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Newsletter

Project Lakes Go Digital

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Explore lakes as vital social-ecological systems that quietly support drinking water, flood protection, biodiversity, recreation, and climate resilience. Get to know how lake ecosystem services work, why they are sensitive to pollution and climate change, and how the Lakes Go Digital project uses smart technologies to better understand and protect them in Latvia and Lithuania. By connecting science, local decision-making, and everyday benefits, it shows why healthy lakes matter to both nature and people.

TOPIC 01

Lake ecosystem services - lakes do far more than look beautiful - they quietly clean our water, store nutrients, reduce floods, and lock away carbon. When these hidden services fail, the impacts ripple straight into our landscapes, and daily lives.

TOPIC 02

Digital monitoring of lakes - what if lakes could tell us how they feel? Now they can!
With smart buoys and digital monitoring, Lakes Go Digital reveals invisible changes beneath the surface, turning data into early warnings and smarter decisions.

TOPIC 03

Community led sustainability initiatives - from swimming and fishing to calm views and cultural meaning, lakes shape how we live and feel. This project shows why protecting lake health isn't just about nature — it's about our well-being, safety, and future.

LAKES AS PILLARS OF OUR SOCIAL–ECOLOGICAL LANDSCAPE

If we think about lakes, we often imagine beautiful places to swim or watch the sunset. But beneath their calm surfaces, they are quietly doing much more.
Lakes function as **living infrastructure**, supporting our daily needs, stabilizing local climate and shaping cultural identity.
In the Baltic region, even relatively small lakes play an outsized role in how communities live, work, and connect with nature.

Scientists describe these benefits as ecosystem services: the many ways ecosystems support human well-being.

One of the most direct ways is through the **provision of freshwater for drinking and everyday use.** While this connection is often taken for granted, lake-based drinking water systems are complex, carefully managed, and deeply dependent on healthy ecosystems.

In the Baltic region, lakes supply drinking water either directly as **surface water sources** or indirectly by recharging **groundwater aquifers.** Before reaching households, lake water is going through treatment **such as filtration and disinfection,** but the quality of the source water matters greatly.

Healthy aquatic vegetation, reed beds, and surrounding wetlands act as natural filters, trapping sediments and nutrients and reducing the burden on technical treatment systems.

Many lakes are also connected to **groundwater,** allowing water to slowly infiltrate and be naturally purified underground. This provides a stable and high-quality drinking water reserve, especially important during dry periods.

However, these services **are sensitive to pollution and land-use pressure**. Excess nutrients from agriculture, poorly treated wastewater, or urban runoff can degrade water quality at the source. Once pollutants enter a lakes groundwater system, they can persist for years or even decades, making prevention far more effective.

Climate change adds another layer of complexity. Warmer temperatures and altered precipitation patterns can increase algal blooms, reduce oxygen levels, and strain drinking water systems.

Maintaining healthy lake ecosystems is therefore not only an environmental concern, but a long-term water security strategy.

Fish and fishery are a classic provisioning service. They provide families with food and carry cultural memories. But if we look closer, fish populations are also **living indicators.**
They reflect oxygen levels, habitat quality, water clarity, and the balance between plants, plankton, and nutrients.

When **aquatic vegetation** is healthy, it creates nursery habitat and shelter. When it collapses, for example, after repeated algal blooms, fish communities often shift toward species that tolerate warmer, lower - oxygen conditions.

A key hidden link here is nutrients. Excess phosphorus and nitrogen can fuel blooms that reduce water transparency and, in severe cases, contribute to oxygen depletion. That can reduce spawning success and stress sensitive species.

Aquatic plants help stabilize this system by absorbing nutrients, trapping particles, and limiting sediment resuspension, which supports clearer water and better habitat structure.

Sustaining fisheries is often inseparable from **sustaining reeds, macrophytes, wetlands, and shoreline buffers -** the parts of the system that keep water clean and habitat intact. **Reed beds** are especially useful by helping to trap sediments, bind nutrients, and provide habitat for birds and invertebrates.

This is where provisioning and regulating services overlap in a surprisingly practical way: harvesting reeds removes nutrients and organic material from the system. In other words, when carried out carefully, **harvesting helps the lake shed excess material and nutrients.**

Baltic initiatives around reed use explicitly frame harvesting as a way to recycle nutrients back to land and reduce eutrophication pressure. One great example - lake Germantas in Lithuania is a place where reed beds can be harvested for craft and bio - energy. This has been done thoughtfully: avoiding sensitive nesting periods, preventing shoreline erosion and keeping some reed structure for biodiversity.

Flood prevention is one of the most important lake ecosystem services, but it's visible only when it fails. Lakes, wetlands, and floodplains **work as storage and slowdown systems**: they spread peak flows, hold water temporarily, and release it more gradually. This matters strongly in river - connected landscapes like **Augšdaugava**, where floodplains can reduce downstream flood risk by functioning as large-scale storage zones.

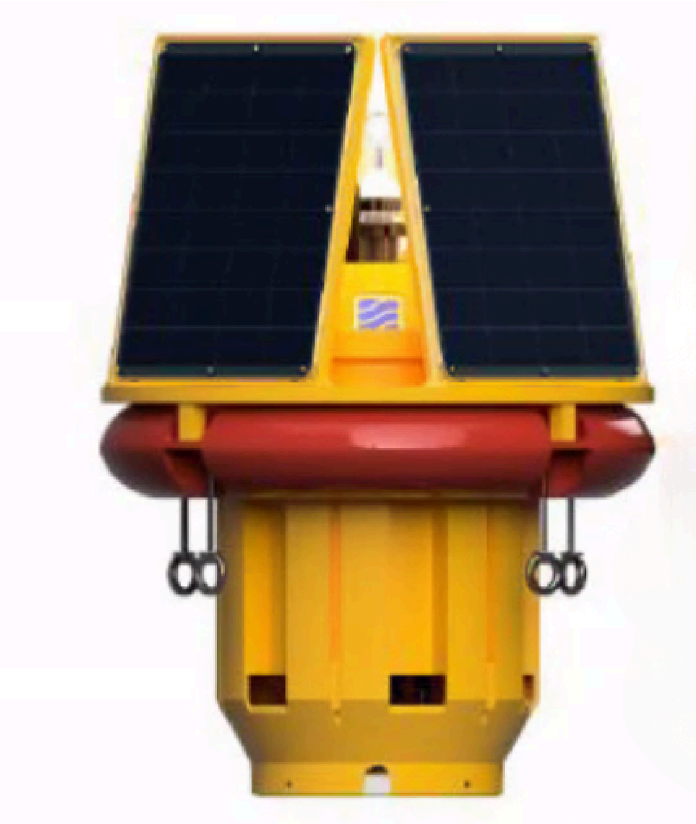
Climate change adds another layer of complexity. Warmer temperatures and altered rainfall patterns can increase algal blooms, reduce oxygen levels, and place additional pressure on lake ecosystem.

Lakes do not only cycle carbon, they also store it. When algae, plants, and organic particles sink, some of this material becomes buried in sediments, removing carbon from the short-term atmosphere–biosphere cycle. At the same time, stressed lakes can release greenhouse gases, meaning their climate role depends on oxygen conditions, nutrient levels, and overall ecological health.

This is where lake ecology becomes climate strategy. Healthy aquatic vegetation and stable sediments help keep carbon stored in the lake bed rather than released into the air.

Understanding lake ecosystem services help people see how lakes support flood safety, drinking water, education and well - being, protection becomes a shared responsibility rather than an abstract environmental goal.

WHAT EXACTLY WILL BE ANALYSED



In the Lakes Go Digital project, ecosystem services are assessed through very concrete, measurable ecological parameters, selected together with local stakeholders in Latvia and Lithuania.
The project focuses on ecosystem services which grouped into regulating & maintenance services and cultural services. Each of them is linked to specific lake processes that can be observed, measured, and mapped

1. Water filtration and nutrient retention

This service looks at how well lake ecosystems **clean and store water**.
In practical terms, the project analyses:

- The **capacity of aquatic plants, algae, microorganisms, and sediments** to trap and retain nutrients such as phosphorus and nitrogen
- The **accumulation of organic matter** in lake sediments
- The lake's ability to **buffer pollution** coming from urban runoff and surrounding land use

These processes are essential for maintaining water clarity, limiting algal blooms, and supporting drinking water sources. When this filtering function weakens, lakes become more vulnerable to eutrophication and oxygen depletion.
This service directly underpins **drinking water quality, fish habitats, and recreational use.**

2. Hydrological cycle and flood regulation

Using special sensors the focus goes on how lakes regulate **water movement**.
The project examines:

- The lake's role in **storing water during high rainfall**
- Connections between lakes, floodplains, and surrounding landscapes
- The capacity of lake ecosystems to **slow down and redistribute water**, reducing flood risk

This is especially relevant for lakes like **Luknas**, where floodplain dynamics play a role in protecting downstream areas. Healthy lake–floodplain systems act as natural safety valves during extreme weather events.

WHAT EXACTLY WILL BE ANALYSED

Parameters analysed in this project are directly relevant to stakeholders and municipalities for planning, management, and decision-making processes. By mapping and assessing these services across six lakes in Latvia and Lithuania, the project creates a shared knowledge base that helps to identify ecological risks early, support water management and flood planning as well as strengthen links between environmental quality and human well-being.

3. Recreation and nature-based activities

Not all benefits are material. This service focuses on how lake ecosystems **enable people to spend time in and around water**.

The project assesses:

- Conditions that support **active recreation** (swimming, paddling, walking)
- Conditions that support **passive enjoyment** (birdwatching, nature observation)
- The ecological features that make these activities possible, such as water clarity, shoreline vegetation, and biodiversity

This connects directly to **public health, well-being, and education**, especially for urban lakes.

4. Aesthetic value of lake landscapes

This service addresses how people feel and see lakes and why that matters.

The project considers:

- Visual qualities of lake water (clarity, colour, presence of blooms)
- Shoreline structure and vegetation
- The overall landscape character surrounding the lake

Aesthetic quality strongly influences how people value lakes, whether they support protection efforts, and how often lakes are used for leisure, learning and cultural activities.

LAKES GO DIGITAL

Key ecological parameters

To analyze ecological status of lakes during the project, scientists will gather data from smart bouy sensors and make laboratory analyses to ensure comprehensive monitoring and adaptive management.

Reflects the hydrological balance of a lake and influences habitat availability for aquatic organisms and shoreline ecosystems. Stable and appropriate water levels are crucial for supporting living organisms including plants involved in filtration and nutrient cycling, as well as for recreational uses such as swimming and boating. Sudden changes can affect aesthetics and wildlife viewing opportunities by altering vegetation and bird habitats.
It will be mesured by smart bouy sensors once a week from spring to autum.

Affects the chemical environment of a lake, influencing nutrient availability, metal solubility and the survival of aquatic life. Many organisms essential for water filtration and nutrient sequestration thrive only within specific pH ranges. Extreme pH levels can harm fish and algae, reducing opportunities for recreation and aesthetic enjoyment, and degrading overall ecosystem services. This will be measured using a probe sensor three times per year.

Regulates metabolic rates of aquatic organisms and determines oxygen solubility, influencing filtration and nutrient cycling. It affects species composition and seasonal mixing, critical for hydrological and biological processes. Warmer or cooler than normal conditions can impact recreation (swimming) and alter the visual appeal of the lake due to algal blooms or fish kills. This will be mesured every day by smart bouy sensors and three times per period with probe sensors.

Important for aerobic aquatic life including fish, invertebrates, and decomposers that help recycle nutrients. Low oxygen level can lead to fish kills, reducing biodiversity and degrading aesthetic and recreational values. This will also be measured every day by smart bouy sensors and three times per period by probe sensors.

This indicates the concentration of dissolved ions. Conductivity changes can indicate contamination (e.g., road salts, agricultural runoff, oil spills) what in turn can impact aquatic filtration processes and habitat quality. It will be measured the same way as Oxygen and temperature.

Secchi depth measures transparency, a key indicator of turbidity and algal growth. Clearer water enhances recreational uses, aesthetic experiences, and passive enjoyment. Reduced clarity often signals nutrient enrichment - algal blooms or pollution, which can impact ecosystem filtration and disrupt aquatic habitats.This will be measured by sensors every day and secchi disk three times per year.

KEY ECOLOGICAL PARAMETERS

Chlorophyll

Chlorophyll is a green pigment that the phytoplankton use to absorb sunlight, its measurements indicate algal amount and helps assess primary production and eutrophication. Moderate levels support food webs and filtration, but excessive growth leads to harmful algal blooms, impairing swimming safety, aesthetics, and oxygen balance. Monitoring chlorophyll is crucial to support management of nutrient loads and maintain ecosystem services. Mesurements will be taken by sensors uninterrupted and water samples will be collected on site and analysed with spectrophotometer three times per year.

Phytoplankton

Microalgae function is to be primary producers supporting aquatic food webs and nutrient cycling. Their abundance and diversity reflect water quality and influence representatives of higher trophic levels consuming phytoplankton. Balanced phytoplankton communities enhance aesthetics and ecosystem resilience, where blooms can reduce recreational use and oxygen levels. This will be analyzed by microscopy analysis three times per year.

Total Phosphorus

Phosphorus is a key nutrient driving algal and plant growth. Excess phosphorus can trigger eutrophication, harmful algal blooms, and oxygen depletion, impacting filtration services and recreation. Proper phosphorus amount maintains ecological balance, enhances aesthetic quality, and supports healthy aquatic habitats. This will be analyzed by water sample collected on site and analysed with spectrophotometer three times per period.

Blue-Green Algae

Cyanobacteria can produce toxins harmful to humans and wildlife when in bloom. Monitoring their levels safeguards recreational activities like swimming and ensures aesthetic and passive enjoyment of the lake. They are also indicators of nutrient imbalance. This will be measured by sensors all the time built in smart buoy and three times with Probe sensor.

Bacteria

Bacteria monitoring ensures water safety for recreational use and health. Elevated bacteria levels often signal pollution which impairs ecosystem filtration services and poses health risks. Monitoring is done according to health inspections institutions both in Latvia and Lithuania to ensure bathing water quality checks at swimming sites. Two microbiological indicators are measured in water samples: *Escherichia coli* (E. coli) and intestinal enterococci to assess their concentrations. These indicators are used to detect possible fecal contamination, which can contain disease-causing bacteria and viruses. This will be measured every day by sensors.

Microplastics

Microplastics presence, concentration and composition indicate possible plastic pollution on shore - macroplastics, from sewage and runoff. It can threaten aquatic organisms and bioaccumulate, disrupting filtration processes of benthic and planktonic communities. Their presence affects water aesthetics and may harm recreational users. This will be analyzed by water sample collecting on site, microscopy and LDIR (chemical imaging system) analysis. This will be analyzed three times per year.

Examine the lakes

Project **Lakes Go Digital** explores lakes across **Latvia and Lithuania.**
To help municipalities and stakeholders adopt better water management principles, scientists will deploy **six specially designed smart buoys.**
These buoys will become quiet observers — tracking changes, revealing hidden patterns, and helping us understand how lakes respond to nature, climate, and people. They will record the different parameters in real time, such as pH, temperature, pollution, and others.
Each buoy will have its own unique QR code, so that anyone visiting the lake can see the water condition via the website. The QR code will be installed near the lake. For residents, this means **greater reliability and confidence** in safe recreation by the water, while for municipalities it helps to monitor, supervise, and make prompt decisions.
The most interesting part is the scientific relevance and approach in this project - what happens when we place the same technology into protected areas, urban lakes, lakes with historical and cultural meaning, and even a man-made pond?
The answer is **a living comparison of ecosystems**, pressures and possibilities.
With this real time data observation it will be possible to see how changes in weather, outer world, seasons and people actions will affect water conditions.
After municipalities chose the lakes which will be examined during the project, scientists visited them to gather needed data and to choose the placement for smart buoys.
We took in consideration aspects such as **visibility** (buoys need to be seen from the shore line to gain bigger trust from society), it **can't interfere with water traffic** and it needs **specific depth** and network coverage.

6 lakes

- Germantas (LT)
- Mastis (LT)
- Cieceres (LV)
- Luknas (LV)
- Lielais Ludzas (LV)
- Mičurinietis (LV)

LAKES GO DIGITAL

Lake Germantas

Lake Germantas is a quiet, forest-fringed lake in western Lithuania's Telšiai region, known for its natural landscape and protection status. There's a well-developed **cognitive/educational trail** around the lake, with nature stations, outdoor installations, picnic spots and places to enjoy the forest and lakeshore.
From a scientific perspective, Germantas offers something rare: a chance to observe a lake where **human pressure is intentionally low**. Motorized boats are restricted, biodiversity is high - the reserve supports diverse bird species, plants, fungi, and lichens, some of which are **protected at national and European levels.**
One of the biggest problems was with digital infrastructure - finding a stable internet connection for the smart buoy was a challenge itself.

55.979524, 22.151080

- Area: ≈ 1.65 km²
- Length: ≈ 1.9 km
- Width: ≈ 1.5 km
- Depth: Max ≈ 5.8 m average ≈ 2.4 m
- Elevation: ≈159.8 m above sea level.
- Two small islands on the lake

Lake Mastis

Only a short distance away from the Germantas lake, Lake Mastis shows a very different view. This is a **moderately sized, shallow lake** in Telšiai that **shapes both local nature and city life,** offering outdoor recreation, scenic walking/biking paths, and water leisure right next to an urban center.
Its position and integration into Telšiai's cultural spaces make it a part of **regional identity**.
The lake formed in a former glacial ice block depression - typical for many Lithuanian lakes. The lake basin is **muddy** with relatively shallow water throughout.
Shallow lakes respond quickly to heat, nutrients, and disturbance. Algal blooms can develop fast, oxygen levels can shift, and **water quality can change within days**.
For an urban lake, monitoring is a must, because it directly affects whether people can swim, boat, or trust the water they live beside.
Smart bouys in this lake work as **an early-warning system.**

55.968480, 22.260473

- Area: ≈ 2.72 km²
- Length: ≈ 4.2 km
- Width: ≈ 1.1–1.5 km
- Depth: max ≈ 5.3 m, average ≈ 2.6–3.1 m
- Elevation: ≈ 125.2 m above sea level
- Two islands are located on the lake


Lake Cieceres

At first glance, Lake Cieceres looks **almost like a river**. Long, narrow, and bordered by steep banks, **it was carved by glaciers** and now channels water through a subglacial furrow. Rivers flow in and out so the water is always on the move.
This movement matters. Flow-through lakes behave differently from closed basins: nutrients travel, oxygen distributes unevenly, and biological communities adapt to constant change. At the lake's centre lies 14 ha large **Oak Island, part of the Natura 2000 network.**
This lake is located in southern Latvia, in **Saldus Municipality** and local authorities already conduct scientific fishing surveys to monitor fish stocks and water quality, so smart bouy installation in this lake is step further for **improved water management system.**

56.654625, 22.560162

- Area ≈ 2.77 km^2
- Length: ≈ 9.5 km
- Depth: max ≈ 22m
  average ≈7.2 m
- Elevation: ≈ 100 m
  above sea level

Lake Lukna

Lake Lukna is a picturesque lake in a **region of lakes and forests** in Latgale. This lake is appreciated for its calm waters, countryside scenery, **rich fish populations** and long cycling routes looping through forests and villages. Fishermen all over the country gather here for angling not only for their joy but also **for championships in spinning and ice fishing**.
Ecologically, Lukna delivers all kinds of **ecosystem services** like supporting food web dynamics, clean water, recreation, and aesthetic value. This is a lake where the link between ecological health and human benefit is obvious, so the project will contribute to this by gathering crucial information about lake ecosystem state.

56.072735, 26.759500

- Area: ≈ 4.09 km^2
- Depth: max ≈ 6.1 m
  average ≈2.4 m
- Elevation: ≈ 181 m
  above sea level

Lielais Ludzas lake

56.553040, 27.741958

In eastern Latgale stories from history reveals **Lielais Ludzas lake.** This lake is very calm and wide, about seven kilometers from one end to another, broken by small islands, peninsulas, and hidden bays.
If we look back in history, then this lake has a lot of **archaeological finds nearby**. Most visible historical footprint is the ruins of the **Medieval castle** standing high near the lakes shore welcoming tourists and visitors all around the area.
It's very surprising that this wide, big lake is actually **very shallow - average depth of only a few meters**.
Shallow depth means temperature, oxygen, and nutrient dynamics **can shift quickly**. Being a **flow-through lake** adds another layer of complexity because water is always arriving and leaving.

- Area: ≈ 8.51 km^2
- Length: ≈ 7.0 km
- Depth: max ≈ 6,5 m

  average ≈ 3,5 m
- The lake is elongated with coves, peninsulas and four islands scattered across it

Lake Mičurinietis

55.827686, 26.489691

Lake Mičurinietis is **not a natural lake.** It is a small, **man-made pond**, built during the 1950s–1980s. Usually ponds like this were built to support irrigation for fields, providing water livestock, fish farming, water supply as well as small-scale recreation for kolkhoz workers. Precisely because of its small size, it is one of the **most revealing sites in the project.**
Small water bodies react fast. A warmer weather, nutrient runoff, or pollution **shows up almost immediately** in temperature spikes, algal blooms, or changes in clarity. **The smart buoy turns the pond into a visible lesson to absorve cause and effect.**
Yet even here, life persists. Native crayfish, fish, frogs, birds, and insects have made this pond their habitat making it very important **micro-ecosystem**.

- Area: ≈ 0.09 km^2
- Length: ≈ 0,61 km
- Depth: max ≈
- average ≈

WHAT'S NEXT IN THE PROJECT

Following detailed site assessments and field visits, **the placement of smart buoys has been carefully selected** in all six lakes across Latvia and Lithuania.

Locations were chosen to best **capture key lake processes** such as water circulation, nutrient dynamics and ecosystem responses, while ensuring reliable data collection, visibility and minimal interference with water traffic and lake usage.

Close **collaboration with municipalities and local stakeholders** has helped define the specific information needs for each lake, so this approach strengthens the link between ecological data, water management, and community well-being.

Once winter conditions will subside and lake ice will be fully melted, the project will enter its next operational phase: **the deployment of smart buoys in all six lakes.**

These buoys will continuously monitor key ecological parameters, revealing how lakes will respond to seasonal change, weather events and human pressures. By combining **real-time digital monitoring with ecological understanding**, Lakes Go Digital will create a shared knowledge base that supports early risk detection, adaptive management and long-term protection.

Stay updated about our next field visits, project development and researchers notes here: