes part in the action can get to know the surrounding nature better.

Who can take part?

Everyone! There are no age restrictions or requirements regarding ornithological knowledge. Participation in the event is free of charge, and you do not need any specialized equipment to observe birds. You can count birds alone, with family, friends or in a larger group. This is the perfect opportunity to spend time outdoors while helping to protect nature.

How to get involved?

Taking part in the winter count is very simple. Enough:

- Choose a place for observation – it can be your garden, a nearby park, a forest or any other place.
- Spend an hour counting birds – preferably at a time convenient for you on one of the action days.
- Record all species observed and their abundance.
- Send your results to OTOP using the form available from January 24 on their website.

If you are not sure how to recognize individual species, don't worry – on the OTOP website you will find photos and descriptions of the most common birds that will help you identify them.

What birds can we meet?

During the Winter Bird Count, participants most often see birds that feel good in cities and around people. Among them are sparrows - small birds that used to be very numerous, but their population has begun to decline in recent years. The great tit is also very popular, a bird with a characteristic yellow belly that likes to visit feeders in gardens and parks. In cities you can often see jackdaws, small birds from the corvid family, and city pigeons, which are a permanent element of the urban landscape.

However, depending on where you observe, you may encounter more unique guests. For example, waxwings, which have beautiful plumage and appear in winter when they come to us from the north, or bullfinches - birds with a characteristic red belly that stand out especially against the snow. It is this diversity that makes bird watching a fascinating experience.

Are waterbirds also counted?

Water birds, such as ducks, swans and seagulls, are an important element of Polish nature, but their counting does not take place as part of the Winter Bird Count. The counting of these species is carried out as part of a separate program - Monitoring of Wintering Water Birds (MZPW), which is also coordinated by OTOP. This year it took place on January 18-19, 2025. The organizers emphasize that if for any reason it was not possible to count birds on this date, it can be done on another date, but no later than January 31, 2025.

Both experienced ornithologists and less experienced people who want to contribute to nature conservation can take part in the MZPW. It is important that participants have basic knowledge about waterbirds and are able to perform reliable counting. To participate, please contact the regional coordinator (list available on the OTOP website) for detailed information and instructions.

<https://wodnesprawy.pl/en/how-do-fish-and-water-birds-cope-with-winter-st/>

Why is it worth taking part?

Winter bird counting is not only an interesting way to spend time, but above all a chance to do something good for nature. By counting birds and sending our results to the organizers, we help scientists obtain valuable information. Thanks to this, you can understand how the number of birds in Poland is changing and which species are most exposed to threats. Participating in the campaign is also an opportunity to get to know the nature around you better. For children, it is an excellent lesson in nature that takes place in real life, not only in books.

Where to look for information?

If you want to learn more about the Winter Bird Count, visit the OTOP website. There you will find all the necessary information - forms for sending results, photos and descriptions of birds that will help you recognize them, and instructions on how to take part in the action. Additionally, the organizers encourage you to share your observations on social media. You can post a photo or a short description of your experiences - perhaps you will inspire others to join this initiative.

DONALD TRUMP CANCELS THE GREEN DEAL

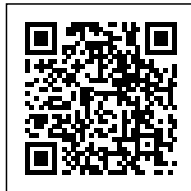
Posted on 21 January 2025 by Agata Pavlinec



Donald Trump's inaugural speech sparks global controversy. The 47th President of the United States declared a national energy emergency on his first day in office, promising a return to fossil fuel exploitation. He firmly opposed the Green New Deal, electric vehicles, and international climate cooperation.

Categories: [Issue 1/2025](#), [News](#)

Tags: [climate](#), [CO2 emissions](#), [Donald Trump](#), [president](#)



Donald Trump's inaugural speech sparks global controversy. The 47th President of the United States declared a national energy emergency on his first day in office, promising a return to fossil fuel exploitation. He firmly opposed the Green New Deal, electric vehicles, and international climate cooperation.

The United States increases oil production

In his speech, Donald Trump reiterated his campaign promises, emphasizing that under his leadership, America would return to its golden era. One of the main goals of his plan is to increase oil and natural gas production to lower energy prices. Efforts will focus on natural resources located in Alaska

The declaration of a state of energy emergency was immediately published on the White House website. It authorizes state agencies to take immediate action to build the necessary infrastructure and sets a 30-day period for agency heads to prepare reports on increasing energy production.

CBS News noted that in October 2024, the United States produced 13.4 million barrels of oil daily, 17% more than during Trump's previous term and the highest level since 1920.

Trump withdraws from the Paris Agreement

Immediately following his inaugural address, Donald Trump signed several executive orders. Among them was a decision to withdraw once again from the Paris Agreement, which commits signatories to reducing greenhouse gas emissions to limit global warming to 1.5°C above pre-industrial levels. Trump had already withdrawn the U.S. during his first term, but the Biden administration later rejoined the international coalition to combat climate change. The current decision is particularly shocking, as California is battling massive wildfires, which scientists attribute to global warming.

The new president also announced the U.S. withdrawal from the World Health Organization (WHO), citing its alleged inefficiency in addressing the COVID-19 pandemic and other global health crises. According to White House officials, the U.S. pays disproportionately high dues, and the WHO is overly influenced by member nations' politics.

<https://wodnesprawy.pl/en/what-does-donald-trumps-victory-mean-for-climat/>

No more subsidies for electric vehicles

The decision to double down on fossil fuels strikes a blow to the broadly defined Green New Deal, a package of pro-environmental resolutions yet to be approved by Congress. Trump criticized the Biden administration's policies, which included subsidies for electric vehicle purchases. Contrary to the new president's claims, the U.S. does not mandate EV adoption but merely provides support for eco-friendly vehicles. This support will now be withdrawn as unfair and harmful to the traditional automotive industry. Biden's executive order to increase the share of EVs in new car sales to 50% by 2030 has also been annulled. Additionally, Trump's first-day orders include a plan to lower vehicle emissions

standards.

The new president also pledged to provide Americans with the freedom to choose everyday products such as dishwashers and showerheads, directly opposing previous policies promoting water- and energy-efficient products.

Manish Bapna, president of the Natural Resources Defense Council (NRDC), commented: “There is no energy emergency. There is a climate emergency.” He added that no president can disregard established safeguards and laws with a simple stroke of a pen. Ashfaq Khalfan, Climate Justice Director at Oxfam America, called Trump’s decisions “a recipe for disaster, favoring wealthy polluters at the expense of people and the planet.”

main photo: Trump White House, Public Domain, via Wikimedia Commons

GREEN LIGHT FOR POLAND'S FIRST NUCLEAR POWER PLANT

Posted on 20 January 2025 by Iwona Szyprowska-Głodzik



The General Director for Environmental Protection (GDOŚ) has upheld the environmental decision regarding the construction of Poland's first nuclear power plant in the Lubiatowo-Kopalino location. This decision marks another step forward in realizing a strategic energy project for Poland.

Categories: [Issue 1/2025](#), [News](#)

Tags: [environmental decision](#), [GDOŚ](#), [nuclear power plant](#), [power plant](#)



The General Director for Environmental Protection (GDOŚ) has upheld the environmental decision regarding the construction of Poland's first nuclear power plant in the Lubiatowo–Kopalino location. This decision marks another step forward in realizing a strategic energy project for Poland.

Environmental Decision Upheld

On January 16, 2025, GDOŚ partially amended the decision from September 19, 2023, correcting only two points that contained clerical errors while maintaining the decision's validity in all other aspects. As a result, the environmental conditions for the construction of the nuclear power plant in the municipalities of Choczewo, Gniewino, or Krokowa were confirmed to comply with applicable regulations and the requirements derived from the environmental impact assessment.

After reviewing the case again, GDOŚ determined that the submitted environmental report met all formal requirements. The project's implementation, in accordance with specified environmental conditions, will not result in significant negative impacts on the environment. Furthermore, the public participation process carried out as part of the EIA procedure was deemed proper.

Scope of Environmental Analysis

During the assessment of the project's environmental impact, the General Directorate for Environmental Protection thoroughly analyzed the following aspects:

- Project variations
- Impact on land surface and cultural landscape: Evaluating terrain reshaping, effects on soil, monuments, and landscape.
- Waste management, including radioactive waste.
- Emissions into the atmosphere: Considering the impact of gas, dust, and noise emissions.
- Seismic and tectonic risks: Analyzing geological stability and potential risks for plant operation.
- Impact on water resources: Assessing effects on groundwater, surface water, and marine waters, including the ability to achieve environmental goals.
- Impact on natural habitats and Natura 2000 areas: Analyzing effects on ecological corridors and protected species of animals and plants.
- **Climate impact**

Addressing Allegations

In its decision, GDOŚ also addressed the allegations raised by social organizations, concluding that the environmental report and proposed technical solutions minimize the risk of negative environmental impacts.

The allegations from NGOs included issues such as:

- Lack of analysis regarding the extraction, storage, and transportation of radioactive materials.
- Failure to consider the construction of road and rail infrastructure necessary for the project.
- Ignoring the project's impact on property values.

These issues were not taken into account, as they fell outside the scope of the environmental decision process.

Source: <https://www.gov.pl/web/gdos>

A NEARLY 2-MILE DEEP DRILL TO UNCOVER EARTH'S PAST

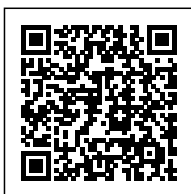
Posted on 19 January 2025 by Patrycja Draguć



Scientists have completed a bold project: extracting an ice core nearly 2.8 km long from the Antarctic ice sheet. What secrets does this cylinder hold? It turns out that studying this ice will be crucial for understanding Earth's changing climate.

Categories: [Issue 1/2025](#), [News](#)

Tags: [Antarctica](#), [ice](#), [ice sheet](#)



Scientists have completed a bold project: extracting an ice core nearly 2.8 km long from the Antarctic ice sheet. What secrets does this cylinder hold? It turns out that studying this ice will be crucial for understanding Earth's changing climate.

Why is the drill so deep?

Antarctica is not just the coldest continent on Earth—it's also the planet's climate archive. The ice there has been forming for millions of years through layers of snow that, under their own weight, compress into ice. Each layer corresponds to a single year, and analyzing them enables scientists to track climate changes over epochs. By drilling this deep, researchers reached ice that formed over a million years ago. Such records allow the reconstruction of long-term climate processes, including glacial cycles.

Ice cores: Earth's time capsules

Ice cores are cylindrical fragments of ice extracted from the deep layers of ice sheets. Every centimeter of these cores holds a story. Trapped within the ice are microscopic air bubbles—true time capsules. These bubbles contain the atmosphere from millions of years ago, including carbon dioxide, methane, and other greenhouse gases. Analyzing their concentrations helps scientists understand past climate changes and their effects. This knowledge is critical for learning how the planet's temperature regulation mechanisms work. Additionally, the hydrogen and oxygen isotopes in the ice reveal the temperatures present when each layer formed, offering insights into conditions that existed hundreds of thousands of years ago.

<https://wodnesprawy.pl/en/ice-and-glacial-caves-amazing-ice-formations-of-our-planet-2/>

Why do scientists study ice cores?

Analyzing ice cores helps determine how variations in greenhouse gas concentrations influenced global temperatures. By comparing past climate changes with current trends, scientists can create more accurate models and predict the consequences of modern emissions. Researchers are confident that the stories told by ice cores serve as a warning about the impacts of climate change, enabling policymakers and NGOs to better plan their actions.

Working in extreme conditions

Some compare drilling in Antarctica to the challenges of space exploration. The work takes place under extreme conditions: temperatures drop below -50°C , and the nearest civilization is thousands of kilometers away. The drilling process took four years, with each stage requiring immense physical and logistical effort. Furthermore, the specialized equipment needed for drilling had to be transported by sea and then assembled and operated on the icy desert.

What happens to the extracted ice core?

After extraction, ice cores are sent to specialized laboratories such as the NSF-ICF (National Science Foundation Ice Core Facility) in the USA. They are stored in freezers at -36°C . Every fragment is meticulously cataloged and prepared for further research.

Ice cores allow scientists to read Earth's past with unprecedented precision. They provide critical insights into the planet's climate mechanisms. These studies not only prepare us for future challenges associated with global warming but also empower us to proactively mitigate its effects.

UNDERWATER CAVES – BEAUTIFUL AND DANGEROUS

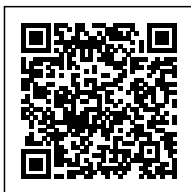
Posted on 18 January 2025 by Iwona Szyrowska-Głodzik



Underwater caves are significant for geological and biological research, as well as for scuba diving exploration. These natural rock formations can be found in both marine waters and freshwater lakes and rivers. They come in the form of tunnels, corridors, chambers, and systems stretching for dozens of kilometers. For scientists, they are a treasure trove of knowledge about Earth's past; for divers, an exhilarating adventure; and for most of us, a mystery we are unlikely to explore.

Categories: [Issue 1/2025](#), [News](#)

Tags: [caves](#), [diving](#)



Underwater caves are significant for geological and biological research, as well as for scuba diving exploration. These natural rock formations can be found in both marine waters and freshwater lakes and rivers. They come in the form of tunnels, corridors, chambers, and systems stretching for dozens of kilometers. For scientists, they are a treasure trove of knowledge about Earth's past; for divers, an exhilarating adventure; and for most of us, a mystery we are unlikely to explore.

Mechanisms of underwater cave formation

The formation of underwater caves is a lengthy process influenced by various geological and hydrological factors. Three primary mechanisms are responsible for creating these structures:

- **Erosion of rocks by water**
Erosion primarily affects limestone and gypsum, which dissolve under the influence of water. The formation of corridors and chambers can take millions of years, with many existing underwater caves having once been dry grottos.
- **Volcanic activity**
Volcanic eruptions can create lava tunnels, which, after being submerged, transform into underwater caves. These formations are most commonly found in regions with high volcanic activity.
- **Tectonic phenomena**
Underwater caves can also form due to tectonic plate movements. This process creates cracks and sinkholes that eventually fill with water, resulting in expansive and often very deep cave systems.

The most famous underwater caves

The world is home to many underwater cave systems with diverse lengths and characteristics. Here are some of the most renowned examples:

- **Sistema Dos Ojos**
Located on the Yucatán Peninsula, this system is one of the longest in the world, with corridors spanning over 80 km. The name Dos Ojos comes from its two entrances, which resemble eyes. The water here is exceptionally clear. During exploration, numerous archaeological treasures, including prehistoric human and animal remains, have been discovered.
- **Blue Hole**
Situated in Dahab on Egypt's Sinai Peninsula, the Blue Hole exceeds 100 meters in depth. It is famous for *The Arch*, a tunnel connecting the cave to the open sea at a depth of 56 meters. This site is immensely popular among divers but is also considered one of the most dangerous, earning the nickname Diver's Cemetery due to numerous fatal accidents.
- **Orda Cave**
The world's longest known gypsum cave is located in Russia's Perm region. It stretches over 5 km, most of which is underwater. The

cave is distinguished by its extraordinarily clear water, offering visibility for dozens of meters.



photo: ashleyhallphotonnk / envato

Challenges and dangers of exploration

Underwater caves are some of the most challenging and dangerous places for divers to explore. These unique environments require not only experience and specialized skills but also meticulous planning and proper equipment. Even the smallest mistake can have serious, sometimes fatal consequences, making it essential to fully understand the risks involved.

One of the greatest dangers in underwater caves is the lack of natural light. These are spaces where no sunlight penetrates, leaving flashlights as the sole source of illumination. If equipment fails, divers can lose their orientation and become lost, often leading to tragic outcomes. Another critical issue is the limited air supply. Every minute underwater requires precise planning, leaving little room for error.

<https://wodnesprawy.pl/en/marble-caves-in-chile-a-phenomenon-on-the-edge-of-the-world/>

The complex structure of underwater caves—with numerous corridors and tunnels that look similar—makes navigation extremely difficult. Even experienced divers can become disoriented in these labyrinths, which is why navigation techniques and marking routes are absolutely essential. Additional challenges include the risk of decompression sickness. During deep dives, gradual ascent is necessary to avoid severe health issues caused by sudden pressure changes.

Underwater caves are also extremely sensitive ecosystems, where even the slightest human interference can impact the environment. Divers entering these caves must be fully aware of their responsibility to nature.

KUMBH MELA 2025 – MILLIONS OF PILGRIMS ON THE BANKS OF THE GANGES

Posted on 17 January 2025 by Iwona Szyprowska-Głodzik



Kumbh Mela can truly be described as a one-of-a-kind event in the world. It is the largest celebration of faith, tradition, and spiritual purification, drawing millions of believers from all over the globe. Held every 12 years in four locations sacred to Hindus, this year's festivities, running from January 13 to February 26, are expected to attract as many as 400 million pilgrims. They gather to immerse themselves in a spiritual meeting, connect with divinity, and participate in sacred rituals, including the Shahi Snan bath at the confluence of three rivers – the Ganges, Yamuna, and the mystical Saraswati. For many, this is a once-in-a-lifetime event, a moment of purification that transcends everyday life and leads to inner peace. However, Kumbh Mela also highlights the clash of two worlds – ancient spirituality rooted in distant history and the modern-day ecological challenges. The river, which for centuries symbolized divinity and renewal, now faces a serious crisis.

Categories: [Issue 1/2025](#), [News](#)

Tags: [Ganges](#), [river](#)



Kumbh Mela can truly be described as a one-of-a-kind event in the world. It is the largest celebration of faith, tradition, and spiritual purification, drawing millions of believers from all over the globe. Held every 12 years in four locations sacred to Hindus, this year's festivities, running from January 13 to February 26, are expected to attract as many as 400 million pilgrims.

They gather to immerse themselves in a spiritual meeting, connect with divinity, and participate in sacred rituals, including the Shahi Snan bath at the confluence of three rivers – the Ganges, Yamuna, and the mystical Saraswati. For many, this is a once-in-a-lifetime event, a moment of purification that transcends everyday life and leads to inner peace.

However, Kumbh Mela also highlights the clash of two worlds – ancient spirituality rooted in distant history and the modern-day ecological challenges. The river, which for centuries symbolized divinity and renewal, now faces a serious crisis.

The origins of Kumbh Mela: the legend of Samudra Manthana

The story of Kumbh Mela is intertwined with one of the most fascinating tales in Hindu mythology – the legend of Samudra Manthana, or the churning of the cosmic ocean of milk.

According to this ancient narrative, the gods (Devas) joined forces with the demons (Asuras) to extract Amrita – the nectar of immortality – from the ocean. However, it was a competition, as both sides wanted to claim the precious elixir for themselves. When it was finally found, the god Vishnu, taking the form of the beautiful Mohini, fled with the pot of Amrita to prevent the demons from seizing it. During this journey, a few drops of the nectar fell to the earth, sanctifying Prayagraj (formerly Allahabad), Haridwar, Ujjain, and Nashik. This event endowed these four locations with unique spiritual significance, making them ideal sites for hosting Kumbh Mela.

Shahi Snan

The key moment of Kumbh Mela is the holy bath in Sangam – the extraordinary confluence of three rivers: the sacred Ganga, the majestic Yamuna, and the mystical, invisible Saraswati. According to beliefs, immersion in these waters purifies not only the body but, most importantly, the soul, washing away all sins and bringing blessings for the future.

This is no ordinary bath – it is a deeply spiritual act where every gesture and every drop of water holds meaning. Pilgrims arrive from the farthest corners of the world, often after months of spiritual preparation, to immerse themselves in these rivers, which for centuries have symbolized divine energy.



photo: Ninara, CC BY 2.0 / commons.wikimedia.org

Along the banks of Sangam, an entire spiritual city springs to life. Camps are set up along the river, where pilgrims can meet sadhu, holy men who have renounced material possessions, as well as gurus and spiritual teachers. There, one can also attend lectures, ceremonies, and prayers.

The scale of this event is evident from the numbers alone. According to press reports, by 3:00 PM on January 14, 25 million people had already bathed in Sangam. This shows how significant this moment is for the faithful.

Sacred but polluted

Kumbh Mela, one of the most important spiritual events in India, attracts millions seeking purification and renewal. However, the festival also exposes the challenges of the modern world. The Ganges, long revered as sacred and a source of spiritual cleansing, now faces serious pollution.

Reports highlight significant issues with water quality. According to measurements by the Central Pollution Control Board (CPCB), the biological oxygen demand (BOD) level in Sangam reached 4 mg/l, exceeding the permissible limit of 3 mg/l. A higher BOD level indicates a large amount of organic matter, reflecting poor water quality. Studies have also shown that the concentration of fecal bacteria (*E. coli*) far exceeds acceptable standards. The river is also burdened with heavy metals and chemicals from industrial and agricultural waste.

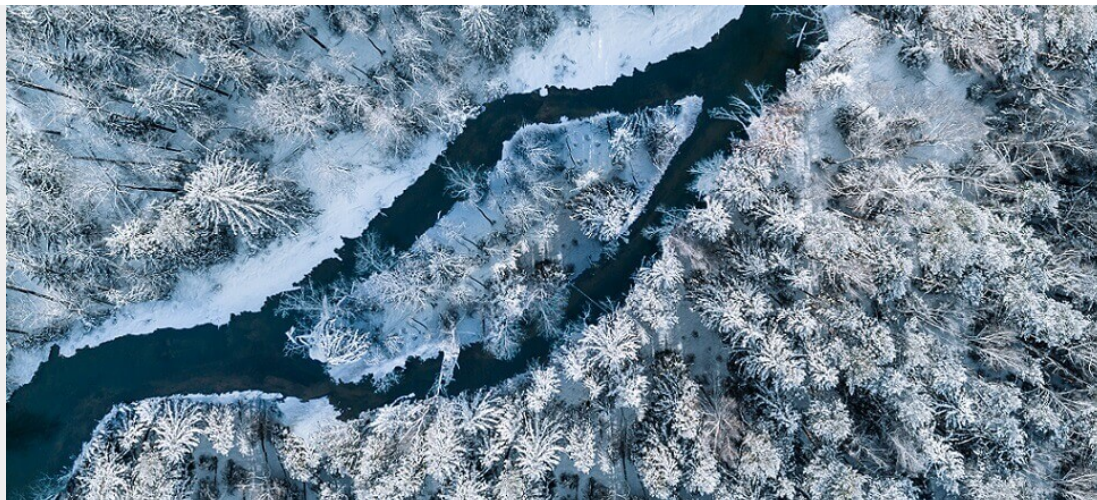
<https://wodnesprawy.pl/en/the-holiest-river-in-the-world-is-one-of-the-dirtiest/>

Local authorities are working to improve the situation. As part of the Namami Gange program, temporary water treatment plants have been installed, water quality monitoring introduced, and information campaigns launched for pilgrims. Barriers have been set up along the riverbanks to catch waste, and bathing areas are regularly checked for safety. However, with a record number of participants at this year's festival, the scale of the problem remains immense, hindering effective action.

Will bathing in the Ganges during this year's Kumbh Mela truly cleanse the faithful of their sins? This question lies in the realm of spirituality. However, whether such a bath is safe for health raises serious doubts.

PLANNED RESTORATION OF 1500 KM OF RIVERS: NATURE RESTORATION LAW IN POLAND

Posted on 16 January 2025 by Agata Pavlinec



On January 14 in Warsaw, a conference titled Nature Saves People – Implementing the Nature Restoration Law in Poland was held. During the event, Joanna Kopczyńska, President of Wody Polskie (Polish Waters), presented a plan for river restoration and wetland recovery. The need for action stems from the EU's Biodiversity Strategy for 2030.

Categories: [Issue 1/2025](#), [News](#)

Tags: [nature](#), [Nature restoration law](#), [river](#)



On January 14 in Warsaw, a conference titled *Nature Saves People – Implementing the Nature Restoration Law in Poland* was held. During the event, Joanna Kopczyńska, President of Wody Polskie (Polish Waters), presented a plan for river restoration and wetland recovery. The need for action stems from the EU's Biodiversity Strategy for 2030.

Nature Restoration Law in Poland

The regulation adopted in June 2024 by the European Parliament and the Council obliges all member states to undertake measures aimed at restoring natural resources. By 2030, at least 20% of all aquatic and terrestrial ecosystems must be restored, with actions covering all areas by 2050.

The Warsaw conference, organized by the Coalition 10%, aimed to discuss various aspects of implementing the Nature Restoration Law, ensuring it also encompasses forest and agricultural policies in Poland. Emphasis was placed on utilizing opportunities provided by the NRL and finding financial resources for its implementation. Among the invited experts were representatives from Wody Polskie.

Plans of Wody Polskie

In her presentation, President Joanna Kopczyńska highlighted ongoing efforts by Wody Polskie that are expected to positively impact the country's biodiversity. In August 2024, an agreement was signed for a project worth over PLN 94 million, titled *Restoring Biodiversity in the Nida Valley through the Restoration of Ecological Corridors and Groundwater Retention*. The project includes 124 km of watercourses and 12 migration barriers, which will be removed or made passable for aquatic organisms.

Additional projects are planned under Action 2.4 *Adaptation to Climate Change, Disaster and Crisis Prevention* within the European Funds for Climate, Infrastructure, and Environment (FEnIKS) program. In December 2024, Wody Polskie signed 12 preliminary agreements for the ecological opening of 473 km of river corridors. These actions will address 145 migration barriers, with the total cost estimated at PLN 280 million.

A further 650 km of rivers are to be restored through projects co-financed by the LIFE program. Wody Polskie has submitted eight applications in this regard.

President Kopczyńska emphasized that the 22 planned actions aligned with the Nature Restoration Law will cover at least 1,491 km of Polish rivers and 322 migration barriers, with a total estimated value of approximately PLN 600 million.



photo: Pilat666 / envato

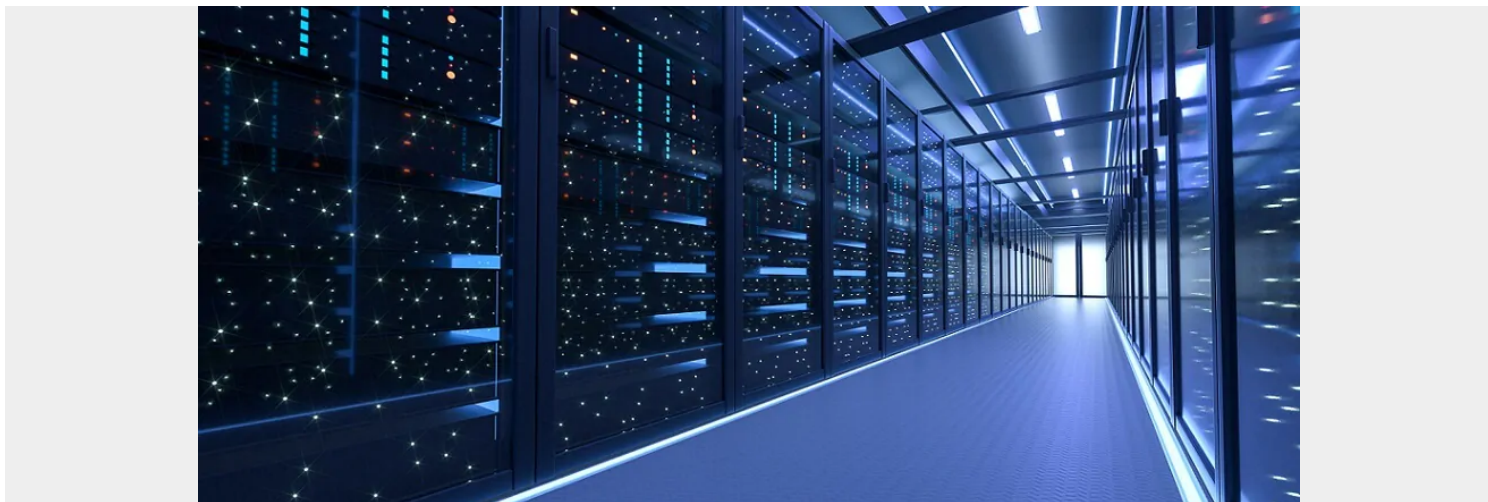
Free-Flowing rivers: restoring natural river courses

The Nature Restoration Law aims to restore at least 25,000 km of rivers in Europe to their free-flowing state by 2030. The methodology, known as Free-Flowing Rivers (FFR), is part of the EU Biodiversity Strategy for 2030 and aims to support the development of freshwater ecosystems and facilitate the migration of endangered species. Expected benefits include flood protection, natural water purification, and recreational potential.

Wody Polskie has joined the testing phase of the FFR plan, designating 100 river sections in the areas managed by the Regional Water Management Boards (RZGW) in Gdańsk and Warsaw. These sections have been analyzed for the presence of cross-sectional barriers, flood embankments, and regulatory structures. The project, implemented in cooperation with the WWF Poland Foundation and the Inland Fisheries Institute, will soon be expanded to include additional sections where restoration actions are deemed justified.

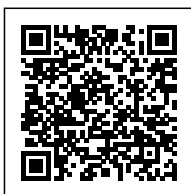
MICROSOFT – COOLING DATA CENTERS WITHOUT WATER?

Posted on 15 January 2025 by Agata Pavlinec



As a leader in computer software, operating systems, cloud computing, and AI applications, Microsoft introduces groundbreaking technology aimed at reducing water usage in the ICT sector. This innovative solution seeks to decrease the environmental burden of data centers while protecting diminishing water resources in various regions. What does this innovation entail?

Categories: [Issue 1/2025](#), [News](#)



As a leader in computer software, operating systems, cloud computing, and AI applications, Microsoft introduces groundbreaking technology aimed at reducing water usage in the ICT sector. This innovative solution seeks to decrease the environmental burden of data centers while protecting diminishing water resources in various regions. What does this innovation entail?

The problem with data centers

The rapid development of artificial intelligence and cloud platforms has increased the demand for data centers—physical “warehouses” of servers with immense capabilities. These facilities consume not only massive amounts of electricity but also significant quantities of water. The latter is primarily used to cool servers and comes from local sources, adding pressure to specific watersheds.

Until now, Microsoft’s data centers have used evaporative cooling technology, which transforms heat in the air into latent energy in the form of humidity. Simply put, water supplied to the centers evaporates, cooling the air and preventing the electronic equipment from overheating. While effective, this solution has become increasingly controversial, considering global droughts and challenges in ensuring water supply for populations.

<https://wodnesprawy.pl/en/chatgpt-a-water-guzzling-giant/>

The new cooling method – implementation plan

In August 2024, Microsoft began rolling out new data center cooling technology utilizing a closed-loop water system. The system is filled with H₂O during construction, and its operation requires no additional water resources. Cooling occurs at the chip level, allowing precise temperature control of servers. According to Microsoft, this solution will save 125 million liters of water annually per data center.

Existing data centers currently operate with both the old and new technologies simultaneously. However, the tech giant promises that starting in 2026, new centers planned in Phoenix, Arizona, and Wisconsin will be equipped exclusively with mechanical cooling systems. Water will then only be used for building administration purposes, such as kitchens and restrooms.

Microsoft’s environmental commitment

Microsoft’s new initiative is a continuation of its goals outlined in a June 2024 declaration, aimed at minimizing reliance on local natural resources and reducing the operational footprint of data centers for the benefit of local communities. These investments are already delivering measurable benefits in water management, tracked using the Water Usage Efficiency (WUE) metric. This metric represents the annual amount of water used for humidification and cooling in data centers relative to their energy demand.

In 2021, Microsoft’s global average WUE was 0.49 liters/kWh, which decreased to 0.30 liters/kWh in 2024—a 39% improvement in water efficiency. Initiatives like expanding the operational temperature range and using recycled water in Texas, Washington, California, and Singapore have contributed to this success. The new server cooling technology is expected to bring the WUE metric close to zero, according to company representatives.

Microsoft acknowledges that implementing mechanical cooling systems will increase nominal energy consumption in data centers. However, efforts are underway to develop technological enhancements to mitigate this effect. Furthermore, recognizing its role and responsibility as a leader in AI systems, Microsoft aims to further transform its data centers to achieve net negative carbon emissions and zero waste by 2030. By 2025, the company also plans to power its data centers entirely with renewable energy, expanding and decarbonizing local electrical grids.

SUCCESS IN COMBATING GOLDEN ALGAE – AN EXPERIMENT ON THE KŁODNICA RIVER

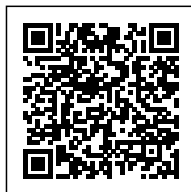
Posted on 14 January 2025 by Agata Pavlinec



In the summer of 2024, a team of scientists conducted an experiment involving the use of hydrogen peroxide to limit the bloom of *Prymnesium parvum* algae in the Kłodnica River in Silesia. The method proved highly promising, allowing researchers to formulate basic guidelines for preventing future toxic algae blooms.

Categories: [Issue 1/2025](#), [News](#)

Tags: [Golden algae](#), [Prymnesium parvum](#), [river](#)



In the summer of 2024, a team of scientists conducted an experiment involving the use of hydrogen peroxide to limit the bloom of *Prymnesium parvum* algae in the Kłodnica River in Silesia. The method proved highly promising, allowing researchers to formulate basic guidelines for preventing future toxic algae blooms.

Seasonal and geographical context of the experiment

The bloom of golden algae in 2022 caused an ecological disaster on the Odra River, resulting in 249 tons of dead fish being collected across five provinces within a few weeks. Unsurprisingly, experts have been working for two years to develop methods to combat this lethal haptophyte, which has found particularly favorable conditions for growth in the Gliwice Canal. The Kłodnica River was selected as the site of the experiment because the problematic canal flows into it before continuing on to the Odra.

In early August 2024, large amounts of *Prymnesium parvum* were detected in the Dzierżno Duże Reservoir, with increasing concentrations also found in the Kłodnica River. The risk of another ecological disaster prompted scientists to attempt the use of perhydrol, a 35% hydrogen peroxide solution commonly used worldwide for wastewater treatment and algae bloom control, including haptophytes. In Poland, the efficacy of H₂O₂ in combating golden algae had already been confirmed in laboratory tests conducted at the University of Warsaw.

How were the tests with perhydrol on the Kłodnica River conducted?

The experiment was made possible through the successful collaboration of the IOŚ-PIB, GDOŚ, and RDOŚ Katowice, as well as RZGW Gliwice, public officials, and local governments. From August 13, perhydrol was introduced into the river over three weeks via an installation mounted below the Pławniowice water dam. Two water sampling points were established upstream, and four sites downstream were used to assess the actual effects of the substance application.

Throughout the experiment, regular measurements were taken to monitor perhydrol concentrations in different sections of the river. Additionally, researchers assessed water temperature, oxygen levels, pH, redox potential, and the presence of chlorides, sulfates, and nitrogen and phosphorus compounds. Analyses also included biological and chemical oxygen demand, as well as other physicochemical and microbiological parameters. The most crucial part of the study involved measuring the abundance of *Prymnesium parvum* in the Kłodnica.

Results of the experiment on the Kłodnica River

The application of perhydrol at a concentration of 10 mg/l eliminated golden algae with 90% efficiency, while doses of approximately 15 mg/l achieved an efficiency of over 99%. These results demonstrate that hydrogen peroxide is exceptionally effective in combating *Prymnesium parvum* blooms. To reduce the abundance of the haptophyte below the warning level set by GIOŚ, a dose of 13 mg/l is sufficient—lower than previously expected.

The experiment on the Kłodnica River also showed that using perhydrol does not pose a significant threat to the natural environment. There was no increase in levels of ichthyotoxins harmful to fish, nor did fundamental physicochemical or microbiological water parameters change significantly. The only issue encountered was a temporary rise in H₂O₂ concentration, caused by reduced water flow through a power plant

located upstream of the application site. According to the experiment's authors, applying perhydrol at recommended doses should not impact fish populations. Other algae also appear to be much more resistant to hydrogen peroxide than haptophytes. However, the tests did affect rotifers (small invertebrates that are part of the zooplankton) and submerged macrophytes.

Experts from the Inland Fisheries Institute PIB positively assessed the results of the experiment conducted on the Kłodnica. However, they suggest careful dosing in future applications and ensuring that fish have the ability to migrate to areas with lower concentrations of the compound. Hydrogen peroxide should initially be introduced at low concentrations to drive fish away, with doses gradually increasing to the target levels.

Despite the positive results, the authors of the Kłodnica experiment caution that these findings apply only to the local situation. In different environmental conditions, combating golden algae with hydrogen peroxide may yield varying results.

<https://ios.edu.pl/wp-content/uploads/2025/01/raport-eksperymentalne-zastosowanie-nadtlenku-wodoru-do-ograniczenia-zakwitu-prymnesium-parvum-w-rzece-klodnicy-latem-2024-r.pdf>

Main photo: gov.p

CAN A MUNICIPALITY WITHDRAW FROM ADMINISTRATIVE PROCEEDINGS IN WHICH IT PARTICIPATES

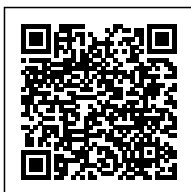
Posted on 13 January 2025 by Piotr Tarkowski



In cases concerning changes in water conditions on land that adversely affect neighboring properties, the municipality often appears as a party to such proceedings. This is not accidental, as municipalities frequently own numerous properties.

Categories: [Issue 1/2025](#), [News](#)

Tags: [Administrative proceedings](#), [Municipality](#), [water law](#)



In cases concerning changes in water conditions on land that adversely affect neighboring properties, the municipality often appears as a party to such proceedings. This is not accidental, as municipalities frequently own numerous properties.

Article 234(3) of the Water Law states: *If changes in water conditions on land caused by a landowner adversely affect neighboring properties, the mayor, city mayor, or president, ex officio or upon request, shall, by decision, order the landowner to restore the previous condition or to construct facilities to prevent damages, setting a deadline for these actions.* Therefore, the municipality may be both a party to the proceedings and the entity that concludes them with a decision issued by the executive body—either the mayor, city mayor, or president.

It seems logical that the mayor, city mayor, or president should not conduct proceedings in which the municipality is a party. This situation raises legitimate concerns, as other parties to the proceedings may primarily question the impartiality and fairness of conducting such a case. What do legal regulations say about this situation? Do they allow the executive body of a municipality to withdraw from such proceedings so that they may be conducted by the executive body of another, neighboring municipality, for example?

Amendment to the Code of Administrative Procedure from 1990

On May 24, 1990, with the entry into force of a law three days later (published in *Dz.U. No. 34, item 201*), a provision was added to the Code of Administrative Procedure, which stated:

Article 27a § 1: *Municipal authorities are also excluded from handling cases in which the municipality is a party.*

§ 2: *In cases defined in § 1, the case shall be handled by the authority of another municipality designated by:*

1. *The appeals board at the voivodeship council—in matters concerning the municipality's own tasks,*
2. *The voivode—in matters concerning delegated tasks of government administration.*

This provision, as its literal wording indicated, allowed for the exclusion of a municipality's authority (including its executive body) from handling cases in which the municipality was a party.

However, this provision was removed from the Code of Administrative Procedure by the Act of October 12, 1994 (*Dz.U. No. 122, item 593*), which came into force on December 6, 1994. After this date, there was no general provision (in the Code of Administrative Procedure) that allowed for the exclusion of a municipality's authority from handling cases in which the municipality was a party. Appropriate exclusions could therefore only be found in specific laws, including the Water Law discussed in this article.

Lack of relevant exclusions in the Water Law

From December 6, 1994, onward, the following Water Laws have been in force in Poland:

- The Act of October 24, 1974,
- The Act of July 18, 2001,
- The currently applicable Act of July 20, 2017.

None of these laws have included provisions stipulating that a mayor, city mayor, or president must be excluded from handling cases concerning changes in water conditions on land that adversely affect neighboring properties, in which the municipality is a party, and the executive body (mayor, city mayor, or president) conducts the proceedings. It seems clear, therefore, that there is currently no legal basis for such exclusion, making it legally impossible.

Court rulings on this issue

The issue of the lack of grounds for excluding mayors, city mayors, or presidents from handling cases concerning changes in water conditions on land that adversely affect neighboring properties—where the municipality is a party and the executive body conducts the proceedings—also appears definitively and unequivocally resolved in court rulings.

The Provincial Administrative Court in Warsaw, in its judgment of May 25, 2012 (case no. IV SA/Wa 507/12), stated:

In the Court's opinion, there is no clear legal provision supporting the position of the authority presented in the challenged decision of (...) January 2012. In other words, the Mayor of the Municipality of S., as a public administration authority, is not excluded from ruling in a case in which the Municipality of S. is a party.

The obligation to exclude the authority in the case at hand cannot be derived from Article 24 of the Code of Administrative Procedure, as this provision concerns the exclusion of an authority's employee rather than the authority itself. The exclusion of an administrative authority is the subject of a separate regulation under Article 25 § 1 of the Code of Administrative Procedure, which also cannot apply to this case.

This position is also supported by rulings from the Supreme Administrative Court in Warsaw, including the judgment of April 1, 2009 (case no. II OSK 460/08)—

There is no clear legal provision, similar to the repealed Article 27a of the Code of Administrative Procedure, excluding the mayor, city mayor, or president from ruling in cases where their municipality is a party—and the judgment of May 24, 2012 (case no. II OSK 2657/11):

It should also be noted that the procedural regulations in force do not include a general provision requiring the exclusion of a local government authority when the case subject to administrative proceedings is connected to the legal interest of the given local government entity.

Likewise, the Water Law does not provide for the exclusion of mayors, city mayors, or presidents in cases where the municipality is a party to the substantive legal relationship. However, such situations are provided for in other substantive legal provisions, where the legislator, recognizing the conflict of legal interests between the local government community and individuals, introduced the institution of authority exclusion. An example is the amendment to the Act on Real Estate Management introduced by the Act of August 24, 2007.

Similar rulings have been made by other provincial administrative courts, such as in Lublin (judgment of December 20, 2016, case no. II SA/Lu 729/16) and Białystok (judgment of September 13, 2016, case no. II SA/Bk 341/16).

Faulty practice of appeals boards

Due to the aforementioned administrative court rulings, it is extremely rare for cases concerning changes in water conditions on land that adversely affect neighboring properties to be handled by the executive body of a municipality other than the one with local jurisdiction. Nevertheless, such cases do occur. They mainly result from erroneous rulings by local appeals boards, often issued at the request of a mayor, city mayor, or president who does not wish to rule in a case in which the municipality is a party and the executive body. Since such rulings are improper (being issued without legal basis) and cannot be appealed, they can only be challenged in an appeal against the issued decision by the unauthorized authority or subsequently in a complaint to the provincial administrative court.

LARGEST UNDERWATER SHIPWRECKS

Posted on 12 January 2025 by Agata Pavlinec



The history of sea voyages is strewn with dramas, the traces of which rest on the seabed today. Among the biggest wrecks are unsinkable warships and luxury passenger ships. Some of them have gone down in history as the most tragic disasters at sea with thousands of deaths. There are also underwater wrecks whose contents still thrill.

Categories: [Issue 1/2025](#), [News](#), [Onet](#)

Tags: [Baltic](#), [ocean](#), [sea](#), [ships](#), [wrecks](#)



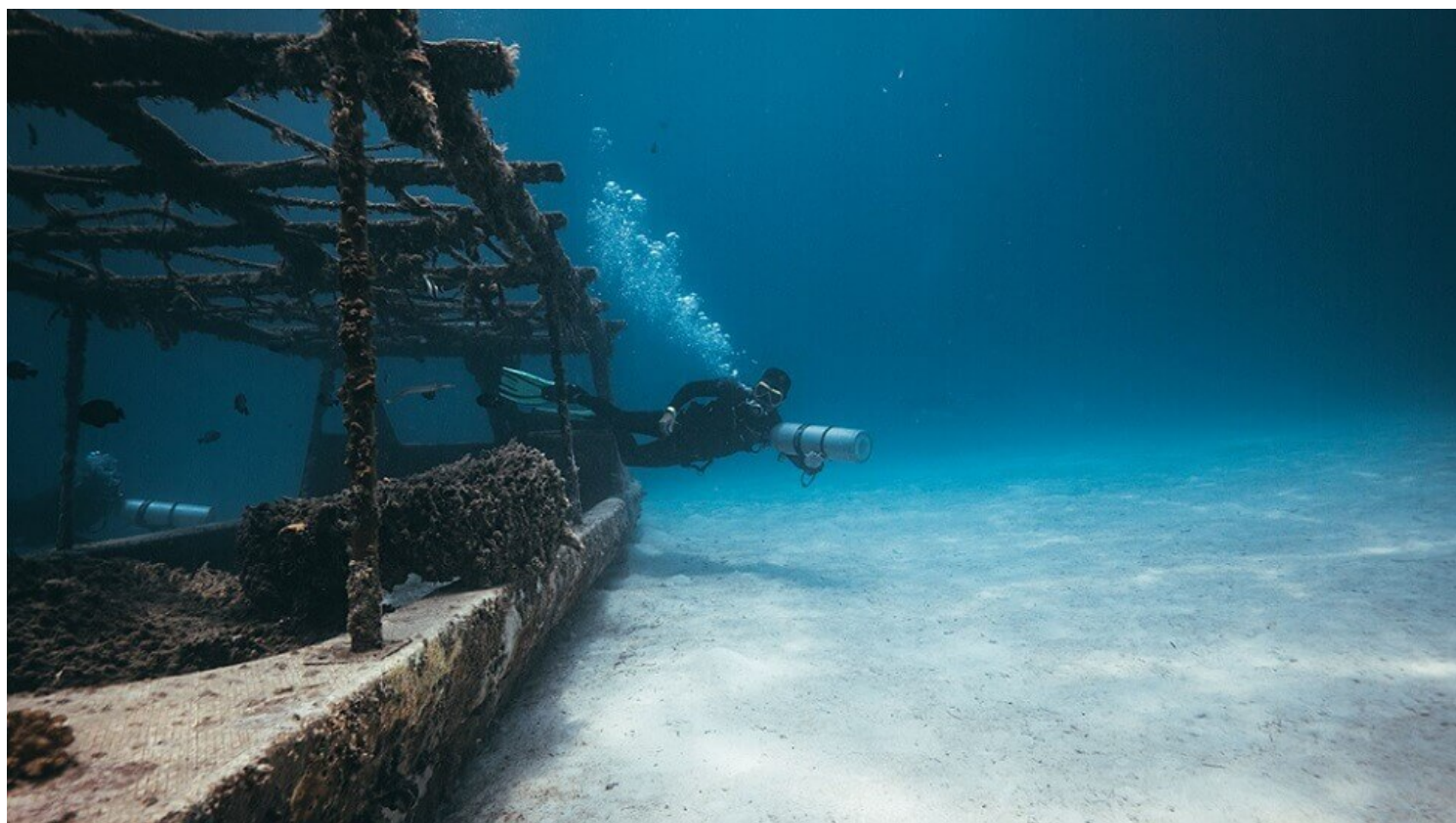
The history of sea voyages is strewn with dramas, the traces of which rest on the seabed today. Among the biggest wrecks are *unsinkable* warships and luxury passenger ships. Some of them have gone down in history as the most tragic disasters at sea with thousands of deaths. There are also underwater wrecks whose contents still thrill.

Undersea cemeteries

350 nautical miles off the coast of Newfoundland, the wreck of the world's most famous ship rests at a depth of 3840 meters. *The Titanic* on its first voyage from Southampton to New York in 1912 collided with an iceberg and sank along with more than 1,500 passengers and crew. At the time, it was the largest passenger ship in the world at 269 meters in length, and on board were valuables that still generate much excitement today. Not surprisingly, exactly 100 years after the tragedy, the wreck was protected as a UNESCO Underwater Cultural Heritage.

An almost identical wreck is sunk at a depth of just 122 meters, 2 nautical miles off the coast of Kea Island in the Aegean Sea. *The Britannic* was launched 3 years after the *Titanic* tragedy, but was used as the largest floating hospital in the world as World War I unfolded. In 1916 it hit a German mine and went down within an hour. Fortunately, most of the more than 1,000 passengers were saved.

A year earlier, the British transatlantic liner *Lusitania* was sunk by a German submarine 11 nautical miles off the coast of Ireland. The 239.9-meter-long ship had just sailed from New York with 1,960 passengers on board. The unexpected German aggression claimed nearly 1,200 lives, 128 of whom were Americans. The tragedy reinforced the US public's support for joining the war. The wreckage is at a depth of 93 meters, and its hull is beginning to disintegrate.



pic. wirestock / envato

Largest military wrecks

The warfare sank a huge number of ships, on which civilians also died. The biggest maritime disaster in history was the torpedoing of the German ship *MS Gustloff* by a Soviet submarine in 1945. The death toll at the time was around 9,000 passengers, including Poles, Lithuanians and Latvians evacuated from Germany. The wreck of *the Gustloff* haunts to this day - as one of the largest such objects at the bottom of the Baltic Sea, it provokes questions about the possibility of toxic leaks as corrosive materials degrade.

Among the largest military wrecks are also two of Japan's brother ships, the *Yamato* and *Musashi*, the heaviest and most heavily armed vessels of their time. Both measured 263 meters and had a displacement of 73,000. tone. The American-attacked *Musashi* sank in the Philippine Sea at a depth of more than 1,000 kilometers - its wreck was only discovered by American billionaire Paul Allen in 2015. It was much easier to find the sunken wreck of the *Yamato*, which is located at a depth of 340 meters, 180 miles off the Japanese island of Kyushu.

Treasures and self-destruction, or controversial shipwrecks

On the sandy bottom of the Atlantic, between the coast of South Carolina and Bermuda, more than 5 km below the surface of the sea, rests the wreck of the only super aircraft carrier ever sunk. Paradoxically, measuring more than 300 meters in length, the ship *USS America* was deliberately sent to the bottom by the US military. The vessel, built in the 1960s, served the Navy in Vietnam and during the Persian Gulf conflict. As part of her retirement in 2005, a series of bomb and torpedo tests were conducted on her to test the endurance of super aircraft carriers. The controversial sinking idea sparked opposition from a wide range of war veterans.

Even more exciting, and has been for more than 100 years, is the wreck of the British transatlantic liner *RMS Republic*. In 1909, the 173-meter-long luxury ship collided in thick fog with the Italian *SS Florida* and sank off the coast of Massachusetts. On board were coins valued at a staggering \$10 billion. So far, the treasure remains buried 82 meters below sea level, and there has been a fierce court battle over ownership for the past four decades since its location. In 2025. plans to extract valuable cargo.

MORSKIE OKO IN WINTER – WHY DOES IT ATTRACT THE MOST TOURISTS DURING THIS SEASON?

Posted on 11 January 2025 by Patrycja Draguć



Tourists agree that the pearl of the Tatra Mountains, as Morskie Oko is commonly called, becomes its most magical in winter. It's easy to imagine the grandeur of the moment when this lake, surrounded by snow-covered peaks, reveals the true power of nature. While winter is an exceptionally charming season, especially in the mountains, it can also bring dangers. Discover key information and plan your dream trip to Morskie Oko in winter.

Categories: [Issue 1/2025](#), [News](#)

Tags: [MorskieOko](#), [mountains](#), [snow](#), [winter](#)



Tourists agree that the pearl of the Tatra Mountains, as Morskie Oko is commonly called, becomes its most magical in winter. It's easy to imagine the grandeur of the moment when this lake, surrounded by snow-covered peaks, reveals the true power of nature. While winter is an exceptionally charming season, especially in the mountains, it can also bring dangers. Discover key information and plan your dream trip to Morskie Oko in winter.

Natural and environmental features

Morskie Oko is the largest lake in the Tatra Mountains, located at an altitude of 1,395 meters above sea level. When it freezes, it forms an ice cover that, in the past, reached up to 1 meter in thickness. Unfortunately, climate change has left its mark here. This thickness has decreased to 0.65 meters, and the duration of ice cover has shortened from 170 to 139 days.

Visiting the pearl of the Tatras in winter allows you to admire the snow-covered surrounding mountains: Mnich and Mięguszowieckie Peaks. However, such conditions also bring the risk of avalanches, particularly in the gullies, such as Żandarmeria or Marchwiczny, where masses of snow, ice, and rocks regularly flow. These avalanches can reach the trails and pose a real threat to tourists.

Getting to Morskie Oko in winter and changes in transportation

Traditionally, tourists reach Morskie Oko in winter on foot or by horse-drawn sleighs, which replace the summer wagons (fasiagi). The trail begins at Palenica Białczańska, where there is a paid parking lot and buses from Zakopane. From there, a 7.7-kilometer asphalt road leads to the lake, which can be traversed on foot in about 3 hours. In recent years, initiatives have been launched to modernize transportation to Morskie Oko. In May 2024, electric buses were tested on this route as a replacement for traditional horse-drawn carriages. The ultimate goal is to introduce electric buses to improve animal welfare and modernize tourist transportation in the region.

Practical tips for tourists visiting Morskie Oko in winter

- Proper preparation is key: Ensure you have warm clothing, suitable footwear, and a thermos with a hot drink. Check current weather conditions and avalanche warnings before setting off. Since it gets dark earlier in winter, start your hike earlier in the day.
- Safety on the trail: Due to avalanche risks, particularly on the section above Włosienica, caution is advised, and hikes should be avoided in unfavorable conditions. Walking on the frozen lake surface is also strongly discouraged, as the ice may be thin and could break under a person's weight.
- Transportation to Morskie Oko: Currently, tourists can use sleighs to get to Włosienica, from where it's about a 1.5-kilometer walk to the shelter by the lake. However, keep track of updates, as the introduction of electric buses may change access methods in the future.

Morskie Oko in winter captivates with its unique charm. Before starting your trip, check current information and announcements, and follow the recommendations of the Tatra National Park staff to safely and fully enjoy your planned mountain adventure.

Fun facts about Morskie Oko – do you know them?

- The name: Do you know why Morskie Oko is called that? German settlers described lakes in the Tatras with the words *Meer* (sea) and *Auge* (eye). Another legend suggests that the name comes from an underground connection between the lake and the sea.
- Stocked mountain lake: Morskie Oko was once called Fish Lake (*Rybim Jeziorem*) or Fish Pond (*Rybim Stawem*) because it is one of the few naturally stocked lakes in the Tatras, home to trout.
- Legends of a connection to the Adriatic: According to legends, Morskie Oko has no bottom because it is directly connected to the sea. Evidence for this claim is said to be the retrieval of objects from Morskie Oko's waters that came from a ship sunk in the Adriatic Sea.

FIRES IN CALIFORNIA – ELEMENT CONSUMES THOUSANDS OF HECTARES

Posted on 10 January 2025 by Iwona Szyprowska-Głodzik



As of January 7, 2025. California is grappling with one of the most tragic natural disasters in history. The fires that have covered much of Los Angeles County have caused unimaginable damage. The cause of the element is attributed to the extreme weather conditions that have been occurring in the region for months. Years of drought have led to the drying up of reservoirs and rivers, turning vegetation into ideal fuel. The situation is exacerbated by gusty Santa Ana winds, reaching speeds of up to 80 km/h, which scatter sparks over vast distances, accelerating the spread of the fire.

Categories: [Issue 1/2025](#), [News](#), [Onet](#)

Tags: [California](#), [fires](#), [USA](#)



As of January 7, 2025. California is grappling with one of the most tragic disasters in history. The fires that have covered much of Los Angeles County have caused unimaginable damage. The cause of the element is attributed to the extreme weather conditions the region has been experiencing for months. Years of drought have led to the drying up of reservoirs and rivers, turning vegetation into ideal fuel. The situation is exacerbated by gusty Santa Ana winds, reaching speeds of up to 80 km/h, which scatter sparks over vast distances, accelerating the spread of the fire.

The number of victims is growing

The fires have already claimed 10 lives, but authorities fear the number could be higher - many people are still considered missing. More than 130,000 residents have been affected by the evacuation and have had to leave their homes in a hurry. Firefighters, often working in extreme conditions, are struggling to contain the spread of the fire. Authorities and humanitarian organizations are trying to provide those affected with the necessary assistance, but the scale of the tragedy makes it difficult to coordinate efforts.



pic. CAL FIRE_Official / Flickr

Lack of water paralyzes firefighting operations

One of the biggest challenges for firefighters has been the inefficiency of the water supply infrastructure. In many areas, hydrants have stopped working, making it significantly more difficult to extinguish fires effectively. The problem stems from several key causes. First, the prolonged drought has led to a drastic reduction in water levels in reservoirs and rivers, limiting the availability of water resources. Many of the reservoirs have been over-exploited to meet water needs for agriculture, industry and a rapidly growing population.

Second, the water supply network in many areas is outdated and insufficiently prepared for extreme loads. During fires, the huge demand for

water, both for firefighting and for the needs of evacuated residents, causes rapid pressure drops in the network. As a result, hydrants in key locations have been unable to deliver water in sufficient quantities.

An additional factor is the lack of adequate investment in water infrastructure in recent decades. Many municipalities are struggling with limited budgets, making it impossible to upgrade networks and build new water reservoirs. These problems are compounded by climate change, which prolongs drought periods and increases the risk of wildfires.

The lack of water at key moments forced firefighters to use alternative sources such as tankers, but this took time and logistical preparation. Experts point out that the problem stems from years of neglect in upgrading infrastructure and insufficient preparation for such extreme events.



pic. CAL FIRE_Official / Flickr

The threat continues

Meteorological forecasts for Los Angeles County indicate a continuation of adverse weather conditions conducive to the spread of wildfires. The National Weather Service (NWS) has issued a warning in effect until Friday, January 10, 2025, at 6 p.m. Pacific time. The warning applies to inland areas of the Los Angeles County coast, including the center of its capital city.

During this period, north and northeast winds of 15 to 25 mph (24-40 km/h) are forecast, with gusts up to 35 mph (56 km/h), and up to 45 mph (72 km/h) in the Hollywood Hills area. Relative humidity is expected to remain at 7-15 percent, with a slight improvement at night. Local authorities have issued warnings, urging people to be ready to evacuate if the situation worsens.

President Biden promises support

The fires in California are already among the most destructive in the region's history. In Los Angeles County, entire neighborhoods have been completely destroyed, and many families have lost their livelihoods. According to preliminary estimates, more than 9,000 buildings have been destroyed, including homes, businesses and public facilities. The scale of the destruction means that reconstruction will take years, and costs could be record high.

President Joe Biden assured that the federal government will cover the costs of rebuilding the damaged areas. In his speech, he stressed that the disaster calls for decisive action, both in terms of helping those affected and investing in infrastructure to prevent similar tragedies in the future.



pic. Rosemary Miklitsch / Flickr

Celebrity homes in flames

Fire spares no one. The luxury mansions of Paris Hilton, Billy Crystal, Jeff Bridges and Miles Teller burned to the ground. Historic mansions and historic villas, symbols of California's cultural heritage, were also destroyed. Paris Hilton, in an interview, shared her traumatic experience, speaking of her helplessness in the face of the flames engulfing her home.

Some of the destruction has affected places of special historical value, such as the William S. Hart mansion, the silent movie museum and the Getty Villa. Fire also consumes historic villas in Malibu and Pacific Palisades and threatens Will Rogers' residence in the park named after him.

Hazard map

The current situation can be followed on a fire map compiled by the Los Angeles Times. According to the latest data, the largest fires are:

- Palisades Fire: 19,978 acres (8090 ha), destroyed homes and businesses in Pacific Palisades and along Pacific Coast Highway;
- Eaton Fire: 13,690 acres (5540 ha), significant damage in Altadena and Pasadena;
- Kenneth Fire: 960 acres (390 ha), damage in Woodland Hills area;
- Sunset Fire: 60 acres (24 ha) in Hollywood and Hollywood Hills;
- Hurst Fire: 855 acres (346 ha), partially contained in Sylmar.

Curfew and prevention activities

Due to numerous incidents of looting in areas affected by the fires, Los Angeles authorities have imposed a curfew to protect residents' property. The National Guard has been called in to assist local services, tasked with maintaining order and supporting evacuations. Authorities are appealing to residents to observe safety rules and report any suspicious activity.

WATER MAINTENANCE PLANS ARE NOT BUILDING RESERVOIRS

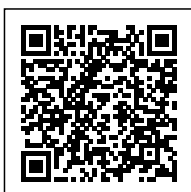
Posted on 9 January 2025 by Agnieszka Hobot



The topic of water maintenance plans has resurfaced across the country. For a simple reason - public consultations have just started on 11 documents that indicate where and what will be done on rivers in terms of maintenance work. Are these documents in line with public expectations? How many voices - so many opinions.

Categories: [Issue 1/2025](#), [Issue topic](#), [Onet](#)

Tags: [retention tank](#), [water maintenance plans](#)



The topic of water maintenance plans has resurfaced across the country. For a simple reason – public consultations have just started on 11 documents that indicate where and what will be done on rivers in terms of maintenance work. Are these documents in line with public expectations? How many voices – so many opinions.

The water maintenance plan is about maintaining

Well the name couldn't be any more literal. A water maintenance plan refers to activities that are defined as just that. Only with this definition most of us have a problem. Why is that? The answer is obvious – has anyone outside the industry, local governments or NGOs even heard of it? I think it's a waste of time to do a street poll on this issue, since most of the *difficult* water management formulations have not been heard of by anyone in this country. Is this a pebble in someone's garden?

No, this is the result of historical ignoring of water management. This has always been the case, regardless of policy or attempts by the administration to raise public awareness. However, returning to water maintenance, it is worth emphasizing what it is. In the pages of *Water Matters*, at the beginning of last year, after the Polish Water Administration began working on new documents, there was an article by Katarzyna Biegun, who explained it precisely. I recommend this reading for the second time. What is worth quoting again is the sheer scope of maintenance work that is carried out on our rivers and streams. And they are:

- Mowing plants from the bottom and banks;
- Removal of floating and rooting plants in the bottom;
- Removal of trees and shrubs overgrowing the bottom and banks;
- Removal of natural and man-made obstacles;
- Backfilling of bank and bed breakouts and biological development;
- Pumping by removing blockages that impede the free flow of water and removing silt and debris;
- Repair or maintenance of regulatory structures and insurance of water facilities;
- Demolition or modification of beaver dams and backfilling of beaver burrows or burrows of other animals in the banks of watercourses.

That is, the above statement does not include the construction of any hydrotechnical infrastructure, including flood control. I emphasize that carrying out maintenance activities should be justified, preceded by a thorough analysis of needs, and then evaluated in terms of impact on the state and natural resources.

Does this apply to my neighborhood?

My impression is that the Water Law is among other legislation of the same level a hundred times unique – cruel to the reader. Even if one wanted to learn more about water maintenance, one has little chance to do so. The documents themselves, prepared in accordance with the

wording of Article 327 of the same law, in a form that would allow them to get through the Government Legislation Center, are simply tabular summaries containing hundreds of records of data. How do I find out if maintenance work will be done on this river that flows in my municipality or beyond my fence?

And well - first you need to determine where this river is located in relation to the unit of Polish Waters responsible for the administration of watercourses. It would seem - porridge with milk, but if you haven't yet had the need to contact Polish Waters, it is no longer so obvious. Water maintenance plans are prepared in a catchment division, according to the boundaries established for each regional water management board: Bialystok, Bydgoszcz, Gdansk, Gliwice, Krakow, Lublin, Poznan, Rzeszow, Szczecin, Warsaw, Wroclaw.

If you are not sure of the location of the surrounding watercourse - it is worth using the [hydroportal](#), where your neighborhood and this division can be found. In order to facilitate the use of tabular lists of maintenance works during public consultations, a portal has been prepared to present them in an accessible form. You can find it at the [link](#).

Expectations versus reality

Anyone who has encountered a flood or even flooding disaster - regardless of the value of the property involved - generally expects the problem to be moved away, which is hardly surprising. This push-back from one's plot of land, farmland or other property close to us often means that someone else - further downstream - will experience such a problem. Impounding watercourses beyond the necessary minimum results, even leaving aside environmental considerations, in water flowing faster in the river, often further eroding the banks, which in turn requires another intervention - fortifications. And so the circle closes.

I deliberately leave out the environmental aspect, as environmental organizations are working vigorously to prevent excessive degradation of ecosystems. And that's a good thing. It is impossible to disagree with a number of these arguments. How, then, is there to be a wolf that eats and a sheep that is whole? It is difficult to have such a situation, unless someone feeds the wolf something else. And what could that be in the case of water maintenance? Nothing more than to make small changes in the development of the plot or field through which our river flows.

Fortunately, there are more and more farms and areas in Poland where instead of cleaning the river of everything in it, river-friendly measures are being implemented and promoted. Which, in the long run, in the face of the country's worsening drought, produces extremely beneficial results. I will agree that such changes are not possible everywhere. There are and will be places where interference with a watercourse bed or its banks will be necessary. But such conduct should be the exception, not the rule. Therefore, it is worth reading the maintenance plans and expressing your opinion.

Public consultation on water maintenance plans 2025

I always say that public consultations are not just a formality, but first and foremost an opportunity for each of us - from riverside residents to local governments to environmental organizations - to express our opinions on water maintenance plans. This time it's about the documents for the next few years, so it's worth knowing what we'll find in them and whether our area is affected. Another, more direct way to get acquainted with the documents are the consultation meetings organized throughout Poland - you can find all the details about the places and dates on the Polish Water website.

Water maintenance plans - although they sound dry and technical - affect each of us. Public consultation is the moment when we can make a difference, but only if we take the chance. Should everyone take an interest? Yes. Will everyone do it? Probably not. But if we care about good management of Poland's waters, it's worth looking at the portal to see what's really planned. Because if not us, then who?

pic. main: Max Hermansson / Unsplash

POLAND'S PRESIDENCY OF THE COUNCIL OF THE EU

Posted on 9 January 2025 by Monika Zabrzeńska-Chaterera



Poland's trio presidency of the Council of the European Union with Denmark and Cyprus will last from January 1 to June 30, 2025. This means cooperation between the three countries holding the presidency in succession and the European Commission to prepare an 18-month work program. On the basis of this, each of them develops its own more detailed six-month program.

Categories: [From the European Commission](#), [Issue 1/2025](#), [Onet](#)

Tags: [Council of the EU](#), [EU](#), [Presidency](#)



Od 1 stycznia do 30 czerwca 2025 r. trwać będzie prezydencja Polski w Radzie Unii Europejskiej w ramach trio z Danią i Cyprem. Oznacza to współpracę trzech państw sprawujących kolejno po sobie prezydencję z Komisją Europejską w celu przygotowania osiemnastomiesięcznego programu pracy. Na jego podstawie każde z nich opracowuje własny, bardziej szczegółowy program półroczny. Mottem polskiej prezydencji w Radzie Unii Europejskiej jest *Bezpieczeństwo, Europa*.

The security pillars of the Polish presidency will be: the ability to defend and protect people and borders, resilience to foreign interference and disinformation; ensuring security and freedom of economic activity, energy transition; competitive and resilient agriculture, and health security.

General context

In order to ensure continuity for the presiding member states, a trio system was introduced in 2009. (through the Lisbon Treaty) a trio system was introduced. Each country's presidency begins on January 1 or July 1 and ends on June 30 or December 31, respectively.

Przedstawiciele państwa sprawującego prezydencję w Radzie Unii Europejskiej, zarówno na szczeblu ministerialnym, jak i eksperckim, są odpowiedzialni za ustalanie porządku obrad posiedzeń poszczególnych gremiów Rady UE oraz prowadzenie negocjacji w gronie państw członkowskich. Polska po raz pierwszy prezydencję w Radzie Unii Europejskiej sprawowała w drugiej połowie 2011 r. i już wówczas współpracowała z Danią i Cyprem.

Main areas of activity of the Council of the European Union

The Council of the European Union operates within the following bodies:

- General Affairs Council (GAC);
- Foreign Affairs Council (FAC);
- Economic and Financial Affairs Council (ECOFIN);
- Justice and Home Affairs Council (JHA);
- Employment, Social Policy, Health and Consumer Affairs Council (EPSCO);
- Competitiveness Council (COMPET);
- Council for Transport, Telecommunications and Energy (TTE);
- Council on Agriculture and Fisheries (AGRIFISH);
- Environmental Affairs Council (ENVI);
- Education, Youth, Culture and Sports Council (EYCS).

Program of the Polish Presidency of the EU Council

In December 2024, the Government of the Republic of Poland adopted a program for the Presidency of the Council of the European Union. The aim of the presidency is to ensure Europe's security in the broadest sense, and the key objectives include:

- defense and security;
- Protection of people and borders;
- Resistance to foreign interference and disinformation;
- Ensuring security and freedom of economic activity;
- health security;
- energy transition;
- competitive and resilient agriculture. The Polish presidency will aim to:
 - shaping a strong Common Agricultural Policy that supports farmers and rural development;
 - encourage, rather than force, farmers to take measures that will protect the environment and show the benefits of combating and preventing the effects of climate change.

Water under the Polish Presidency of the Council of the EU

The Polish Presidency's program of work in ENVI indicates:

The work of the Environmental Council will focus on measures to build the resilience of the environment and societies to climate change. We will emphasize the tangible benefits that healthy and stable ecosystems provide to societies. We will emphasize issues of legislation regarding access to resources of critical importance to humans, such as water and soil . (...)

The Polish presidency will focus on issues of security in the face of climate change, environmental and societal resilience, and will support EU efforts to prepare a climate adaptation plan for the EU. The natural disasters experienced by the EU, including the recent floods in Europe, underscore the need to develop measures to mitigate the effects of increasingly dangerous weather events. (...)

In the area of water management, the Presidency will focus on the continuation and possible finalization of legislative work on draft amendments to directives on priority substances in water. It is also looking forward to a communication on water resilience (water resilience).

As part of AGRI's work, we can read:

In the area of agriculture, the Polish Presidency will hold a political debate on the Vision for Agriculture and Food announced by the European Commission. The results of this discussion will be an important input for, among other things, determining the shape of the CAP after 2027. Future CAP solutions will be crucial for food security and stabilization of farmers' incomes. They must also be conducive to building and maintaining a competitive

and resilient European agriculture and rural development. They should support the transformation needed to address environmental and climate challenges, including access to water.

Agriculture under the Polish Presidency of the Council of the EU

Aspekty wodne są ważne dla różnych sektorów, w tym rolnictwa. Priorytety polskiej prezydencji w Radzie Unii Europejskiej w obszarze rolnictwa zostały zaprezentowane przez ministra Czesława Siekierskiego podczas konferencji prasowej 19 grudnia 2024 r. Prace skoncentrowane będą na działaniach niezbędnych dla poprawy konkurencyjności sektora oraz zwiększenia jego odporności na kryzysy. Wśród kluczowych tematów, które będą poruszane na posiedzeniach AGRIFISH wskazano:

- *Vision for Agriculture and Food* strategy (goal: to focus on elements that are key to the future CAP and other EU policies, i.e.: competitiveness, profitability and resilience of agriculture; support for rural development; support for generational exchange; support for transformation towards sustainable methods; access to water; simplification; EU enlargement);
- Simplifying the green architecture of the Common Agricultural Policy;
- implementing the principle of *rural proofing*;
- Empowering farmers in the food chain;
- The situation in agricultural markets;
- trade-related matters;
- research, innovation and digitization.

STATE OF SOILS IN EUROPE – JRC REPORT

Posted on 9 January 2025 by Monika Zabrzeńska-Chaterera



The European Commission's Joint Research Center (JRC) and the European Environment Agency (EEA) have prepared a report entitled The State of Soils in Europe. The document provides data and information on pressures that cause soil degradation.

Categories: [From the European Commission](#), [Issue 1/2025](#), [Onet](#)

Tags: [KE](#), [soil](#), [soils](#)



The European Commission's Joint Research Center (JRC) and the European Environment Agency (EEA) have prepared a report entitled *The State of Soils in Europe*. The document provides data and information on pressures that cause soil degradation.

The results of the analysis were collected in the following subject areas:

- The role of soil as a provider of key ecosystem services;
- factors that cause changes in soil health;
- The condition of soils in the regions and trends in its degradation;
- Evidence of soil degradation in Europe;
- Understanding the interdependence of pressures drivers and their impact on soil degradation;
- The role of science in assessing soil conditions;
- Sustainable soil management: policy directions for maintaining soil health in Europe;
- Ensuring soil health and ecosystem resilience in the face of Europe's diverse land use needs.

The report, entitled *The State of Soils in Europe*, can be downloaded from the website of the Publications Office of the European Union.

General context

The role and importance of soil cannot be overestimated not only for the functioning of nature, but also for humans. It is the main element of the terrestrial ecosystem. It purifies water, reduces pollutants, allows the circulation of elements/nutrients. In addition, it provides an environment for living organisms, and for humans it is the basic element for food production.

Soil health, which includes the overall health and functionality of the soil ecosystem, reflects its ability to support plant growth, maintain biodiversity, regulate nutrient cycles and provide other essential ecosystem services.

Don't forget that soil acts as a natural filter, purifying the water that flows through it. This process helps maintain quality by reducing groundwater and surface water pollution. In addition, soils play a large role in regulating water, affecting its availability in ecosystems. Well-managed soils contribute to flood prevention and sustainable water supply.

United Nations Food and Agriculture Organization. The Food and Agriculture Organization (FAO) identifies, among other things, as the main functions of soil:

- The habitat (environment) of living organisms;
- Water purification and pollution reduction;

- climate regulation;
- carbon sequestration;
- food delivery;
- fuel delivery;
- circulation of elements, nutrients;
- Supply of construction, building materials;
- cultural, historical heritage.

Report *The State of Soils in Europe*

Published in 2024. The report *The State of Soils in Europe* analyzes the interactions between factors affecting changes in soil health. Both anthropogenic and natural pressures that shape soil degradation processes and their consequences are analyzed.

The report defines soil degradation, following the FAO, as a change in soil health resulting in a reduction in the capacity of an ecosystem to provide goods and services to its beneficiaries. The published document highlights the significant impact of soil degradation on agriculture, ecosystem resilience, water quality, biodiversity or human health, while pointing out the urgent need to prepare comprehensive management strategies.

The authors pointed to the importance of research, public involvement in soil monitoring and conservation efforts, and the importance of policies to promote sustainable management, supported by research and innovation. The above is expected to help protect soil health and ensure the long-term resilience of ecosystems.

Current status and trends of soil degradation in Europe

The report assesses the condition of soils in Europe based on a range of physical, chemical and biological indicators. Based on survey results, case studies and soil monitoring data, the assessment focuses on the following indicators of soil degradation:

- soil acidification;
- Changing the carbon content of the soil;
- Soil erosion;
- soil compaction;
- soil contamination;

- soil salinity;
- Changing soil biodiversity;
- soil sealing and land occupation.

In the context of the above indicators, the report points out, among other things, that the consequences of soil degradation affect the ecological, social and economic zones. For example, the effects of sealing and occupation of land can be seen in reduced functionality, increased urban heat island effects, increased water pollution. The above points to the need to implement sustainable land management practices, including green infrastructure or appropriate land use regulations.

Conclusions of the report *The state of soils in Europe*

The *State of Soils in Europe* report describes the interplay of various factors and processes that cause soil degradation. It indicates that both natural phenomena and human activities contribute, while emphasizing the need for integrated approaches to caring for soil health.

The document stresses the importance of science and the dissemination of knowledge to the public, which is an important way to raise awareness of the importance of soil health and increase public involvement in monitoring and caring for it. At the same time, it stresses the need for additional efforts to increase public participation in conservation efforts, especially in urban areas.

The report points out that policy initiatives in the European Union demonstrate a commitment to holistic soil management, but nevertheless, given the different approaches to the subject around the world, different levels of protection are observed, as well as different obstacles to the resilience and sustainability of the resource.

As actions for the future, the need to prioritize increased monitoring and data collection on soils and stakeholder involvement in sustainable management are identified. According to the report's authors, efforts should focus on facilitating long-term monitoring, implementing technological innovations and fostering international cooperation.

By combining scientific knowledge, public involvement and policy initiatives, it is possible to work together to protect soils, safeguarding this priceless natural resource for present and future generations and ensuring the health and well-being of our planet.

MODERNIZATION FUND – AN ADDITIONAL €2.7 BILLION FOR CLEANER ENERGY SYSTEMS

Posted on 9 January 2025 by Karol Kucharski



The European Commission has disbursed an additional €2.7 billion to support 39 investment projects in eight member states. The Modernization Fund, financed by revenues from the EU Emissions Trading System (EU ETS), has provided €15.45 billion in investment to support clean energy transition projects since its launch in 2021. It helps implement investments in renewable energy generation and use, energy efficiency, energy storage, modernization of energy grids, including pipelines and district heating networks, and equitable transition in coal-dependent regions.

Categories: [From the European Commission](#), [Issue 1/2025](#), [Onet](#)

Tags: [clean energy](#), [KE](#), [Modernization fund](#)



The European Commission has disbursed an additional €2.7 billion to support 39 investment projects in eight member states. The Modernization Fund, financed by revenues from the EU Emissions Trading System (EU ETS), has provided €15.45 billion in investment to support clean energy transition projects since its launch in 2021. It helps implement investments in renewable energy generation and use, energy efficiency, energy storage, modernization of energy grids, including pipelines and district heating networks, and equitable transition in coal-dependent regions.

Modernization fund - 2024 summary.

The support, announced at the end of December, complements investments of nearly €2.97 billion for 38 other projects initiated in June 2024, bringing the total disbursements from the modernization fund in 2024 to €5.67 billion, covering 77 projects in 11 countries. This year alone, disbursements were made to Bulgaria (65 million euros), Croatia (52 million euros), the Czech Republic (1.283 billion euros), Estonia (84 million euros), Hungary (202 million euros), Latvia (27 million euros), Lithuania (185 million euros), Poland (1.733 billion euros), Romania (1.956 billion euros), Slovenia (309 million euros) and Slovakia (153 million euros). We wrote about previous projects implemented from the Modernization Fund in a previous article: [Modernization Fund - support for clean energy projects](#).

All 77 projects supported from 2024 onward focus on electricity generation from renewable energy sources, grid modernization, energy efficiency and replacing coal generation with lower carbon-intensive fuels.

Projects implemented from 2024 include activities such as:

- Strengthening the electricity transmission grid to support the integration of renewable energy sources in Bulgaria;
- Photovoltaic power generation and energy storage by water service providers in Croatia;
- Reducing_{CO2} emissions during heat production in the Czech Republic;
- Improving energy efficiency and promoting the use of renewable energy in public buildings in Estonia;
- Modernization and development of renewable energy-based district heating systems in Hungary;
- Use of renewable energy sources in multi-apartment buildings, public buildings and energy communities in Latvia;
- Modernization of multi-apartment buildings in Lithuania, ensuring the achievement of at least Class B energy efficiency in renovated buildings and energy savings of at least 40 percent;
- Development of electricity storage systems in Poland to improve the stability of the national electricity grid;
- Installation of at least 1,500 MWh of battery energy storage systems at existing renewable energy generation plants in Romania;
- Increasing energy efficiency and reducing greenhouse gas emissions in lower-income households in Slovakia;
- Investment in renewable electricity generation and energy storage capacity in Slovenia.

Modernization fund - further calls for applications

According to information posted on the European Commission's website, the deadline for submitting investment applications for potential support from the modernization fund in the next disbursement cycle is February 18, 2025 for priority applications and January 21, 2025 for non-priority applications. The first group consists of investments aimed at modernizing energy systems, reducing greenhouse gas emissions in energy, industry and transportation, and improving energy efficiency as listed in the EU ETS Directive. All other initiatives eligible for the modernization fund are considered non-priority and subject to additional scrutiny.

Modernization fund as a key tool for EU green financing

The Modernization Fund, financed by revenues from EU ETS emissions allowance auctions, currently aims to support 13 EU countries in their transition to climate neutrality. The revised EU ETS has expanded the scope of the fund, which can provide financial support to additional beneficiaries Greece, Portugal and Slovenia from January 1, 2024.

The Modernization Fund complements other European instruments, such as the Cohesion Policy and the Equitable Transformation Fund. It has mobilized significant resources that can help eligible countries invest in line with the REPowerEU plan and the Ready for 55 package. The Modernization Fund operates under the responsibility of its beneficiaries and in close cooperation with the European Commission and the European Investment Bank (EIB).

EUROPEAN INVESTMENT BANK TO ALLOCATE €3 BILLION FOR AGRICULTURE, FORESTRY AND FISHERIES

Posted on 9 January 2025 by Karol Kucharski



The European Investment Bank (EIB) will launch a €3 billion financing package for agriculture, forestry and fisheries, along with measures to strengthen farm insurance. The support is the EIB's largest financing initiative for European agriculture and will target small and medium-sized enterprises and companies. The new financing is expected to spur investment in a range of activities, including soil health, digital tools, water management and climate resilience.

Categories: [From the European Commission](#), [Issue 1/2025](#), [Onet](#)

Tags: [agriculture](#), [EU](#), [fishing](#), [forestry](#), [funding](#)



The European Investment Bank (EIB) will launch a €3 billion financing package for agriculture, forestry and fisheries, along with measures to strengthen farm insurance. The support is the EIB's largest financing initiative for European agriculture and will target small and medium-sized enterprises and companies. The new financing is expected to spur investment in a range of activities, including soil health, digital tools, water management and climate resilience.

Financial support for agriculture, forestry and fisheries

The European Investment Bank is the European Union's long-term lending institution to its member countries. As part of a new financial support package for agriculture, forestry and fisheries, the EIB will provide €3 billion in low-interest loans for agriculture and other bioeconomy-related activities across Europe, with a focus on young farmers, gender equality and green investments. The EIB Group's loans will be accompanied by action from other financial institutions, unlocking nearly €8.4 billion in long-term investment for the bioeconomy sector. As planned, the support package will be spread over the next three years, with the first loans expected to be signed by mid-2025.

The new funding is expected to spur investment in a range of activities, including those related to soil health, digital tools, water management and climate resilience. The financial support also aims to intensify training in sustainable farming practices and land acquisition for young or new farmers, helping to increase their share of the sector's workforce. The initiative also targets women, who make up less than ^{a third of} farmers.

To ensure favorable lending terms, the EIB is enabling the financing to be supplemented with interest or capital grants from EU and national budgets. Participating financial institutions will also receive additional advisory support through the Green Gateway program and an improved Green Eligibility Verification Tool - an online method for assessing the eligibility and climate impact of green investment projects.

European Investment Bank and cooperation with the European Commission

The European Investment Bank is working with the European Commission to develop new forms of agricultural insurance and programs to mitigate risks associated with extreme weather events. One of these activities is planned financial support for agriculture, forestry and fisheries.

The institution, working with partners, seeks to help meet the challenge for agriculture to produce affordable food, protect agricultural production and livelihoods in the face of climate change, and protect the environment and natural resources.

The European Commission welcomes the EIB's strong commitment to the EU farming community, especially young farmers and women farmers. Closing the financing gap in this sector is essential, and with the group's support, the EIB gets the tools to develop and grow. The European Commission intends to work with the Bank to ensure that the new financing opportunity is used on the ground and delivers results.

Actions to adapt to climate change

As part of its increased support for the bioeconomy, the EIB Group is exploring ways to improve insurance against more frequent extreme weather events, including floods and droughts. The European Investment Bank will work with the European Commission, the insurance industry and other stakeholders to explore ways to increase support for current insurance schemes in conjunction with pan-European measures to accelerate investment in climate adaptation or to provide more liquidity and credit risk coverage to businesses affected by climate disasters.

The new initiatives are part of the EIB Group's action plan in the context of *the Strategic Dialogue on the Future of EU Agriculture*, launched by European Commission President Ursula von der Leyen in January 2024. We wrote about the details of the summary of the Strategic Dialogue held in a previous article: [Strategic Dialogue instead of a European Green Deal?](#)

European Investment Bank

The European Investment Bank finances investments that contribute to EU policy goals. EIB projects enhance competitiveness, spur innovation, promote sustainable development, enhance social and territorial cohesion, and support a fair and rapid transition to climate neutrality.

The EIB Group, which also includes the European Investment Fund (EIF), has signed new financing totaling €88 billion for more than 900 projects in 2023. The commitments are expected to mobilize some €320 billion in investment, supporting 400,000 businesses and 5.4 million jobs.

All projects financed by the EIB are consistent with the Paris Climate Agreement. The group does not support investments in fossil fuels. More than half of its annual financing is for projects that directly contribute to climate change mitigation, adaptation and a healthier environment. About half of the EIB's financing in the European Union goes to regions covered by the cohesion policy, where per capita income is less than the European average.

HOW MUCH DID NATURAL DISASTERS COST IN 2024? ALARMING REPORT

Posted on 9 January 2025 by Agata Pavlinec



Climate change is translating into mounting economic and humanitarian losses, according to the latest report by environmental charity Christian Aid on the biggest natural disasters of 2024. Analysts point out that the death toll is higher in poor countries and the financial cost is higher in developed countries. Which regions of the world have suffered the most?

Categories: [Business and economics](#), [In this issue](#), [Issue 1/2025](#), [Onet](#)

Tags: [climate change](#), [costs](#), [disaster](#), [flood](#), [hurricane](#)



Climate change is translating into mounting economic and humanitarian losses, according to the latest report by environmental charity Christian Aid on the biggest natural disasters of 2024. Analysts point out that the death toll is higher in poor countries and the financial cost is higher in developed countries. Which regions of the world have suffered the most?

North American hurricanes - the most costly

The authors of the Christian Aid report based their calculations on estimates from insurance companies that pay out compensation for damage caused by disasters. As they themselves point out, these figures are underestimates, as they do not include losses in agriculture or trade, for example. However, the more developed and costly infrastructure in affluent countries requires more money to rebuild. It is no surprise, then, that hurricanes that swept through North America were considered the most costly natural disasters in 2024.

[Hurricane Milton](#), which hit the United States in October, would have been only a strong Category 2 storm without the impact of the changing climate, according to experts. However, rising ocean temperatures caused the phenomenon to escalate, bringing strong winds and heavy rainfall, as well as local tornadoes. Financial damage is estimated at \$60 billion, ranking Milton among the costliest hurricanes in US history. It left 25 people dead, 260,000 without access to drinking water and 2 million without electricity.

Two weeks earlier, the southeastern coast of the US was hit by Hurricane Helene, classified as a Category 4. It turned out to be one of the most tragic in the country's history - the death toll reached more than 230, and up to 4.7 million citizens were left without electricity. Economic losses were estimated at about \$55 billion.

In addition, 46 severe thunderstorms with lightning, downpours and hail were observed in the United States between January and September. They resulted in the loss of 88 lives and total damages of more than \$60 billion. The entire 2024 hurricane season, according to AccuWeather experts, reached an infamous \$500 billion in losses, which also included Hurricanes Beryl (\$28-32 billion) and Debby (\$28 billion).

Deadly natural disasters in Asia

In early September, super typhoon Yagi swept with devastating force over Southeast Asia. The losses it caused were estimated at \$12.6 billion, and the death toll exceeded 800. In Vietnam, 26 provinces were affected, and thousands of homes lay in ruins - the most expensive typhoon in the country's history. In Myanmar, it destroyed entire villages and more than 2.3 million hectares of farmland. Thailand and the Philippines were hit by flash floods that severely damaged infrastructure.

Other costly 2024 typhoons include:

- Gaemi with losses of \$220-245 million;
- Shanshan, which caused \$331 million in damage in Japan alone;
- Kong-rey super typhoon, which forced Taiwan to suspend \$2.5 trillion worth of stock market operations.

Floods caused by unusually heavy rainfall also occurred in late June and early July in southern and central China. A record number of rivers flooded, and 6 provinces recorded the highest rainfall totals on record. Several dams were breached, and 2 million hectares of farmland were under water. Total damage was estimated at \$15.6 billion, and the Chinese government has set aside \$100 million to provide immediate relief

to those affected.

Giant European floods

The climate crisis has also manifested itself with great force in Europe. In early June, a low came over Germany's Bavaria and Baden-Württemberg, bringing unprecedented amounts of rainfall - in some locations the daily total exceeded the monthly average. As a result, six people lost their lives, and flood losses totaled \$4.45 billion.

Unfortunately, this was just a prelude to an exceptionally rainy autumn. The Boris low that came over central and eastern Europe in mid-September triggered flooding on a scale not seen in decades. Total losses, according to Christian Aid, reached more than \$5 billion, and at least 26 people died. A study published in the periodical *Communications Earth & Environment* found that, as a result of climate change, lower Boris brought 9 percent more abundant precipitation, and that the territory of central Europe with precipitation totals of more than 100 ^{mm/m²} increased by 18 percent.

A rainy disaster hit southern [Spain](#) in late October. An isolated meteorological depression flooded the regions of Valencia, Andalusia and Castilla-La Mancha, with total losses estimated at \$4.22 billion. 226 people were killed.

The list of disasters does not end

Unfortunately, no continent has escaped the dramatic effects of climate change in 2024. Rampant rainfall in the Brazilian state of Rio Grande do Sul led to floods that destroyed 100,000 homes and claimed 183 lives. Total damages amounted to more than \$5 billion. Floods on an unprecedented scale also reached Afghanistan, Pakistan, the United Arab Emirates and West Africa. In the latter region, water destroyed 600,000 homes and 720,000 hectares of fields.

Residents of the island of Mayotte likened cyclone Chido, classified as Category 4, to nuclear war. Winds of up to 225 mph leveled the poorest neighborhoods, burying hundreds if not thousands of people under the rubble - the number of victims is difficult to estimate due to the huge number of unregistered migrants.

Paradoxically, the world has also been plagued by record droughts in the past year. In Colombia, water levels in the Amazon River fell by 90 percent, making it difficult for local communities to obtain food and transportation. According to UNICEF, as many as 420,000 children in Brazil, Colombia and Peru have suffered from drinking water shortages. The situation is also dramatic in southern African countries - in Zambia, where the drought was the most severe on record, a state of emergency has been declared, with as many as 15 million citizens affected.

Another troublesome calamity has been the heat waves experienced by the Gaza Strip, Bangladesh and even... East Antarctica, among others. Although this latest change (so far) is not being felt in a measurable financial way, scientists are warning that the polar regions are warming twice as fast as the rest of the world, and we are likely to pay for it in the future.

What are the implications of this?

The Christian Aid report was created to initiate changes that will help protect societies from the rising costs of natural disasters and ensure global climate justice. Among the authors' recommendations, therefore, are suggestions to more sharply reduce greenhouse gas emissions and phase out all new fossil fuel-based projects.

Both the New Common Financial Target set at the COP29 conference and the Loss and Damage Fund seem insufficient, according to the authors, to cover the financial needs of poorer countries, where the climate crisis is making its strongest mark. The huge costs of natural disasters in 2024 clearly demonstrate that adaptation should be a priority today. Eco-agriculture was cited as a good example, helping to reduce emissions while strengthening the resilience of ecosystems to droughts and floods. It is also particularly important, according to Christian Aid, to develop systems to assist citizens whose possessions have been destroyed by disasters. People should have a chance to preserve their dignity and quickly return to normal life.

The Christian Aid report also makes recommendations to scientists. Countries in the so-called Global South lack reliable systems for collecting data on the effects of natural disasters - damage estimates are therefore either unreliable or quite unavailable. In turn, the development of methods that could determine the long-term financial impact of disasters could change the approach in the sphere of international climate finance to one that is more focused on real needs.

COSTS OF SEA LEVEL RISE ON THE EXAMPLE OF NORTH CAROLINA

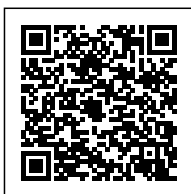
Posted on 9 January 2025 by Piotr Panek



A distinctive feature of the east coast of the United States, especially its southern part, are shoals that cut off coastal waters from the open ocean. To some extent, this resembles the situation of the Polish part of the Baltic Sea.

Categories: [Business and economics](#), [Issue 1/2025](#), [Onet](#)

Tags: [costs](#), [sea](#), [water level](#)



A distinctive feature of the east coast of the United States, especially its southern part, are shoals that cut off coastal waters from the open ocean. To some extent, this resembles the situation of the Polish part of the Baltic Sea.

Salinity level vs. cost-effectiveness of treatment

In our country, shoals usually cut off the reservoir completely, except for the riverbed, forming coastal lakes. In the US, the situation is usually different - open lagoons are more common, and spits are not peninsulas, but barrier islands. Either way, lagoons are less salty than the open ocean, more enclosed lakes - almost freshwater, and more open lagoons - only brackish. In European water policy jargon, they are referred to as transitional waters.

The salinity of lagoons and coastal lakes is low enough to make it profitable to treat their resources for consumption. Interestingly, the only large intake of such waters located on a lake in Poland concerns Miedwia, a facility that is not a classic spit lake, but is located near marine waters and its salinity, although not on a par with, for example, Gardno, is higher than average (conductivity exceeds 500 $\mu\text{S}/\text{cm}$).

In the Atlantic resorts of the US, water from sweetened lagoons is the primary source feeding the water supply. Near the ocean, its undercurrents make groundwater more saline and make it even more expensive to treat.

How does terrain affect water prices?

Spits are formations related to coastal dunes and revetments. They are elongated, but narrow and low. During storms, waves can easily pour through them, bringing salty water into the lagoon. With a long-term change in ocean level, their height, shaped by waves and wind, will eventually adjust to it, but before that happens, they can rise and disappear. The current rise in ocean levels is causing lagoons to become more exposed to ocean water inflow.

For North Carolina beaches, the current sea level rise is 2-5 mm per year, and forecasts by the US National Oceanic and Atmospheric Administration predict an acceleration of this trend. This means an increase in the salinity of the lagoons and, consequently, the expense of treating drinking water. The process is a trade-off between the cost of obtaining perfectly fresh water and consumers' tolerance for some salinity. As a result, tourists visiting resorts in the future will have to pay more for treated tap water or put up with its higher salinity, or perhaps both.

Summary of survey results

Accordingly, a group of economists from North Carolina and Georgia decided to estimate the preferences of potential tourists in relation to these projections. To do this, they used classic (though modernized compared to the 1970s approach) methods of estimating the value of ecosystem services by surveying those who use them about actual and acceptable expenditures. The survey was conducted among people who not only declare a desire to spend their vacation at the seaside, but also have previously purchased at least one night at the coast, and thus confirmed their desire with deeds.

The survey focused on beach vacationing only in North Carolina, and surveyed residents of that state who do not own waterfront property. This excluded those who have invested so much in vacationing at a particular beach that a minor inconvenience would not cause them to change their plans. Owners of summer cottages are more likely to spend their vacation in the place where they bought the property. Residents of farther-away states are less likely to interrupt their vacation than those who can return home and go somewhere else within a few hours.

Tourists were asked a series of questions about both their recent vacations to the seaside and their plans for the next. They were also asked to declare what degree of difficulties would discourage them from repeating their stay in the same place. The average respondent (or rather, respondent, since women slightly outnumbered men among the responses) has been on almost 3 overnight trips to the sea over the past year, and spent \$749 on the last one. (the survey was conducted in 2021).

Besides, he was prepared to spend \$879 next time. Not surprisingly, therefore, when asked whether a \$100 increase in cost would cause him to change his plans, no one answered in the affirmative. As one might guess, as the potential cost increased, the percentage of those discouraged grew. For an increase of 1,000. dollars. Only 60 percent of respondents would already agree.

Another series of questions concerned the quality of tap water, specifically its salinity. Light to moderate salinity would not deter most tourists. For that, you would need significant salinity or a combination of salinity and cost. A number of those surveyed would not care at all, relying on water brought from home or bottled water purchased locally. Those who would give up their planned vacation, however, would be most likely to swap it for a trip to another beach in the same state, but with better conditions. Worse, if it turned out to be the same everywhere.

Financial consequences of sea level rise

The numbers resulting from the survey were substituted by economists into models and estimated what losses in the tourism industry could result from the expected rise in ocean levels and salinization of drinking water sources. In the most pessimistic scenario, they would amount to \$232 million, \$193 million and \$402 million in 2040, 2060 and 2080, respectively.

Sea level rise and the thawing of spits are not just a matter of cost and drinking water quality. Even this group of tourists, who will not be deterred by these problems, may have less recreational space available to them when it is swallowed up by the ocean. A few years ago, the cost of losing ocean fishing spots in North Carolina was estimated at \$430 million, and the decline in coastal property values at \$7 billion. These sums may not come down to every cent, but they provide a glimpse that climate change is a concrete financial problem.

Naturalistic losses in coastal habitats have not been calculated. Many naturalists criticize estimates of the value of ecosystem services used in economics, believing that they include only a slice of the real value. They point out that it is immeasurable, and it is absurd to consider the existence of a species or habitat worth a specific amount.

Source: doi 10.1029/2023WR036440

ANTIBIOTIC-RESISTANT MICROORGANISMS IN WASTEWATER TREATMENT PLANTS

Posted on 9 January 2025 by Edyta Łaskawiec



In September 2024, the prestigious journal Lancet [1] published a comprehensive analysis of drug resistance from 1990 to 2021, with an outlook to 2050. Antibiotic-resistant microorganisms and their development are currently one of the biggest public health challenges.

Categories: [Feedback](#), [In this issue](#), [Issue 1/2025](#), [Onet](#)

Tags: [microorganisms](#), [sewage](#), [sewage treatment plants](#)



In September 2024, the prestigious journal *Lancet* published a comprehensive analysis of drug resistance from 1990 to 2021, with an outlook to 2050. Antibiotic-resistant microorganisms and their development are currently one of the biggest public health challenges.

Drug resistance in numbers

Researchers estimated that in 2021 alone, more than 4.71 million deaths worldwide were linked to bacterial antimicrobial resistance. And in 2050, the annual number of deaths from such infections will exceed 8 million. However, these figures are likely to be severely underestimated due to the gaps that still exist in recording drug-resistant infections. In addition, many parts of the world lack monitoring systems, such as through wastewater, to assess the scale of the future threat. In the previously mentioned publication, researchers analyzed mortality data from 204 countries, focusing on 22 pathogens, 84 drug combinations used to treat infections, and 11 diseases, including bloodstream infections and bacterial meningitis.

Researchers have noted the highest increase in antibiotic resistance in the case of methicillin-resistant *Staphylococcus aureus* bacteria (a narrow-spectrum β -lactam antibiotic). Commonly found in the nasopharyngeal cavity and on the skin, the gram-positive bacterium can cause serious health problems once it enters the bloodstream. In 1990, drug-resistant *Staphylococcus aureus* caused more than 261 thousand associated deaths and more than 57 thousand attributed deaths. However, by 2021, these numbers had already risen to 550,000 and more than 130,000, respectively.

Gram-negative bacterial strains are also gaining resistance, most rapidly to carbapenems (broad-spectrum β -lactam antibiotics), widely used for their effectiveness. From 1990 to 2021, the number of deaths associated with infections with gram-negative bacteria that are also resistant to this class of antibiotics rose from 619,000 to more than 1 million per year. And the number of confirmed direct infections increased from 127,000 to 216,000 per year.

The threat of drug-resistant infections in a social and geographic context

Although the number of deaths from drug-resistant infections in children is gradually decreasing (between 1990 and 2021, it fell by more than 50 percent in the under-5 age group), at the same time, the number of deaths in those over 70 years of age increased by an average of 80 percent during the analyzed period. The decline in mortality in children is primarily the result of fewer infections with pneumococci and bacteria spread by so-called "dirty hands".

This phenomenon follows the wider availability of pneumococcal vaccines and measures to increase hygiene levels and access to water and sanitation services. However, success in the fight against infections in children has been half-hearted, as at the same time the number of deaths from septicemia has increased in the under-5 group over the period analyzed (by 5 percent between 1990 and 2021), suggesting that over time bacterial infections are also becoming more difficult to treat in the youngest.

Researchers predict that the regions likely to be hardest hit by an antibiotic resistance pandemic in the future are South Asia, Latin America and the Caribbean. But an increase in drug-resistant microbes will occur in all areas of the world, including Western and Central Europe, where such infections have so far been strictly controlled and periodically even managed to reduce the number of fatal cases.

According to the European Center for Disease Prevention and Control, 35,000 people die each year in the European Union from antibiotic-resistant infections, that's up to 100 people a day. In addition to antibiotic-resistant bacteria, drug-resistant fungi such as *Candida auris* are of growing concern. In this case, the number of reports doubled between 2020 and 2021. Researchers estimate that without urgent remedial action, 169 million people infected with drug-resistant bacteria will die between 2025 and 2050. The projected burden trends are largely

driven by changes in population size (growth, especially in cities) and age structure (aging population).

Antibiotic-resistant microorganisms – where does this problem come from?

The decades between the 1930s and 1960s. In the 1970s. are considered the golden age of antibiotic development due to the number of compounds discovered during this period. The use of antimicrobials in clinical practice is one of the greatest achievements of medicine, which has significantly extended the lives of patients. However, progress has been slowed by the natural flexibility of microorganisms to develop mechanisms that build resistance to environmental stressors. Bacterial evolution is not limited to random mutations in genes, inheritance through offspring and natural selection of appropriate phenotypes.

Bacteria modulate their own rate of DNA mutation after exposure to environmental stressors and are able to transfer genetic material among themselves. Bacterial genomes contain different types of mobile elements that allow DNA to move between chromosomal locations in a single cell and between different bacterial cells. Bacteria can associate with each other, or "conjugate," allowing genetic elements to be transferred between each other. So we can say that bacterial DNA is extremely mobile, alive and flexible.

Horizontal (horizontal) gene transfer is one of the most well-known and widespread mechanisms among bacterial populations for gene transfer and enrichment of new traits. Microorganisms rapidly transfer resistance genes between strains, with the environment in which they are found playing a special role. Studies show that one of the more preferred environments for microbial evolution is human organisms.

Human microbiomes are complex ecosystems including bacteria, viruses, archaeons or eukaryotes that co-evolve in an environment subject to various selection pressures, such as antibiotic intake, contact with pollutants, disease and lifestyle. In the human body, commensal bacteria – non-pathogenic microorganisms found on the mucous membranes of the gastrointestinal, respiratory and urogenital tracts in mammals, including humans, among others – play an important role.

They provide essential nutrients to the host and help protect it from opportunistic pathogens, but they are also important factors in the antibiotic resistance gene pool. There is evidence of antibiotic resistance gene transfer between commensal bacteria and bacterial pathogens in the human gut. For example, *Escherichia coli*, commonly found in our intestines, has been well studied as an indicator of the surveillance and spread of acquired antibiotic resistance genes among pathogens in the environment.

The gut microbiome contains a wide range of resistance genes, but studies mostly distinguish resistance against tetracycline, β -lactams, aminoglycosides and glycopeptides. Some antibiotic resistance genes present in healthy humans appear, already in infancy, because they can be passed on from the mother's body. Among other things, ampicillin- and cotrimoxazole-resistant *E. coli* bacteria have been isolated from the fecal microbiota of newborns less than one month old who were not receiving antibiotic therapy.

There are various driving factors and trigger points contributing to the development and spread of drug resistance. Antibiotics are not only abused in human therapy, but also in food production. They are used in agriculture to combat bacteria that attack plants, aquaculture and livestock production. Scientific evidence supports a close link between the development of antibiotic resistance in human pathogens and the use of antibiotics in agricultural production.

Animal/plant foods and organic fertilizers can serve as important vectors for gene migration. Bacteria can colonize plants, animals, humans and the environment and can easily move between these elements to transfer genes. Many studies emphasize the importance of the aquatic environment in the transmission of antibiotic-resistant microorganisms, particularly surface water resources that are exposed to sewage inflows and surface runoff, such as from agricultural areas. Also, wastewater treatment plants are considered "hot spots" for the transmission and spread of antibiotic resistance genes.

Importance of wastewater treatment plants in the development of antibiotic resistance

In addition to the fact that some of the microorganisms regularly excreted from the human body may possess as well as carry antibiotic resistance genes, wastewater also has unique characteristics conducive to initiating further gene migration. They are increasingly recognized as a potential source of new resistance genes due to the constant supply of low doses of antibiotics, the extreme genetic diversity of microbes and contact with the environment. Researchers examined DNA from thousands of samples taken from different environments to find those traits that link antibiotic-resistant microbes. Wastewater turned out to be a place where drug-resistant bacteria are more common than in any other environment.

Wastewater treatment includes mechanical, physical, biological and chemical processes that affect the fate of pharmaceuticals and microorganisms. While the treatment process itself is expected to reduce the number of bacteria in wastewater, especially pathogenic ones, it can simultaneously contribute to an increase in their resistance. Studies show an increase, up to several percent, in the number of antibiotic-resistant bacteria of the genera *Enterococcus*, *Acinetobacter*, *Bacillus*, *Mycobacterium*, *Nocardia* in treated wastewater. Personal care products, disinfectants, and heavy metals are commonly present in wastewater, which promotes the building of bacterial resistance.

Antibiotics can undergo hydrolysis, degradation and adsorption processes on sludge - organic and inorganic particles. However, they are not removed sufficiently in wastewater treatment plants. Most substances are non-volatile due to their high molecular weight. The efficiency of conventional processes (mechanical-biological treatment using activated sludge) ranges from 50 to 80 percent, depending on the technologies used, operational parameters and physicochemical properties of the drugs. Typically, treatment processes are focused on the efficient removal of nitrogen compounds, phosphorus, suspended solids and selected organic substances with high biodegradability.

Macrolides (e.g., erythromycin), sulfonamides, trimethoprim and quinolones are found in the highest concentrations in wastewater. Studies have shown that they are resistant to biodegradation and therefore also difficult to remove in biological wastewater treatment chambers. Both wastewater discharges and their use, such as for crop irrigation, are potential pathways for antibiotic-resistant genes and microorganisms, as well as antibiotics themselves, to enter the environment. Studies show that both antibiotic and antibiotic-resistant gene levels decrease with increasing distance from wastewater discharge.

However, microorganisms can adhere to organic and inorganic sludge particles, so they persist in the environment and are subject to further transport. The presence of antibiotic-resistant genes in aerosols near wastewater treatment plants has also been confirmed, posing an additional threat to the operation of the facilities.

Antibiotic resistance - available medical support

Studies have confirmed a higher abundance of microorganisms and antibiotic resistance genes in wastewater in winter, which allows the problem to be partially linked to an increase in seasonal infections. Therefore, one of the main recommendations for curbing the spread of the problem is balanced surveillance of antibiotic consumption in humans and ongoing education. Antibiotics cannot be used to treat viral infections. In addition, antibiotics are still sold over-the-counter in some countries, such as India, which encourages their overconsumption.

The search for new antimicrobial drugs is a growing challenge, so an urgent expansion of vaccination coverage is needed. According to WHO data, the introduction of vaccines against the seven most important resistant bacteria could save an estimated 1.2 million people from death each year. And antibiotic use would drop by 2.5 billion doses per year. Antibiotics don't work against viruses, but viral infections can cause complications in the form of bacterial infections. The WHO estimates that better use of vaccines would reduce the incidence of infections because vaccinated people are more resistant to infections and secondary infections requiring antibiotic treatment.

During the COVID-19 pandemic, the use of antibiotics increased dramatically. Initially fighting an unknown adversary, they were used not only for bacterial and fungal infections that followed or were a complication of the virus, but also in many unwarranted cases. In addition, patients, in fear of worsening their condition, chose to use antibiotics without medical supervision. Both the viruses associated with Severe Acute Respiratory Syndrome (SARS) and Middle East Respiratory Syndrome (MERS) are accompanied by bacterial co-infections, for which the use of antibiotics is essential. However, their use should always be under medical supervision.

Most of the deaths during the 1918 influenza pandemic were caused by secondary bacterial infections, mainly due to *Streptococcus pneumoniae* (the pneumococcus we commonly know). During the 2009 H1N1 influenza pandemic, it is estimated that 29–55 percent of global mortality was associated with secondary bacterial co-infections, in which antimicrobial resistance accounted for a clinically significant percentage. Patient mortality from penicillin-resistant *Streptococcus pneumoniae* accounted for about 1.8 percent, and erythromycin resistance contributed to the deaths of more than 2 percent of patients.

This may be considered a small percentage, but we must take into account that reporting of drug-resistant infections has been conducted for a short time and data from this period is not fully available. Researchers predict a three- or even fourfold increase in deaths due to more frequent pneumococcal co-infections in future flu pandemics. A recent WHO report states that pneumococcal vaccination, covering 90 percent of the world's child population, could reduce antibiotic use by 33 million doses by 2030. Pneumococci are responsible for the highest mortality rate among bacterial infections.

Children and people over 65 are most susceptible to them. Thus, it can be concluded that pneumococcal vaccination not only protects our health, but also reduces the use of antibiotics, which enter the water environment and promote the development of antibiotic resistance genes among microorganisms. Besides, studies have shown that the widespread use of non-steroidal anti-inflammatory drugs, such as, ibuprofen, naproxen, diclofenac, gemfibrozil and the β -blocker propranolol, increases natural transformation in bacterial populations, and thus increases the uptake of exogenous antibiotic resistance gene in bacteria. In an aging society, there will be increasing challenges to medical care. However, prevention can make a significant contribution to reducing the number of drug-resistant infections that end in death.

Antibiotic resistance – the importance of water and wastewater management

There is a strong link between antibiotic resistance and access to safe drinking-water, sanitation and hygiene (WASH). Studies have shown that better access to water and sanitation facilities and infrastructure was associated with a reduction in antibiotic resistance genes, particularly in urban areas. According to a recent UNICEF Report, to achieve universal access to safe drinking water, the pace of efforts to expand water and sanitation infrastructure, among other things, would have to increase sixfold.

No region of the world is currently on track to meet this goal by 2030. In addition, some 3.5 billion people still lack access to safely managed sanitation services, and more than 419 million must take care of their physiological needs outdoors on a daily basis. A fivefold increase in efforts to improve the availability and quality of sanitation services is needed to meet the goal of universal access to toilets by 2030, set by the UN Sustainable Development Goals.

Increasing access to water and improving sanitation can be an effective strategy to reduce the spread of antibiotic resistance in low- and middle-income countries. Moving from 0 to 100 percent in access to sanitation and water and wastewater infrastructure can help reduce the abundance of antibiotic resistance genes in the environment by up to 95 percent.

Education, better management of antimicrobial use in humans and animals, and expanded monitoring of municipal wastewater are currently the main strategies for combating antibiotic resistance. But no less important is the inclusion of expansion and modernization of water and wastewater infrastructure. In middle- and high-income countries, investment and modernization are an important part of climate change adaptation, which will strongly affect the efficiency of water and wastewater management.

Floods, overflows, flooding and heavy rainfall promote the entry of microorganisms into the environment, including pathogenic and drug-resistant ones. Studies show that tertiary treatment techniques, such as ozonation, adsorption on activated carbon, coagulation, and nanofiltration and reverse osmosis, under optimal conditions, are effective in removing antibiotics and antibiotic resistance genes .

Disinfectants such as chlorine tend to act selectively on antibiotic resistance genes, reducing gene abundance (the number of gene copies per ml of sample), while the frequency of these genes (the number of gene copies per total number of bacteria) increases . Sometimes disinfection processes destroy the DNA or cellular structure of bacteria, but drug resistance genes can persist for a long time in cellular debris and the environment. Sometimes they transfer and adapt to new bacteria, further generating the development of antibiotic resistance. Damaged bacteria have low metabolic activity, which becomes active under certain conditions.

They receive a large amount of DNA released from surrounding susceptible bacteria, making horizontal transfer occur more frequently. In addition, when *E. coli*, for example, is exposed frequently to low doses of chlorine, it induces a specific set of proteins, making it less susceptible to disinfection. Chemical disinfection methods also carry the risk of transforming some of the chemical compounds that have not been biodegraded in wastewater treatment processes, which can increase the toxicity of wastewater and cause further negative impacts in the environment. Therefore, it is necessary to increase the number of facilities with three-stage wastewater treatment systems .

Does the changing climate increase the risk of antibiotic resistance?

There are also a growing number of reports on the impact of climate change on the rise of drug resistance in microorganisms. Globally, antimicrobial resistance and climate change are recognized as two major threats to public health . In addition, the two can be linked in a web of current environmental problems. Environmental degradation, deforestation, loss of biodiversity and climate change are increasingly causing human and animal pathogens to intermingle, leading to outbreaks of zoonotic diseases.

Climate change is a significant factor that will drive the increase in infectious disease incidence in the coming decades . Although bacterial resistance develops largely under selective antibiotic pressure, there are other factors that may also play a role at the population level. Among other things, researchers have linked local temperature increases to increased antibiotic resistance in common pathogens such as *Escherichia coli*, *Klebsiella pneumoniae* and *Staphylococcus aureus*. These links apply to most classes of antibiotics and pathogens, and importantly may increase over time with climate pressure .

Dr.-Ing. Edyta Łaskawiec - water and wastewater technologist, science popularizer, author of educational profile on Instagram platform: *wastewater_based.doctor* and podcast *About Wastewater*. Winner of the POP SCIENCE Competition for Science Popularizers of the Silesian Science Festival Katowice 2024.

In the article, I used, among others. z:

GBD 2021 Antimicrobial Resistance Collaborators, *Global burden of bacterial antimicrobial resistance 1990–2021: a systematic analysis with forecasts to 2050* , *The Lancet*, 404(10459), 2024, [https://doi.org/10.1016/S0140-6736\(24\)01867-1](https://doi.org/10.1016/S0140-6736(24)01867-1)

Sh. Kunhikannan, et al, *Environmental hotspots for antibiotic resistance genes*, *MicrobiologyOpen*, 10(3), 2021,1197, <https://doi.org/10.1002/mbo3.1197>

European Centre for Disease Prevention and Control, *Assessing the health burden of infections with antibiotic-resistant bacteria in the EU/EEA, 2016–2020*, Stockholm: ECDC; 2022, <https://www.ecdc.europa.eu/en/news-events/eaad-2022-launch>

- S.A. Baron, et al, *Human microbiomes and antibiotic resistance*, Human Microbiome Journal, 10, 2018, 43-52, <https://doi.org/10.1016/j.humic.2018.08.005>
- R.S. McInnes, et al, *Horizontal transfer of antibiotic resistance genes in the human gut microbiome*, Current Opinion in Microbiology, 53, 2020, 35-43, <https://doi.org/10.1016/j.mib.2020.02.002>
- E. Nji, et al, *High prevalence of antibiotic resistance in commensal Escherichia coli from healthy human sources in community settings*, Scientific Reports, 11, 2021, 3372, <https://doi.org/10.1038/s41598-021-82693-4>
- V. Kasimanickam, et al, *Antibiotics Use in Food Animal Production: Escalation of Antimicrobial Resistance: Where Are We Now in Combating AMR?* Medical Sciences, 9(1), 2021; 14, <https://doi.org/10.3390/medsci9010014>
- J. Wu, et al, *Antibiotics and antibiotic resistance genes in agricultural soils: A systematic analysis*, Critical Reviews in Environmental Science and Technology, 53(7), 2023, <https://doi.org/10.1080/10643389.2022.2094693>
- I. Bueno, et al, *Impact of Point Sources on Antibiotic Resistance Genes in the Natural Environment: A Systematic Review of the Evidence*, Animal Health Research Reviews 18(2), 2017, <https://doi.org/10.1017/S146625231700007X>
- C.L. Brown, et al, *Selection and horizontal gene transfer underlie microdiversity-level heterogeneity in resistance gene fate during wastewater treatment*, Nature Communication, 15, 2024, 5412, <https://doi.org/10.1038/s41467-024-49742-8>
- F. Berglund, et al, *Evidence for wastewaters as environments where mobile antibiotic resistance genes emerge*, Communications Biology, 6, 2023, 321, <https://doi.org/10.1038/s42003-023-04676-7>
- Y. Javvadi, S.V. Mohan, *Temporal dynamics and persistence of resistance genes to broad spectrum antibiotics in an urban community*, npj Clean Water, 7, 56, 2024, <https://doi.org/10.1038/s41545-024-00349-y>
- J. Wang, et al, *Occurrence and fate of antibiotics, antibiotic resistant genes (ARGs) and antibiotic resistant bacteria (ARB) in municipal wastewater treatment plant: An overview*, Science of The Total Environment, 744, 2020, 140997, <https://doi.org/10.1016/j.scitotenv.2020.140997>
- L. Rizzo, et al, *Urban wastewater treatment plants as hotspots for antibiotic resistant bacteria and genes spread into the environment: A review*, Science of The Total Environment, 447, 2013, 345-360, <https://doi.org/10.1016/j.scitotenv.2013.01.032>
- Y.-X.Gao, et al, *Wastewater treatment plants as reservoirs and sources for antibiotic resistance genes: A review on occurrence, transmission and removal*, Journal of Water Process Engineering, 46, 2022,102539, <https://doi.org/10.1016/j.jwpe.2021.102539>
- Y. Wang, et al, *Distribution, sources, and potential risks of antibiotic resistance genes in wastewater treatment plant: A review*, Environmental Pollution, 310, 2022,119870, <https://doi.org/10.1016/j.envpol.2022.119870>
- T.B.M. Mosaka, *Inactivation of antibiotic-resistant bacteria and antibiotic-resistance genes in wastewater streams: Current challenges and future perspectives*, Frontiers in Microbiology, 13, 2022, <https://doi.org/10.3389/fmicb.2022.1100102>
- Antimicrobial resistance surveillance in Europe 2023 - 2021 data. Stockholm: European Centre for Disease Prevention and Control and World Health Organization, 2023.

- J.E. Sosa-Hernández, et al, *Sources of antibiotics pollutants in the aquatic environment under SARS-CoV-2 pandemic situation*, *Case Studies in Chemical and Environmental Engineering*, 4, 2021, 100127, <https://doi.org/10.1016/j.cscee.2021.100127>
- E. Buelow, et al, *Role of pollution on the selection of antibiotic resistance and bacterial pathogens in the environment*, *Current Opinion in Microbiology*, 64, 2021, 117-124, <https://doi.org/10.1016/j.mib.2021.10.005>
- E.R. Fuhrmeister, et al, *Evaluating the relationship between community water and sanitation access and the global burden of antibiotic resistance: an ecological study*, *The Lancet Microbe*, 4, 2023, 591-600, [https://doi.org/10.1016/S2666-5247\(23\)00137-4](https://doi.org/10.1016/S2666-5247(23)00137-4)
- Progress on household drinking water, sanitation and hygiene 2000-2022: special focus on gender, New York: United Nations Children's Fund (UNICEF) and World Health Organization (WHO), 2023.
- R. Magnano San Lio, et al, *How Antimicrobial Resistance Is Linked to Climate Change: An Overview of Two Intertwined Global Challenges*, *International Journal of Environmental Research and Public Health*, 20(3), 2023, 1681, <https://doi.org/10.3390/ijerph20031681>
- M.B. Mahon, et al, *A meta-analysis on global change drivers and the risk of infectious disease*, *Nature*, 629, 2024, 830-836, <https://doi.org/10.1038/s41586-024-07380-6>
- D.R. MacFadden, et al, *Antibiotic resistance increases with local temperature*, *Nature Climate Change*, 8, 2018, 510-514, <https://doi.org/10.1038/s41558-018-0161-6>

WATER IN THE CITY - RAINWATER AND ITS IN SITU MANAGEMENT IN BLUE-GREEN INFRASTRUCTURE

Posted on 9 January 2025 by Adam Stepkowski



There is no more glaring evidence of climate change than that associated with changes in the nature of precipitation. Everyone is familiar with examples of flooded tunnels and basements, accumulated sand and sediment all over the surface of sidewalks, paths and roads, or knocked-out sewer well lids. What was once a rarity is now an everyday occurrence.

Categories: [Feedback](#), [Issue 1/2025](#)

Tags: [city](#), [green and blue infrastructure](#), [rainwater](#), [water](#)



There is no more glaring evidence of climate change than that associated with changes in the nature of precipitation. Everyone is familiar with examples of flooded tunnels and basements, accumulated sand and sediment all over the surface of sidewalks, paths and roads, or knocked-out sewer well lids. What was once a rarity is now an everyday occurrence.

Challenges of rainwater in cities

The main cause of infrastructure problems is the inefficiency of sewer systems, which were not designed to handle such extreme events. In extreme cases, excess rainwater leads to costly damage, obstruction of urban traffic, and runoff of pollutants into the water resources we use, such as river systems and lakes.

Another challenge is that large cities have fewer and fewer permeable surfaces, with concrete, asphalt and other paved surfaces preventing the natural absorption of water by the ground. As a result, rainwater quickly drains into drains, causing overflows. The problems multiply in regions struggling with drought, and exacerbate the phenomenon. We've barely touched on the topic of the effects of climate change, and already the solution is quite clearly in the form of the need to retain water wherever possible, with the simultaneous use of stormwater drains to intercept heavy rainfall and discharge the excess to receiving bodies.

One more important point - when talking about retention, we must remember that behind this word there is a whole scale of solutions with a span from a few meters (a rain garden on a housing estate, about 5^{m3}) to many millions of cubic meters (the Racibórz Dolny Reservoir, about 180 million^{m3}). In everyday communication, this term is used quite arbitrarily, which can cause problems in mutual understanding and substantive discussions. For the purposes of this text, let's assume that we are talking about many small solutions, such as a rain garden or a rain barrel, which by their widespread use will add up to millions of cubic meters of capacity.

To underscore the need to focus on small-scale solutions, it's worth leaning into the way our cities are growing - the fastest to be built is residential development. It is it, fueled by private money, that buys up available land and carries out the investment process without undue delay (commonly at the expense of overtime on projects and construction sites). Investment in large-scale retention facilities usually takes at least as long as two consecutive housing developments.

Securing the availability of land for such developments is also often a problem - competition for space with private developers. These issues, however, are not disconnected, and increasingly often water problems arise only after the construction of a housing development. This is not surprising - if these processes were swapped places and a drainage system was implemented to accommodate runoff from future development, most of the problems could be eliminated. It's easy to write, it's harder to convince everyone of this - despite the fact that everyone intuitively feels that such an order makes much more sense.

Cities face a challenge - climate change is evident, and precipitation will cause more and more problems, so a change in approach is needed, both in terms of development strategies and comprehensive urban planning, which will take into account not only infrastructure development, but also water conservation and sustainable rainwater management. Not taking action and not requiring investors to plan for retention makes it a matter of time before the situation in southern Poland is repeated in other cities.



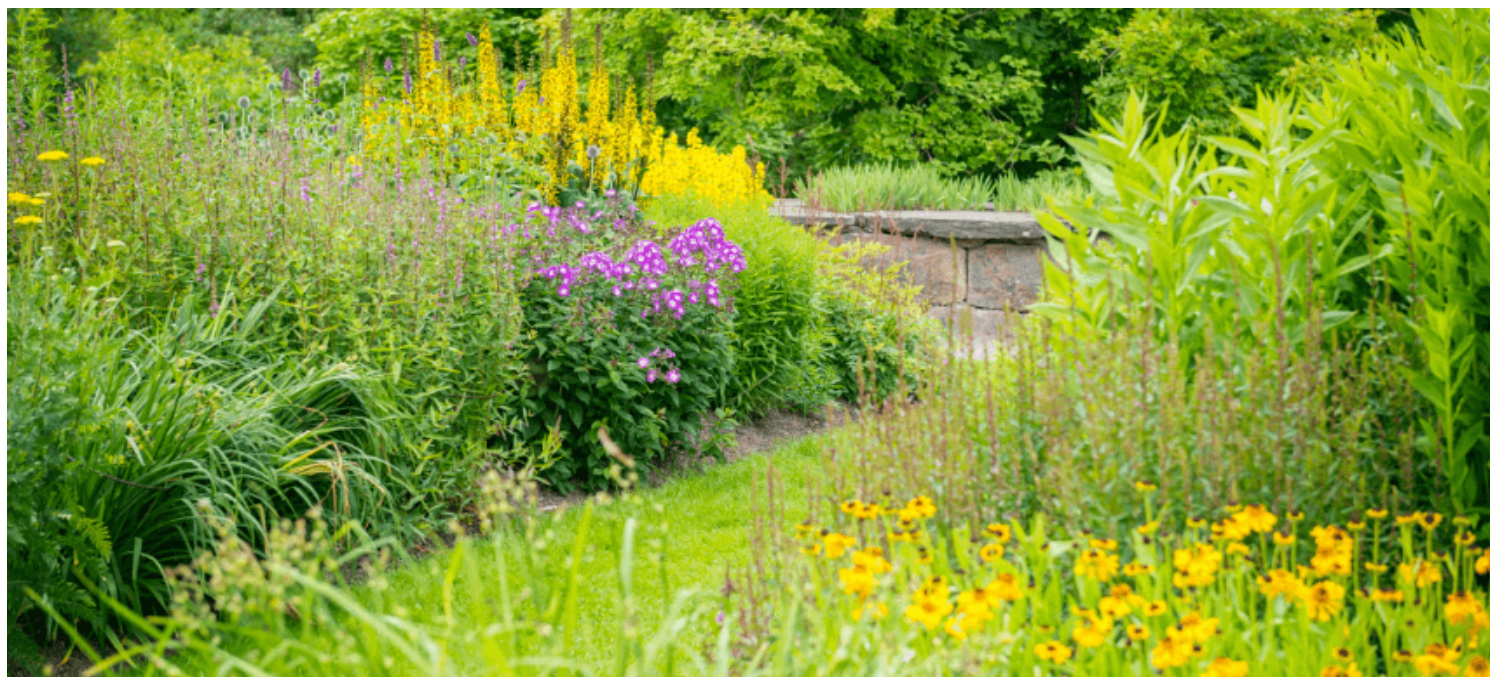
pic. Retentapl

Blue-green infrastructure: definition and meaning

A response to the needs and a common solution that can be used complementary to drainage infrastructure is blue-green infrastructure. That is, an approach to urban space planning that combines rainwater management with greenery integrated into the landscape. Its main goal is to create places that can quickly fill with water during rainfall and allow it to soak in. This means that rainwater is not discharged into the sewer system, but is retained and used on site to support vegetation and improve microclimates, biodiversity and affect other negative effects of climate change.

During dry weather, the space should be able to withstand the phenomenon of drought, such as through natural shading. It is worth paying attention to the planting of such species that can well withstand changing conditions of water availability. Nothing prevents the facility from collecting rainwater permanently, but an emergency overflow should be kept in mind. On a day-to-day basis, the facilities create a cohesive space that is friendly to residents - including by introducing more greenery in their surroundings, promoting biodiversity, improving air quality and reducing the heat island effect.

Examples of such solutions include rain gardens, ponds, drainage ditches, absorption swales, green lanes, green roofs, ecotone zones at the banks of standing and flowing waters, and many other solutions based on the principles of ecohydrology that allow water to seep naturally into the ground. These should be accompanied by a shift in thinking about rainwater management to an approach of finding a place for water wherever possible. The easiest way to understand the need for these solutions is to compensate for the loss of green space by an appropriate amount of cubic meters of retention for every square meter of built-up, impervious surface.



pic. Retentapl

***In situ* rainwater: a key role in sustainable water management**

Managing rainwater *in situ*, that is, directly on the site where it falls, is the most sensible way to compensate for impervious development with retention. It is also the most popular solution used in cities around the world. The idea is to reduce as much as possible the rapid runoff of water into the sewer system and keep it where it fell, allow it to be naturally absorbed and used by the local ecosystem. The difference from the typical urban drainage approach: gully, sewer, outlet to receiver is drastic - we don't get rid of water, but try to retain and use it in the catchment area.

One of the simplest and most effective solutions that can easily achieve these goals are rain gardens. That is, specially designed areas in the form of depressions that collect rainwater, if only from nearby roofs, sidewalks and parking lots. A stone or gravel baffle can be placed at the garden's inlet to trap fine mineral debris, and with the right vegetation and permeable soils, water can seep in there naturally. Plant species for planting in rain gardens are numerous.

It all depends on how much water there will be in it - consider using hydrophytic plants and those that tolerate changing water conditions well. If we do not know whether the soil is permeable, then it is enough to perform a simple percolation test (Retencjapl, Kalisz Supports Nature and Collects Rainwater: Collect and use - how to practically save rainwater, 2022):

1. Dig a hole similar in depth to the one where infiltration will actually occur and watch for 24 hours to see if the water seeps through - if it does, this may indicate a high groundwater level, making infiltration difficult.
2. Check the permeability of the soil by digging a deeper hole (30x30x30-50 cm) and moisten it. If the water soaks in within 24 hours, the site is suitable for creating an absorption basin or rain garden.
3. If water soaks in slowly or not at all, consider other solutions, such as building a pond or sealed tank.

No one needs to be convinced of the positive effects of such solutions - set up a garden, and in time it will be populated by amphibians from a

nearby pond, bees from beehives, which are more and more numerous in urban centers (and bring a bountiful harvest of honey!) and other insects and creatures that will create their own micro-world around the object.

Within cities, green roofs are commonly used as part of biologically active areas, which also serve to manage water *in situ*. Roof surfaces are second only to roadways in generating rapid surface runoff and an easy way to overload sewers. Green (or brown!) roofs, thanks to the layers of substrate (not soil!) and vegetation that cover the top of buildings, allow rainwater to be partially retained, gradually draining away excess water and evaporating. Such solutions not only reduce the amount of water flowing into the sewer system, but also improve the thermal insulation of buildings and introduce greenery into dense urban spaces. They also make up a significant portion of all the green spaces we see from the high floors of some buildings in downtown Warsaw! Bravo!

However, let's return to brown roofs for a moment, because it is a concept, for the time being, not very popular in Poland, and it is definitely quicker to find a tile in this color than to find a definition of the phenomenon and examples. A brown roof (London, 2016) is an unfinished green roof - we prepare the structure and the ground, and leave its settlement in the hands (or pecks) of nature. It's a simple way to employ nature (mainly birds and wind) to do the work of recreating the local flora by freely distributing seeds. In this case, over time, plants that grow on nearby lawns will appear on the roof.

In cities, where compact and tight buildings don't allow much, it's worth considering rain gardens in containers (under a gutter, with an emergency overflow to a nearby grating) or permeable pavements that allow partial infiltration of water into the soil. Unlike asphalt and concrete pavements, which completely block the flow of water, permeable pavements are made of materials (such as a mixture of epoxy resin and gravel) that allow water to soak into the ground. They are ideal for parking lots, sidewalks or city squares.

Another method is the use of retention tanks or sealed rain gardens, which allow rainwater to be collected in areas where its direct absorption into the ground is difficult. The tanks can be placed underground or on the surface, but it is worth remembering to use the collected water, such as for watering vegetation, washing streets or other municipal purposes, and in the case of sealed rain gardens, plant vegetation that will survive in it. Such systems are a valuable solution in cities where there is a lack of natural permeable areas or space for surface solutions.

There are many more ideas, and how they are integrated into the space depends on the designers, who will be motivated to do so by the requirements of the network managers. In Gdansk, any project involving the construction of a drainage system must pass an agreement and provide for retention - without this, no building permit will be issued (Gdansk Water, 2020)! Many other cities are developing procedures that we are helping to implement as Retencjapl (Retencjapl, 2024).

In-situ solutions are a key component of blue-green infrastructure and should form the permanent, essential core of planned development. When undertaking any new development, provision should be made for places to soak up rainwater. The wrong approach is to collect precipitation through sewers and dispose of it - by doing so, we will only end up shifting the problem elsewhere, while getting rid of a valuable resource that may be in short supply during a drought. Climate change forces adaptation, and the most sensible methods are those that occur naturally - it is foolish not to take advantage of them.

As Retencjapl, we put our hand to making a difference and have been helping cities manage stormwater effectively for years, implementing strategies based on blue-green infrastructure, among other things. Our approach focuses on gathering information to map sewer systems and catchments with the highest possible probability when building hydrodynamic models and calibrating them. Then, by performing a series of analyses for different rainfall scenarios, we adjust the conceptual solutions to enhance the attractiveness of cities. Our completed projects are an ideal starting point for building sustainable solutions with climate change adaptation in mind. We also help obtain financing, which in recent years we have successfully translated into investments made in cities such as Bydgoszcz, Lodz, Gdansk, Slupsk, Pruszcz Gdanski and Starogard Gdanski.



pic. Retentapl

Challenges and prospects for the development of blue-green retention systems

Despite its many advantages, the implementation of blue-green retention systems faces a number of challenges. One of the most important is the lack of adequate legal regulations and complicated administrative procedures, such as water permits. In Poland, despite the growing awareness of sustainable water management, there are still many legal barriers that hinder the implementation of nature-friendly projects.

Another problem may be financial constraints. Investments in blue-green infrastructure, despite the long-term benefits, involve high outlays, which discourages some local governments and developers. The cost of installing green roofs, underground infiltration basins or permeable pavement can be high, especially in the context of upgrading existing infrastructure. However, we must not look only through the prism of finances, and should look at the balance of costs and benefits. By investing in rainwater conservation now, we are buying future generations better access to it. If we get rid of water from cities through pipes and outlets - in the near future, urbanized areas will become unfriendly and too polluted to live in.

The prospects for the development of this *sector* are promising, especially with EU funds earmarked for investment in sustainable water management. The European Union has been supporting environmental protection and climate change adaptation projects for years, and blue-green infrastructure fits perfectly with these goals. The availability of funds from such programs as OPI&E, FEnIKS or LIFE is a great opportunity for Poland to accelerate the implementation of current and future projects, and some of them have already been established and are operating alongside us!

Many cities are taking advantage of the funds, making investments that not only improve stormwater management, but also improve the quality of life for residents - this year about PLN 1 billion was allocated for climate change adaptation investments in large and smaller cities (Ministry of Funds and Regional Policy, 2024). Programs such as FEnIKS are not only money for investment, but also promotion and education so that further construction does not involve inconveniencing residents. They are meant to encourage involvement in and anticipation of investments - one of the few opportunities to use EU funds to raise the attractiveness of our close, everyday surroundings.

The future of blue-green retention is therefore closely linked to the approach of network managers to requiring the use of these solutions,

but also to the funding sources available for adapting cities to changing climate conditions. Combined with increasing pressure to protect the environment, these systems are a key element in building the cities of the future - more resilient, greener and more livable.

Summary

Climate change is bringing more and more challenges with alternating problems of excess and shortage of rainwater in cities. Such phenomena as flooding of tunnels or knocking out sewer well manholes are an everyday occurrence in summer, only the place and time differ. An enthusiast can spend the entire holiday season reading articles about extreme phenomena that occur every other day in Poland and every day in the world. Unfortunately, the reality that we experience on our own has its causes in our attitude and neglect of certain issues in the past.

In order for change to occur, a shock is needed (we are able to unite in critical situations), but effective solutions to problems on the climate scale are already a matter of years of commitment and a change of approach to things that we are accustomed to doing under the old rules. In this case, the revolution needs to happen on several levels - formal-legal, administrative, mental and practical. Nevertheless, we have more and more tools (Retencjapl, WaterFolder - Platform for Designers, 2023) and growing awareness, and EU funds, such as the FEnIKS program, represent an opportunity to materialize the dream of the universality of blue-green infrastructure integrated into our cities.

These solutions are essential for adapting cities to changing climate conditions and building more resilient, green urban spaces. The key is to use *in situ* solutions, which means stopping rainwater directly where it falls. Each successive element using simple nature-inspired methods can do much to manage water in a small catchment area, bringing a range of benefits. Observing the greening of our cities already confirms that we are heading in the right direction.

In the article, I used, among others. z:

Danzig Waters. (2020). Retrieved from <https://www.gdmel.pl/dla-inwestorow/wytyczne-dla-projektantow> location

London, M. o. (2016). *The London Plan*. Retrieved from <https://www.wallbarn.com/green-roofs/more-about-green-roofs/what-is-a-brown-roof/> location

Ministry of Funds and Regional Policy. (2024). *European Funds for Infrastructure, Climate, Environment 2021-2027*. retrieved from <https://www.feniks.gov.pl/>

Retencjapl (2022). Kalisz Supports Nature and Collects Rainwater: Collect and use - how to practically save rainwater. Kalisz.

Retentapl (2023). *WaterFolder - A platform for designers*. Retrieved from <https://waterfolder.com/>

Retentapl (2024). *Realized projects*. Downloaded from <https://retencja.pl/o-nas/zrealizowane-projekty/>

CODE OF GOOD PRACTICE FOR WATER USE IN THE POWER INDUSTRY AS A FOUNDATION FOR SUSTAINABLE DEVELOPMENT

Posted on 9 January 2025 by Maja Czarzasty-Zybert



Power generation is counted among key industries and has a huge impact on the environment, and one of the most important resources used in this industry is water. It is used both in the cooling processes of power plants and for generating energy. Its importance is growing in the context of the energy transition and climate change, which is making water resources increasingly scarce. In the face of these challenges, the creation of a code of good practice for the use of water in the power industry could set a new standard for managing this precious resource, combining environmental, social and economic objectives.

Categories: [Feedback](#), [Issue 1/2025](#), [Onet](#)

Tags: [energetics](#), [sustainability](#), [water](#)



Power generation is counted among key industries and has a huge impact on the environment, and one of the most important resources used in this industry is water. It is used both in the cooling processes of power plants and for generating energy. Its importance is growing in the context of the energy transition and climate change, which is making water resources increasingly scarce. In the face of these challenges, the creation of a code of good practice for the use of water in the power industry could set a new standard for managing this precious resource, combining environmental, social and economic objectives.

Water as a key element in the energy sector

Water is one of the pillars of energy operations. In the case of thermal power plants, including nuclear and coal-fired plants, it is used to cool the turbines, as well as in the technological processes involved in power generation. In hydroelectric power plants, on the other hand, it is the primary medium that drives the turbines. Unfortunately, the intensive use of water comes with environmental challenges – from thermal pollution of rivers to the risk of over-extraction, which can lead to local depletion.

Climate change is further exacerbating the problem. Droughts, reduced retention and extreme weather events are making water availability increasingly uncertain. Therefore, the energy sector, which is facing a crisis, must not only adapt to the new conditions, but also set the course for responsible resource management.

Code of good practice – the idea and meaning

A code of good practice would be a set of principles that energy companies could adopt as guidelines for the rational, responsible and sustainable use of water. Such a document would aim not only to ensure compliance with regulations, but also to go beyond the minimum required by regulations, promoting innovation and best practices in water management.

The code could perform several key functions:

- education, showing companies what actions they can take to reduce their impact on water resources;
- motivating, inspiring companies to implement new technologies and solutions that reduce water consumption;
- building trust through transparency and cooperation with local communities and other stakeholders.

What should be included in the code?

The code of good practice should include a comprehensive set of principles and guidelines that would address both the technical aspects of water management and broader social and environmental issues.

An important element would be to promote sustainable water management, which means minimizing water consumption in technological processes. In this regard, companies could use closed-loop systems, which allow the same water to be used multiple times. It would also be important to invest in dry-cooling technologies, which significantly reduce water withdrawals from rivers and lakes.

The code could also emphasize the importance of protecting water quality. Power plants and other energy facilities should strive to reduce

emissions of pollutants, both chemical and thermal. Introducing advanced wastewater treatment systems and limiting the raising of the temperature of water discharged into the environment are examples of measures that could be enshrined in the code.

Adaptation to climate change

With climate change increasing the risk of water shortages on the one hand, and leading to more frequent flooding on the other, a code of good practice could be a tool to help energy companies adapt to these challenges.

One of the key elements should be planning operations in a way that takes water risk into account. This means analyzing local resources already at the stage of selecting the location of new developments, and building retention systems to collect rainwater and use it later in production processes.

Social dimension of the code

An important aspect of the code would be to take into account the needs of local communities. Energy companies must remember that their operations affect the availability of water for local residents and the environment. Therefore, the code should promote activities that support the sustainable development of the regions in which the companies operate.

Initiatives such as co-financing projects that improve access to drinking water or upgrading local water and sewage infrastructure could be highlighted. The code could encourage companies to dialogue with residents and NGOs to build trust and work together to find solutions that protect water resources.

Benefits of the Code

The introduction of a code of good practice for water use in the energy industry could bring many benefits to both companies and society. Companies that adhere to such rules gain an image as responsible and environmentally friendly. At the same time, reducing water use and pollution reduces operating costs and regulatory risks.

From a social perspective, the code promotes the protection of water resources, which are essential for both human health and ecosystems. Promoting sustainable practices in the energy sector can also help improve relations between companies and local communities.

Summary

A code of good practice for water use in the power industry could become an important tool to support the sector's sustainable development. Through clear rules, setting goals and promoting the best technological solutions, it would help power companies to better manage water, protect the environment and build public trust. With the growing challenges of limited water resources, creating such a document would be an important step toward a responsible energy future.

Maja Czarzasty-Zybert, Ph.D. – Legal advisor and doctor of legal sciences in love with energy, yachts and motorsport, especially Formula 1. Graduate of postgraduate studies in nuclear energy at the Warsaw School of Economics. Member of the Governing Board of the Polish Committee of the World Energy Council and co-initiator of the "Energy is a Woman" program implemented by the Polish Committee of the World Energy Council, which aims to encourage women to work in the energy sector. She is a member of the Polish Nuclear Society and the European Nuclear Society.

WORLD'S LARGEST OCTOPUS - THE PACIFIC GIANT

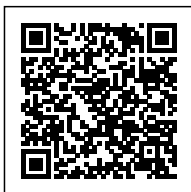
Posted on 9 January 2025 by Iwona Szyprowska-Głodzik



Imagine a creature that can change the color and texture of its skin in a second, on top of that it is flexible enough to squeeze through gaps not much bigger than a tangerine and can weigh as much as the average human. The Pacific giant octopus - the largest in the world - is a true phenomenon of nature. Its life in the depths is so extraordinary that it has stirred people's imagination for centuries, inspiring both fascination and horror.

Categories: [From the world](#), [Issue 1/2025](#), [Onet](#)

Tags: [ocean](#), [octopus](#), [Pacific](#)



Imagine a creature that can change the color and texture of its skin in a second, on top of that it is flexible enough to squeeze through gaps not much bigger than a tangerine and can weigh as much as the average human. The Pacific giant octopus - the largest in the world - is a true phenomenon of nature. Its life in the depths is so extraordinary that it has stirred people's imagination for centuries, inspiring both fascination and horror.

Where does this underwater giant live?

The giant octopus doesn't need luxuries - for it, the ideal place is cool and oxygen-rich water. You will meet it in the North Pacific, from the coast of Alaska, through Canada and Russia to Japan. It feels best at depths of 20 to 1,000 meters, where it finds shelter among the rocks from predators.

In these harsh conditions, the octopus is able to make *a home* for itself. It chooses a suitable place, such as a cave, and *cleans* up around it, throwing away food scraps or unnecessary rock fragments.

Night is her time - in the darkness she comes out to feed, and her long arms move gracefully, searching for prey. During this time, she can seem almost ethereal, as if she were water rather than a living creature.

An appearance that inspires awe and fear

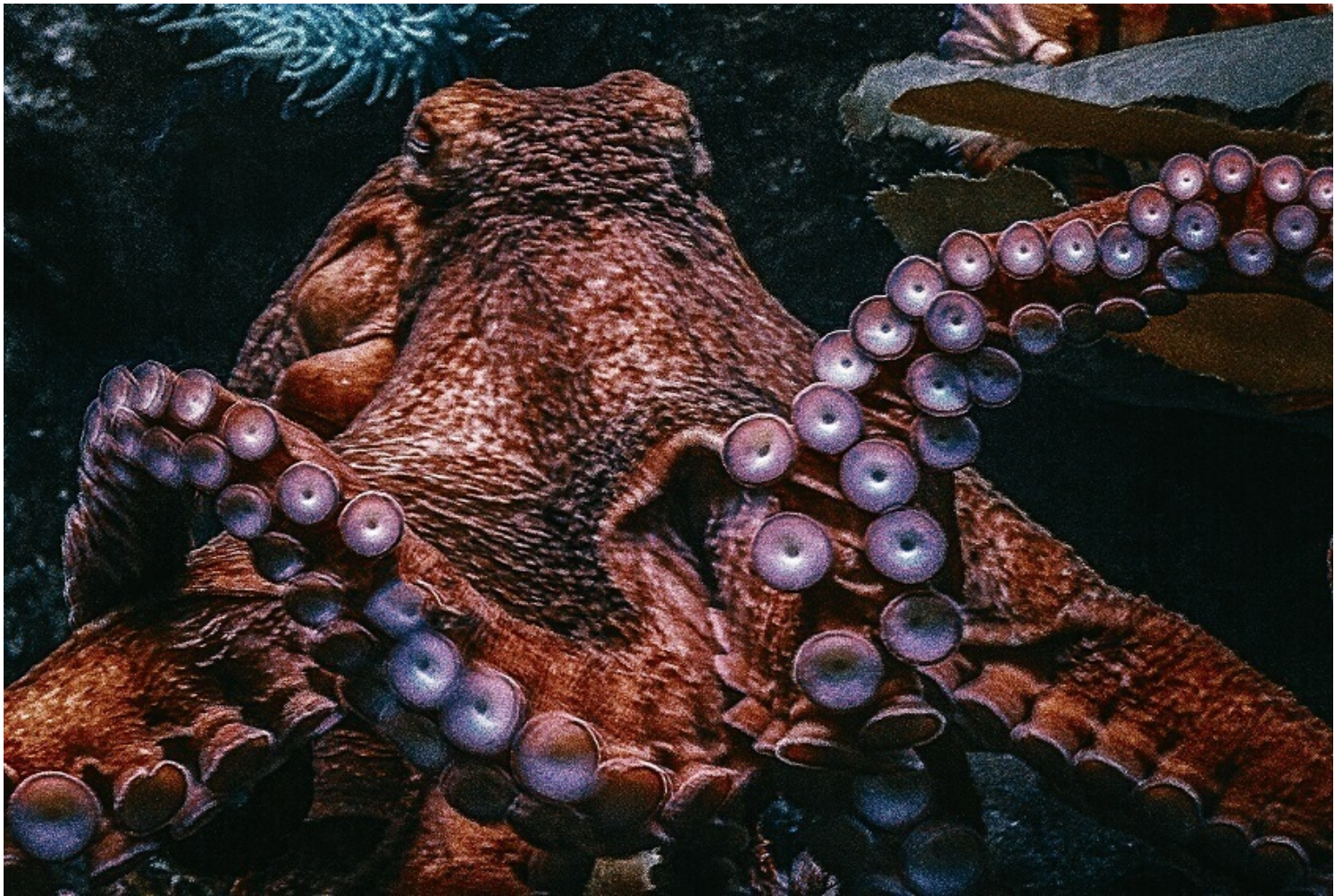
In terms of size, the Pacific giant octopus has no equal among cephalopods. It reaches an arm span of up to 5 m and weighs about 50 kg, but the record-breakers measured as much as 9 m, and their weight exceeded 130 kg!

The unique structure of representatives of this species is the result of millions of years of evolution. Octopuses have a flexible body that allows them to squeeze through crevices no larger in diameter than their beak - the only hard body structure. Meanwhile, the arms, which are the main tool for interacting with the environment, are equipped with hundreds of suction cups that perform not only gripping functions, but also sensory functions. Thanks to the receptors located in them, they are able to analyze the chemical composition of the environment, which allows them to determine precisely whether an object is edible, threatening or neutral. What's more, an advanced nervous system, with most of the neurons located in the arms, enables each limb to make decisions independently.

The unique physiological abilities also extend to the circulatory system. Octopuses are the keepers of as many as three hearts - one is responsible for pumping blood to the entire body, and two additional hearts are responsible for oxygenating blood flowing through the gills. When swimming, the main heart stops working, which reduces the strain on the circulatory system and allows more efficient use of energy.

The eyes of the giant octopus are among the most advanced in the animal kingdom. They allow them to see in varying light conditions, as well as color perception and polarization of light. As a result, they can easily see both a predator and potential prey even in almost total darkness.

An additional feature that ensures their survival is their ability to regenerate lost limbs. If a tentacle is damaged or cut off, the octopus is able to fully reconstitute it within a few months. This unique property significantly increases its chances of survival in the demanding ocean environment.



pic. K. Mitch Hodge / Unsplash

Camouflage and intelligence tools for survival

Octopuses are masters of camouflage. Thanks to special pigment cells contained in their skin (chromatophores), they can change color and pattern, perfectly matching their surroundings. But that's not all - they can also change the texture of their skin, resembling coral, rocks or sand.

The intelligence of octopuses amazes scientists. They can open jars, solve puzzles and remember patterns. In laboratories, they have been observed using tools - shells, for example - for protection or hunting. This proves that these animals are much smarter than we might think.

The daily life of an octopus

The diet of the giant octopus includes crabs, clams, fish and other cephalopods. It hunts cleverly, using its suckers and arms to grab prey, and splitting their carapaces with its beak. It also sometimes falls prey to larger predators itself, such as seals, whales and sharks.

In a threatening situation, it can escape instantly, leaving behind a cloud of ink that acts as a smokescreen.

The cycle of life - a story full of sacrifice

The life of the giant octopus is short but intense - lasting 3 to 5 years. The key stage in the female's cycle begins when she reaches sexual maturity. Then she lays up to 100,000 tiny eggs, carefully arranging them in her hiding place. But this is just the beginning.

For several months she constantly takes care of her future offspring - ventilates the water, cleans the eggs and guards them from predators. During this time she does not eat or leave her hiding place, which leads to the gradual destruction of her body. When the young finally hatch, the female dies.

Photo. main: Mikhail Preobrazhenskiy / Unsplash

HOW ARE GLACIERS FORMED? FROM A SNOWFLAKE TO AN ICE GIANT

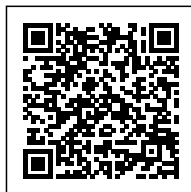
Posted on 9 January 2025 by Iwona Szyprowska-Głodzik



Glaciers are some of nature's most powerful creations. These huge masses of ice not only shape landscapes, but also play a key role in regulating our planet's climate. How are they formed? What features do they have? And why is their presence so important for Earth's future? Let's take a closer look at this ice mystery.

Categories: [From the world](#), [Issue 1/2025](#)

Tags: [climate change](#), [glaciers](#), [ice](#), [snow](#)



Glaciers are some of nature's most powerful creations. These huge masses of ice not only shape landscapes, but also play a key role in regulating our planet's climate. How are they formed? What features do they have? And why is their presence so important for Earth's future? Let's take a closer look at this ice mystery.

How are glaciers formed?

Glaciers *are born* in places where snow accumulates over many years, and summer melting cannot keep up with winter precipitation. Special climatic conditions - low temperatures, high humidity and regular snowfall - play a key role. The process begins with the gentle settling of successive layers of snow, which become more and more compact over time. In this icy metamorphosis, air is gradually squeezed out of the bubbles between them.

Initially, firn is formed - compact, granular snow, a kind of bridge between fresh precipitation and hard glacial ice. The transformation of firn into glacial ice takes decades, sometimes even hundreds of years. This hard, almost transparent ice is the result of relentless weight and the passage of time. When a glacier reaches a critical mass, it begins to move under the influence of its own weight. Although this movement is almost imperceptible to the human eye, it is of great importance in shaping the landscape. Moving masses model their surroundings in a way that leaves a lasting mark on the surface - they not only destroy, but also create new landscape forms.

Glaciers up close

The movement of a glacier can be compared to a slow but relentless stream. The upper layer moves faster, while the lower, plastic part slides over the rocky ground. As a result of this process, the huge and heavy mass sculpts the rocks, creating monumental valleys, steep walls and picturesque lakes.

There is no shortage of examples of glacial formations. In the Yosemite Valley in the United States, we can admire spectacular landscapes, shaped by a long disappeared glacier. In Europe, such traces can be seen in the Alps, where lakes, such as those of Geneva and Bodensee, owe their formation to retreating ice masses. Norwegian fjords, such as Sognefjord or Geirangerfjord, on the other hand, are the results of centuries of glacial relief, which created deep valleys filled with water.

Each of these landscapes is a unique reminder of the icy past. Glacial sculpture combines the power of destruction with creation - destroying existing forms and creating new ones.

The magic of blue ice

One of the most unusual phenomena associated with glaciers is their color. Glaciers often have an intense blue hue that gives them an almost magical character. Where does this color come from? The answer lies in physics. Glacier ice absorbs long wavelengths of light (red and orange), reflecting shorter wavelengths - blue.

Glaciers are not uniform in composition or structure. Inside them you can find tunnels, underground rivers and even trapped fragments of rock or sediment. All this makes them not only unique natural formations, but also fascinating laboratories of nature.

Diversity of glaciers

Glaciers come in many forms, and their diversity reflects the conditions under which they form:

- Mountain glaciers are smaller formations found in the Himalayas, Andes or Alps. They are crucial to local ecosystems, and have the important task of supplying water to millions of people.
- Continental glaciers, such as those covering Greenland and Antarctica, are true giants that contain the world's largest freshwater resources. Their melting affects global ocean levels.
- Shelf glaciers float in ocean waters, and icebergs that break away from them become a habitat for many marine organisms, while also posing a threat to shipping.

Glaciers a reflection of global change

We can't say about glaciers that they are just masses of ice. On the contrary, they are real treasure troves of knowledge about our planet. Their layers act as natural archives - they store information about past climatic conditions, volcanic eruptions and even atmospheric pollution. Each of their layers is like a page from the book of Earth's history, going back hundreds of thousands of years. For scientists, they are an invaluable source of knowledge that allows them to track the changes that have taken place on our planet over the centuries.

When glaciers disappear, they leave behind a void - literally and figuratively. Their melting contributes to rising ocean levels, threatening not only coastal communities, but also fragile aquatic ecosystems. But that's not all - glaciers are a record of our planet's history, allowing scientists to better understand climate change.

For example, ice cores extracted from the depths of glaciers contain a record of the composition of the atmosphere hundreds of thousands of years ago. Analysis of this data allows us to track changes in the levels of greenhouse gases, such as carbon dioxide and methane, as well as temperatures. This allows us to predict future risks and better prepare for the challenges of global warming.

Glaciers are not just scenic wonders - they are the foundations of the global ecosystem. They are a key source of drinking water, regulate the hydrological cycle and support unique ecosystems. Their disappearance is a problem that affects not only polar or mountain regions, but the entire world.

DOI: [10.1126/science.adk3705](https://doi.org/10.1126/science.adk3705)

THE BEAK – A LIVING FOSSIL

Posted on 9 January 2025 by Adam Kapler



All freshwater bodies combined represent a small area compared to that of the sea or land. As a result, competition among freshwater inhabitants will be less severe than elsewhere. New forms will form more slowly, while old forms will die off more slowly. That's why it's in fresh water that we find seven types of ganoid fish, remnants of a once dominant order. In fresh water in general, we can find some of the most anomalous forms now known in the world, such as [dziobak] Ornithorhynchus and [prapłaziec] Lepidosiren, which, like fossils, combine to some extent the orders now widely separated on the natural scale [on the ladder of being, in systematics]. These anomalous forms can almost be called living fossils - they have survived to the present day, inhabiting a limited area and thus being exposed to less severe competition. (Charles Darwin, On the Origin of Species).

Categories: [In this issue](#), [Issue 1/2025](#), [Onet](#), [Science](#)

Tag: [pecker](#)



All freshwater bodies combined represent a small area compared to that of the sea or land. As a result, competition among freshwater inhabitants will be less severe than elsewhere. New forms will form more slowly, while old forms will die off more slowly. That's why it's in fresh water that we find seven types of ganoid fish, remnants of a once dominant order. In fresh water in general, some of the most anomalous forms known in the world today can be found, such as *Ornithorhynchus* and *Lepidosiren*, which, like the fossils, unite to some extent the orders now widely separated on the natural scale .. Te anomalne formy można niemal nazwać żywymi skamieniałościami – przetrwały do dnia dzisiejszego, zamieszkując ograniczony obszar i będąc w ten sposób wystawione na mniej dotkliwą konkurencję . (Karol Darwin, *O pochodzeniu gatunków*).

Already Charles Darwin called the beak a *living fossil*, pointing to its nature as an intermediate link between two clusters: reptiles and mammals. Nowadays, thanks to advances in paleontology and phylogeography, we have come to know many more such peculiarities. We admit the nature of living fossils to such *common* fossils as platypuses, cockroaches and horsetails. On the other hand, some scientists reject the very concept of *living fossils* and *relict species* in general. Regardless of which of these approaches triumphs in research and didactics, steak biology in the broadest sense will remain an inexhaustible source of examples and puzzles for future generations of researchers. Although we don't know how to breed them in a zoo, we have had cell lines of these marvels for more than 40 years .

Once slowly

Platypus genes have been studied for decades. Already the initial version of the genome sequencing was a sensation worthy of publication in *Nature* (May 8, 2008). The attention of scientists and readers was captured by typically reptile and typically mammalian elements. Two genes previously characteristic only of fish, amphibians and birds as typically oviparous animals were also identified. The genome as a whole turned out to be small. It counts a mere 2.3 billion base pairs, forming just over 18,500 protein-coding genes. The number of genes thus turned out to be fairly typical for mammals. Little! More than $\frac{4}{5}$ of our protagonist's genome was consistent with the preliminarily sequenced genomes of typical placentals and marsupials.

For 15,312 of the 18,527 functional genes mentioned earlier, orthologs (in the big picture: 1:1 equivalents) were immediately found for 5 other mammals. All of these pecking orthologs encode metabolism, DNA replication or splicing. These activities take place the same way in all oviparous mammals, so their genes evolve rather slowly .

Once quickly

The remaining genes (without orthologs) change more rapidly. Nearly 2,000 of them encode olfactory receptor proteins. Just as the beak phenotype lacks a uterus and true nipples, so the genotype lacks many genes typical of all viviparous mammals. Among them, as indispensable as they may seem, such as those encoding vitellogenin II, cytochrome P450, glutamine synthetase and melatonin receptor 1C. Scientists have been intrigued for decades by the mechanisms of sex determination in stevedores. As is well known, sex in birds is determined at the genetic level inversely than in mammals. Females have ZW genes, males ZZ, while female placentals have XX and males have XY.

In today's reptiles, a considerable variety of genetic mechanisms responsible for sex have been preserved, since the sex of certain crocodiles and turtles depends on the heat of the environment. In the case of the beak, despite its oviparity, beak and ravenous bones, a typically mammalian determination system with XY males and XX females was expected. Meanwhile, the platypus shocked again. In the field of genetic foundations of sex, it turned out to be similar to reptiles, yet unlike the rest of the insectivores. Not even to the as closely related spiny dogfish with X0 sex determination system .

The beak, however, more reptilian than thought

After decades of searching, researchers have finally accepted that male beaks do not have a Y chromosome or the SRY gene, crucial for male sexual characteristics (even a human with two XX, but active SRY phenotypically and psychologically is considered male). Instead, some homologs of genes typical of birds and reptiles have been discovered. It's been 20 years since scientists from the Australian National University observed a whole 10 sex chromosomes in the beak instead of the 2 characteristic of placentals. Mr. Beak thus has a whole chain of XYXYXYXYXY heterosomes, instead of the modest XY like humans.

The use of the X and Y symbols to describe the beak genome is controversial, since the X chromosome of platypus bears a confusing resemblance to the typically avian Z, rather than the X heterosomes typical of the bagworms or placentals. Could it be homologous to the chromosomes of reptiles and birds? Despite strenuous research, no human X orthologs have been found. The genetic underpinnings of sex determination in the steak beaks turned out to be much more archaic and similar to sauropsids than had been supposed. The sex determination of the beak is as *bird-like* as its eggs or beak. On the other hand, the sex determination system in viviparous animals (bagworms and placentals), based on X and Y heterosomes, turned out to be a much more recent evolutionary invention than previously thought.

It must have emerged only after the evolutionary lineage of steatids and viviparous mammals separated. Platypus spermatozoa contain either the entire 5Y set or the 5X set. During meiosis, the heterosomes of the steakpods form something like a chain. In the absence of the SRY gene, it is not very clear how the 5Y set determines technically (or not?) the male sex in the beak .

But balls!

The genes, and consequently the proteins they encode, responsible for the fertilization of the egg and the earliest divisions of the embryo, turned out - as expected this time - to be something between a typically reptilian and typically mammalian set. KIR (killer cell immunoglobulin-like receptor) paralogs alone were counted in the beak 214 (against less than 20 in humans). The number of 15 given in the Polish Wikipedia for humans needs to be increased by at least 1 (14 active plus 2 pseudogenes).

In *Homo sapiens*, it is the KIRs that are responsible for much of the fertility problems, including so-called immune infertility, habitual miscarriages or implantation problems after *IVF*. Such a large number of perhaps functional KIRs in platypus is due to the complex reproductive biology combining the typically reptilian stage of development in the egg with the almost mammalian (though still similar to mechanisms in oviparous reptiles) stage of feeding the embryo through the egg walls in the female's reproductive tract .

Small is beautiful

The beak also proved peculiar in the area of non-coding RNA proteins. For these were observed in it less than in the rest of mammals, 1220 except for small nuclear RNAs. The latter, conversely, platypus has some 2,000 copies, so ten times more than typical mammals. The general differences in the size of the 52 chromosomes of platypus bring to mind associations with the micro- and macro-chromosomes of typical reptiles. The genome of our hero is dominated by finer microchromosomes. Here, however, the similarities with birds end, for the genes located on them do not overlap with homologous chicken genes .

A little one can do more (spoil?)

There is a veritable rash of short, scattered nuclear retrotransposons lacking long, terminal (SINE)-like repeats, numbering about 40,000. SINE retrotransposons *travel* through genomes by retrotransposition, forming short repeats of the genetic code at the integration site. Scientists are still discussing the possible functions of these stretches. However, they agree on their significant impact on the functioning of entire genomes. In humans, links have been seen between their presence and certain cancers.

SINEs are not bad for markers in phylogenetic analyses because of the marked differences between species. On the other hand, the beak's piRNA, an RNA associated with the Piwi protein, responsible for methylation and DNA silencing, turned out to be remarkably similar to the RNAs of the placental mammals and the placental mammals. In platypus, it is characterized by a higher number of repeats and transposon-protective structures than in viviparous mammals .

Art for art's sake? Or art for the sake of art?

Because of the early divergence of stevedores and viviparous mammals and the small number of surviving species of the former group, the beak has become a frequent object of evolutionary biology research. But isn't chiseling away at its genome and proteome a kind of *art for art's sake*? Finding answers to questions important only to a group of harmless weirdos? Wasting time and resources that should rather be spent on fighting cancer and aging? Or protecting against biological weapons?

The scientists, appealing for further research funding, also cite the potential for practical applications of the results of their work on the beak for all of humanity. Among other things, they promise a better understanding and, as a result, more effective treatment of autoimmune diseases and more efficient production of vaccines for humans, livestock and game .

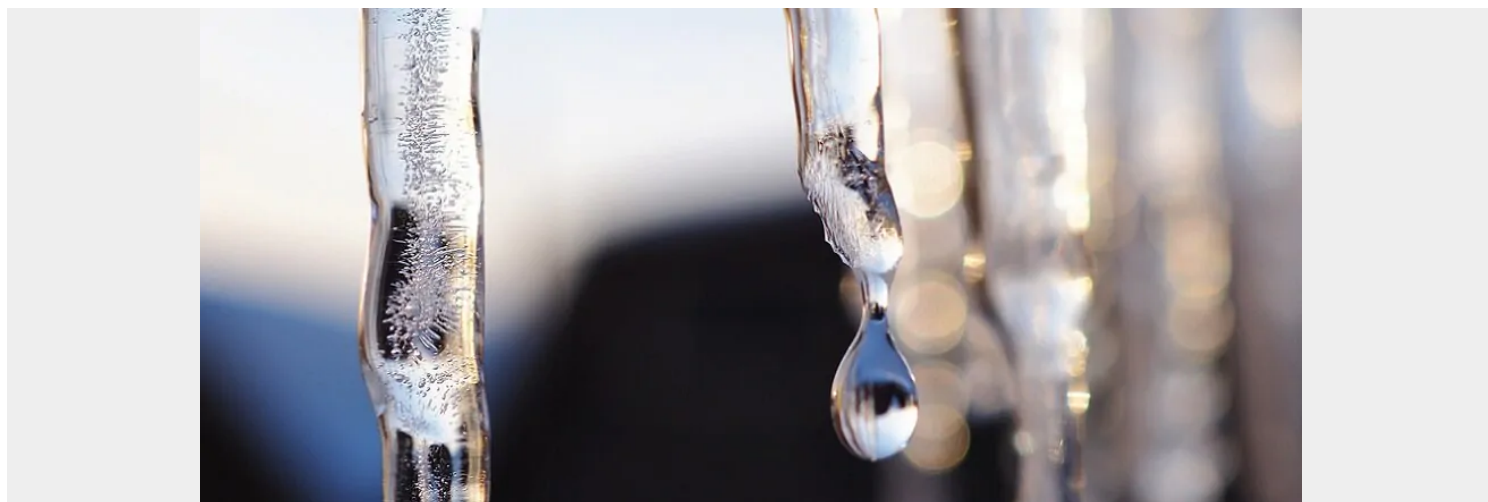
In the article, I used, among other things. z:

1. Baldwin, J., Temple-Smith, P.D. 1973 Distribution of LDHX in mammals: presence in marsupials and absence in the monotremes platypus and echidna. *Comp. Biochem. Physiol.* 46B: 805-811.
2. Bick, Y., Jackson, W. 1967 A mammalian X-O sex chromosome system in the monotreme *Tachyglossus aculeatus* determined from leucocyte cultures and testicular preparations. *Am. Nat.* 101, 79-86.
3. O'Brien, S. 2004 The Platypus Genome Unraveled. *Cell* 133 (6), 953-955.
4. Grützner, F., Deakin J., Rens, W., El-Mogharbel, N., Graves, J.A.M. The monotreme genome: a patchwork of reptile, mammal and unique features? *Comparative Biochemistry and Physiology Part A: Molecular & Integrative Physiology*, 136(4), 867-881.
5. Kirsch, J.A., Mayer, G.C., 1998 The platypus is not a rodent: DNA hybridization, amniote phylogeny and the palimpsest theory. *Phil. Trans. R. Soc. B* 353, 1221-1237.
6. Watson, J.M., Frost, C., Spencer, J.A., Graves, J.A.M. 1993. Sequences homologous to the human X- and Y-borne zinc finger protein genes (ZFX/Y) are autosomal in monotreme mammals. *Genomics* 15: 317-322.
7. Wesley, C., Warren, LaDeana W., Graves, J., Ewan Birney, E., Ponting, C., Grützner, F, Belov, K., Miller W., Clarke L.. 2008. genome analysis of

the platypus reveals unique signatures of evolution. *Nature* 453 (7192), pp. 175-183.

PERMAFROST RELEASES GHOSTS OF THE PAST

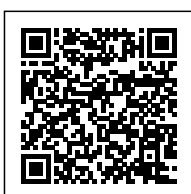
Posted on 9 January 2025 by Agnieszka Kolada



Do you remember the 1969 French film titled *Hibernatus*? The title character - Paul Fournier (played by Bernard Alane) - is awakened after more than 50 years of being frozen in the Greenland ice, and his appearance causes many amusing adventures, but also unexpected problems. It only took half a century of hibernation, and already a newcomer from the past has caused quite a stir. The situation is no different with other frozen animals trapped in the ice of Alaska or Siberia. The permafrost stores not only mammoths, but also many secrets that, when released after tens, hundreds, and sometimes even millions of years, can stir up as much trouble as the titular *Hibernatus*.

Categories: [Issue 1/2025](#), [Onet](#), [Science](#)

Tags: [climate change](#), [melting](#), [permafrost](#)



Do you remember the 1969 French film titled *Hibernatus*? The title character - Paul Fournier (played by Bernard Alane) - is awakened after more than 50 years of being frozen in the Greenland ice, and his appearance causes many amusing adventures, but also unexpected problems. It only took half a century of hibernation, and already a newcomer from the past has caused quite a stir. The situation is no different with other frozen animals trapped in the ice of Alaska or Siberia. The permafrost stores not only mammoths, but also many secrets that, when released after tens, hundreds, and sometimes even millions of years, can stir up as much trouble as the titular *Hibernatus*.

Permafrost, or permafrost

Permafrost (sometimes called permafrost in English) is defined as ground or bottom sediment that remains frozen for a period of not less than 2 years. It is a remnant (relic) of the glaciation that covered much of the Northern Hemisphere's land areas in the Pleistocene. It currently covers about 11 percent of the Earth's surface and 15 percent of the Northern Hemisphere, covering an area, according to various sources, of 18 to 23 million square kilometers. Of this, about 80 percent is in Alaska, most of northern Canada and more than half of Siberia. It is also spotty in the Scandinavian Mountains and Greenland. Discontinuous permafrost is also found in high mountain regions, mainly in Tibet and the Alps.

Not everyone knows that permafrost has also been discovered in northeastern Poland, near Suwałki (after all, the cold pole!). In 2010. Geologists from the National Geological Institute at a depth of more than 350 meters have come across the ceiling of permafrost 13,000 years ago. This is a remnant of permafrost from the period of the last glaciation, which has survived to our time thanks to specific geological conditions, the so-called Suwałki geothermal-hydrogeochemical anomaly.

According to data from the U.S. National Snow and Ice Data Center (NSIDC), the thickness of permafrost varies from less than 1m to more than 1km. Most of this cover has survived in the Arctic for 800,000 to 1 million years, but climate change could significantly change this picture.

Permafrost not so eternal

Numerous data prove that as the planet warms, permafrost is thawing at an accelerating rate; especially since the Arctic regions are experiencing temperature increases about 2-3 times faster than the global average. Over the decade between 2007 and 2016, the rate of permafrost temperature increase ranged from $0.39 \pm 0.15^\circ\text{C}$ to $0.20 \pm 0.10^\circ\text{C}$, and long-term measurements indicate its record high temperatures at depths of 10-20 meters.

Even if the increase in global air temperature does not exceed 2°C by 2100, permafrost will continue to degrade over a significant area. Some estimates indicate that up to two-thirds of the near-surface permafrost could melt by that year. It's not hard to guess that this process will not leave the Earth's ecosystem unaffected.



pic. Boris Radosavljevic, CC BY 2.0 / commons.wikimedia.org

Trapped in ice, or miracle-whirls

For millennia, as a result of natural processes, various incidents or intentional storage, permafrost has accumulated a variety of matter. It traps huge amounts of greenhouse gases, anthropogenic pollutants, including nuclear waste, heavy metals, persistent organic pollutants and other hazardous substances, as well as microorganisms - bacteria and viruses. And as long as they remain frozen, they are inactive and relatively harmless, because no physical or biological processes take place in them. The problem begins when thawing releases them into the environment, and with them known and unknown dangers.

The main issue raised in the media and scientific literature in the context of permafrost melting is the release of greenhouse gases. It is estimated that 1.46 to 1.70 billion tons of carbon, including methane and carbon dioxide, are accumulated in the ice of Arctic areas. The permafrost region contains 33 percent of the global pool of carbon stored on just 15 percent of the world's total land area.

Thawing permafrost releases the greenhouse gases carbon dioxide and methane into the atmosphere, although key elements of this process, such as the amount, specific sources and timing of the release, remain unclear and are still the subject of extensive discussion and analysis. Currently available models predict a variety of scenarios, ranging from those that indicate a gradual release of 5 to 15 percent of carbon stocks over decades and centuries to those that indicate a sharp jump in the amount of carbon released from permafrost into the atmosphere over the next 100 years. Regardless of the severity of this phenomenon, the increase in CO_2 and CH_4 emissions from permafrost areas is a fact.

Free the atom? Heavy metals and DDT too, unfortunately

The release of greenhouse gases is a big, but not the only problem resulting from thawing permafrost. As a 2021 review of the issue, published in *Nature Climate Change*, indicates, since the beginning of the industrial era, permafrost has accumulated heavy metals, soot and other

byproducts of fossil fuel combustion transported long distances by air. Over the past 80 years, the array of anthropogenic pollutants has expanded to include other dangerous chemicals, such as the insecticide DDT (dichlorodiphenyltrichloroethane), hexachlorohexane (HCH) and polychlorinated biphenyls (PCBs), commonly used in coolants.

These substances were banned in the early 21st century, but the Arctic permafrost continues to be a reservoir for them. These and other persistent organic pollutants (POPs), which have entered the Arctic by air and accumulated in the permafrost in significant quantities over time, can negatively affect ecosystem stability, human and animal health when released into the environment.

The release of hazardous substances is reflected in trophic networks. The presence of long-discontinued POPs is found in the tissues of invertebrates, seabirds, fish and mammals, confirming the penetration and transfer of these chemicals to all trophic levels. In Arctic plants, concentrations of PCBs and organochlorine pesticides are now higher than in local soils. Trophic networks will therefore be an important vector for the spread of released substances.

The Arctic hides natural deposits of metals that have been mined for decades. Mining activity has left waste rich in toxic heavy metals such as mercury, arsenic and nickel. It is estimated that mercury alone is stored in the permafrost at around 800,000 tons, and current warming trends could increase its emissions by up to 200 percent by 2300.

The Arctic's soil and permafrost show high levels of radioactive waste, accumulated from nuclear tests conducted here since the 1950s. In the 1970s. Detonations carried out by the Soviet Union in the New Earth archipelago released 265 Mt of nuclear energy. In the Barents and Kara Seas, the Russians sank more than 100 decommissioned nuclear-powered submarines, releasing radioactive plutonium and cesium, detected today in bottom sediments and ice caps, as well as in plants and soil beneath glaciers. Scientists estimate that radiation levels in the Arctic could remain harmful until 2500.

Zombies made of ice

If greenhouse gases and radioactive materials may be a bit of an abstraction for some, then perhaps viruses will no longer be. In truth, they can't be seen by the naked eye either, but the consequences of their appearance can be truly spectacular, as humanity has seen many times in its history.

Indeed, numerous microbial threats, such as bacteria and viruses, also lurk in the Arctic permafrost. The low temperature, lack of light and oxygen create conditions ideal for the preservation of biological material, allowing microorganisms (called Matuzalem microorganisms by scientists because of their longevity) to survive for thousands or even millions of years. In 2014, scientists isolated live viruses from the Siberian permafrost and showed that even though they had been preserved for thousands of years, they still had the ability to infect single-celled organisms.

Granted, they only attacked amoebae and posed no threat to humans, but that doesn't mean that other viruses - now trapped in permafrost - can't cause disease in humans. Further research, published in 2022, revealed the existence of several different strains of viruses in the Siberian ice that maintained the ability to infect cultured cells. One of the samples had more than 48,000 years. A permafrost survey of Sweden's Stordalen Mire found more than 1,900 viruses, 58 percent of which were still active.

Scientists believe that in the deepest layers of permafrost there may be preserved viruses that are up to 1 million years old, much older than our species, which is believed to have emerged around 300,000 years ago. This means that the human immune system has never come into contact with many of them. The scenario in which an unknown virus that once infected a Neanderthal becomes a threat to modern humans, while unlikely, is no longer a complete abstraction.

Not just humans and mammoths

Media reports on finds in the melting permafrost focus mainly on large, spectacular objects, such as the relatively numerous mammoth remains discovered, or *the ice man Ötzi*, found in 1991 on the Alpine glacier Val Senales on the border between Tyrol and Italy, whose age was determined to be five and a half thousand years old. As Maja Lunde writes in her latest book:

Ötzi held the title of Europe's oldest mummy for many years, but that was before the twenty-first century, before the time of the great melt, before the truly age-old ice deposits were exposed (...). The author may enthrall some with her visionary spirit and irritate others with her naiveté, but some of her visions seem increasingly likely. It may not be long before the melting permafrost unleashes even more astonishing ghosts of the past.

In the article, I used, among others. z:

Lindgren A., Hugelius G., Kuhry P., et al. (2016). GIS-based maps and area estimates of Northern Hemisphere permafrost extent during the last glacial maximum: LGM permafrost. *Permafr. Periglac. Process.*, 27 6-16

Overduin P.P., Deimling S. von T., Miesner F., et al. (2019). Submarine permafrost map in the Arctic modeled using 1-D transient heat flux (SuPerMAP). *J. Geophys. Res. Oceans*, 124, 3490-507

Szewczyk J., Frozen Time.

<https://web.archive.org/web/20190501153606/https://www.pgi.gov.pl/kopalnia-wiedzy/128-energia-geotermalna/594-zamroiony-czas.html>

Biskaborn B.K., Smith S.L., Noetzli J. et al. (2019). Permafrost is warming at a global scale. *Nat Commun*, 10, 264.

<https://doi.org/10.1038/s41467-018-08240-4>

Miner K.R., Turetsky M.R., Malina E. et al. (2022) Permafrost carbon emissions in a changing Arctic. *Nat Rev Earth Environ* 3, 55-67.

<https://doi.org/10.1038/s43017-021-00230-3>

Schuur E.A.G., Abbott B.W., Commane R., et al. (2022). Permafrost and Climate Change: Carbon Cycle Feedbacks From the Warming Arctic. *Annual Review of Environment and Resources*, 47:343-371. <https://doi.org/10.1146/annurev-environ-012220-011847>

Miner K.R., D'Andrilli J., Mackelprang R. et al. (2021). Emergent biogeochemical risks from Arctic permafrost degradation. *Nat. Clim. Chang.* 11, 809-819.

<https://doi.org/10.1038/s41558-021-01162-y>

Rigou S., Christo-Foroux E., Santini S., et al. (2022). Metagenomic survey of the microbiome of ancient Siberian permafrost and modern Kamchatkan cryosols. *microLife*, 3, uqac003. <https://doi.org/10.1093/femsml/uqac003>

Rigou S., Santini S., Abergel C., et al. (2022). Past and present giant viruses diversity explored through permafrost metagenomics. *Nat Commun*, 13, 5853. <https://doi.org/10.1038/s41467-022-33633-x>

Emerson J.B., Roux S., Brum J.R., et al. (2018). Host-linked soil viral ecology along a permafrost thaw gradient. *Nat Microbiol* 3, 870-880.

<https://doi.org/10.1038/s41564-018-0190-y>

Lunde M. *Dream of a Tree*. Literary Publishers, 2024

AQUATIC PUBLICATION REVIEW (32)

Posted on 9 January 2025 by Agnieszka Kolada



Small mid-field reservoirs are a very important element of the agricultural landscape. They are not only refugiums of flora and fauna or regulators of the microclimate, but also filterers of excess nitrogen. The effectiveness of such ecosystems in removing this element has been studied in China by scientists there. Since winter is on the calendar, the topic of glaciers could not be missed – it turns out that their role in shaping the Earth's topography and climate due to erosion is greater than that of rivers. These, in turn, have been changing their hydrological patterns in recent years, but these changes are uneven across sections of the watercourses. Scientists came to interesting conclusions by comparing the diversity and taxonomic composition of the microbiome of surface and subsurface environments, as well as marine and terrestrial environments. In turn, an analysis of the conservation status of more than 23,000 taxa of freshwater fauna included in the IUCN Red List shows that 1/4 of them are threatened with extinction. I don't think any of us are surprised by this fact. These, in turn, have been changing their hydrological patterns in recent years, but these changes are uneven across sections of watercourses. Scientists have come to interesting conclusions by comparing the diversity and taxonomic composition of the microbiome of surface and subsurface environments, as well as marine and terrestrial environments. In turn, an analysis of the conservation status of more than 23,000 taxa of freshwater fauna included in the IUCN Red List shows that 1/4 of them are threatened with extinction. I don't think any of us are surprised by this fact.

Categories: [Science](#), [Issue 1/2025](#)

Tags: [agriculture](#), [ecosystems](#), [glaciers](#), [rivers](#), [winter](#)



Small mid-field reservoirs are a very important element of the agricultural landscape. They are not only refugiums of flora and fauna or regulators of the microclimate, but also filterers of excess nitrogen. The effectiveness of such ecosystems in removing this element has been studied in China by scientists there. Since winter is on the calendar, the topic of glaciers could not be missed – it turns out that their role in shaping the Earth's topography and climate due to erosion is greater than that of rivers. These, in turn, have been changing their hydrological patterns in recent years, but the changes have been uneven across sections of the watercourses.

Scientists came to interesting conclusions by comparing the diversity and taxonomic composition of the microbiome of surface and subsurface environments, as well as marine and terrestrial environments. In turn, an analysis of the conservation status of more than 23,000 taxa of freshwater fauna included in the IUCN Red List shows that, $\frac{1}{4}$ of them are threatened with extinction. I don't think any of us are surprised by this fact.

1 Shen W., Zhang L., Ury E.A. et al. (2025). Restoring small water bodies to improve lake and river water quality in China. *Nat Commun* 16, 294 .

Nature restoration is not only of conservation importance, but above all supportive in restoring natural resources and processes that are crucial to our functioning. Researchers in China proved this by studying the role and effectiveness of small inland water bodies as filterers of excess nitrogen from agriculture. Analysis of satellite data from an area of 10 major river basins in mainland China from 1995 to 2015 shows that the number of reservoirs has declined by 43 percent, with the most dramatic decline, both in number and area, found in reservoirs less than $10^{4.5} \text{m}^2$ (3.16 hectares), located in agricultural areas.

Currently, China's reservoirs remove 986 kilotons of nitrogen per year, accounting for 3 percent of the surplus of this element in the landscape. The authors showed that restoring 7 percent of the area of small reservoirs (a total of 2.3 million hectares) could increase nitrogen removal up to 21 percent (211 kilotons per year) nationally, while restoring the same area as a single, large water body would contribute only 5 percent. This is due to the greater efficiency of small reservoirs (90 kg/ha/year) compared to those larger than $10^{4.5} \text{m}^2$ (32 kg/ha/year). This study underscores the tangible economic and environmental benefits of restoring small reservoirs in agricultural landscapes.

2 Feng D., Gleason C. J. (2024). More flow upstream and less flow downstream: The changing form and function of global rivers. *Science* 386, 1305-1311 .

Variability in the physical and hydrological conditions of rivers along their continuum from source to mouth determines erosion patterns, sedimentation, energy distribution and ecological communities. Climate change and associated modifications to the hydrological regime can transform the existing functioning of these dynamic ecosystems. Two U.S. scientists, Feng and Gleason, mapped daily flows in some 2.9 million rivers around the world to determine how they have changed over the past few decades. They showed that from 1984 to 2018, average flow volumes in source sections increased, while those in estuary sections decreased. These changes, among others, have increased the frequency of 100-year floods in sections closer to the sources, while the flood potential of downstream regions has remained constant.

3. Wilner J.A., Nordin B.J., Getraer A., et al. (2024). Limits to timescale dependence in erosion rates: Quantifying glacial and fluvial erosion across timescales. *Sci. Adv.* 10, eadr2009 .

Earth's topography and climate are the result of opposing processes – uplift and erosion. In terms of the latter phenomenon, there is an ongoing scientific debate to resolve whether rivers or [glaciers](#) are the more effective factor. Researchers at Dartmouth College in Hanover,

USA, conducted a comparative analysis of river and glacial erosion rates, supplemented by numerical experiments, through which they showed that globally, average rates of glacial erosion exceed those of river erosion by an order of magnitude over time, and that this difference cannot be explained by Sadlerian deviations or variability due to slope, precipitation or latitude.

The authors also test the hypothesis that the so-called Sadler effect, according to which geologic indicators show an inverse relationship with the time scale of measurement, includes *de facto* three separate effects: thickness measurement error, erosion-deposition error and the error of not observing rest intervals. These findings confirm the occurrence of increased erosion rates after cooling and Cenozoic glaciation, and reveal the importance of glacial erosion on the scale of millennia and the entire orogenesis.

4 Ruff S. E. et al. (2024). A global comparison of surface and subsurface microbiomes reveals large-scale biodiversity gradients, and a marine-terrestrial divide. *Sci. Adv.* 10, eadq0645 .

Subsurface environments are among the largest habitats for microbial life on Earth, but their differences from surface environments have not been well studied so far, mainly because of a lack of data to distinguish between microbiomes living in different places. And this is where genetics comes to the rescue.

The international team of biologists used an extensive analytical database of more than 1,000 metabarcoding data sets for archaeons and bacteria and 147 metagenomes from a variety of widely dispersed environments to conduct an analysis of microbiome differences and similarities between surface and subsurface environments, as well as marine and terrestrial environments. Surface data included water samples from oceans and lakes and shallow sediment samples, while subsurface data came from boreholes or mines and included deep sediments, aquifers and fractured fluids.

Microbial diversity in the marine and terrestrial microbiomes has been shown to be similar at local and global scales. However, the taxonomic composition of the communities differs significantly between sea and land, confirming the generally accepted phylogenetic division. In contrast, community composition between surface and subsurface environments showed a high degree of similarity, indicating some continuum of diversity. Differences in microbial life thus appear to be greater between land and sea than between surface and subsurface. The authors point to differences in the taxonomic composition of microbial communities, but emphasize similar microbial diversity for the Earth's subsurface and surface environments.

5 Sayer C.A., Fernando E., Jimenez R.R. et al. (2025). One-quarter of freshwater fauna threatened with extinction. *Nature* .

Already the title of the article is so telling, in fact, you might not want to read any further. *A quarter of freshwater fauna is threatened with extinction*. Hands up who is surprised! To date, global extinction risk assessments have not included any freshwater species groups, and have primarily used data on terrestrial quadrupeds to guide environmental policy and set conservation priorities.

In order to identify the extinction risk, distribution, conservation requirements, key habitats and pressure factors of freshwater fauna species, a team of scientists conducted an analysis of the conservation status of more than 23,000 taxa, including tenth-generation taxa (crayfish, crabs and shrimp), fish and dragonflies, based on the IUCN Red List. Nearly $\frac{1}{4}$ of the species (24 percent) are at high risk of extinction, a level comparable to that of terrestrial quadrupeds (23 percent).

The highest percentage of endangered species (30 percent) was found in the shellfish group, compared to 26 percent for freshwater fish and 16 percent for dragonflies. Among all endangered freshwater species, as many as 54 percent are becoming extinct due to pollution, 39 percent due to dams and hydrological disturbances from water withdrawals, 37 percent due to land use change, including the effects of agricultural

activities, and 28 percent due to ecological invasions and diseases. Most species (84 percent) are affected by more than one threat.

The priority areas identified for the protection of terrestrial quadrupeds largely mirror those for freshwater fauna, but given the differences in key threats and habitats, it cannot be assumed that meeting the needs of quadrupeds is sufficient to protect freshwater species at the local scale. This proves that a case-by-case approach to each group of organisms is necessary.

<https://doi.org/10.1038/s41467-024-55714-9>

DOI: 10.1126/science.adl5728

DOI: 10.1126/sciadv.adr2009

DOI: 10.1126/sciadv.adq0645

<https://doi.org/10.1038/s41586-024-08375-z>



All content published in the journal is licensed under the Creative Commons: Attribution 4.0 International License, unless otherwise stated.

