

LAYMAN'S REPORT 2023





FOREWORD

Dear fellow citizens,

In Luxembourg, we are acutely aware that environmental and climate challenges require a concerted and determined response. As Minister of the Environment, Climate and Biodiversity, I am particularly proud to present this joint report, the result of our close collaboration with the Luxembourg Institute of Science and Technology (LIST) and the Ministry of the Environment, Climate and Biodiversity.

Research and technology are indeed essential pillars of our strategy to preserve our environment and quality of life. Thanks to the efforts of our scientists, we have invaluable tools and knowledge available to develop informed policies and implement practical solutions that support Luxembourgish stakeholders.

This report, encompassing more than twenty scientific projects, exemplifies how research can guide our actions and inspire effective public policies. By focusing on concrete projects and tangible results, it demonstrates the positive impact that collaboration between the government, the research sector and businesses can have on our society.

Serge Wilmes
Minister of the Environment, Climate and Biodiversity



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Together, we have the power to build a more sustainable and resilient future for generations to come

The famous quote by Charles Darwin, “The species that survive are not the strongest, nor the most intelligent, but those that adapt best to change”, resonates particularly strongly today.

Luxembourg, like the rest of the world, faces the emergence of new environmental, health and economic pressures due, in particular, to climate change and human activity. Extreme weather events, such as the floods that severely affected our country in 2021, are a striking testament to this. Other signals, more discreet but equally significant, are also manifesting, whether in the state of our soils, the status of biodiversity, or the quality of the air we breathe.

As the only research and technology organisation in Luxembourg, LIST aims to be agile in contributing to the sustainability and resilience of the Grand Duchy in the face of these new challenges. Over the past ten years, we have undertaken numerous research, innovation and monitoring projects thanks to the support and impetus of the Ministry of the Environment, Climate and Biodiversity, as well as of its agencies.

In this context, businesses established in Luxembourg, regardless of their sector of activity, also play a crucial role. They have a particular responsibility to preserve the environment and public health by ensuring that their activities comply with current regulations. The research world thus acts as a driving force for these businesses by guiding them towards competitive, innovative and sustainable models.

Dirk Fransaer
CEO a.i. of the Luxembourg Institute of Science and Technology



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STATUS OF BIODIVERSITY IN LUXEMBOURG

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According to a 2019 report of the IPBES, about 1 million animal and plant species are threatened with extinction. This is an alarming estimation, highlighting how fast the fabric of life on which we all depend can unravel. In this context, long-term time series of observation data are essential to provide scientific evidence to policymakers and other stakeholders.

/ WHY RESEARCH MATTERS

Timely, concise and tailored biodiversity monitoring schemes, which document biodiversity changes in a scientifically unequivocal way, are needed for stakeholders to make informed decisions and better understand the anthropogenic drivers behind biodiversity loss.

/ WHAT WE ARE SEEKING

Repeated observations in a network of sites provide the baseline information to estimate changes in biodiversity. Throughout this project, LIST is coordinating the implementation of a large part of the biodiversity monitoring schemes in Luxembourg and contributing to the development of indicators documenting the state of nature at a national and international level.

/ HOW WE ARE DOING IT

LIST focuses on the collection of field observation data on about 30 species (e.g. invertebrates, amphibians, reptiles, mammals) from annexes of the Directive 92/43/EEC based on sampling strategies tailored to each group of species. Standardised sampling designs allow the application of powerful statistical methods (e.g. capture-mark-recapture, site occupancy, habitat suitability modelling) to detect changes in the conservation status of the species.



/ WHAT WE HAVE ALREADY ACHIEVED

LIST's research provides unique observation data and conservation status information on no less than 30 different protected species in Luxembourg. To cite just a few examples, the Institute's monitoring showed that the reproduction of the Common frog has declined by 39% within the last decade, the population of the dormouse and sand lizard have been stable since 2010, and some dragonfly or amphibian species are of particular conservation concern as they are only found in a single or very limited number of locations.

Overall, the project contributes to:

- establishing national environmental policies (e.g. highlighting species to be targeted for pledges or **specific conservation measures**);
- producing large-scale indicators, reports and scientific studies on biodiversity and its conservation.

/ WHAT'S NEXT?

Continue structured data collection to consolidate long-term time series of monitoring data, further develop analytical framework and extend it to additional species, contribute to reporting under Art. 17 for the 2019-2024 period.

Current legislation

Article 17 of the "Habitats" Directive 92/43/EEC
[Plan National concernant la Protection de la Nature 3](#)

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CARBON CAPTURE USE AND STORAGE



Climate change and its impacts create many challenges that need to be addressed, including mitigating carbon emissions, in order to guarantee a viable Earth for future generations. From steel, glass and chemicals to (bio)energy and waste incineration, multiple industrial sectors, in the scope of the EU Emission Trading System (ETS) are incentivised to reduce their greenhouse gas emissions.

/ WHY RESEARCH MATTERS

In this context, Carbon Capture Usage and Storage (CCUS) is a highly promising method combining numerous technologies to reduce greenhouse gas emissions by capturing CO₂, before transporting it to geological offshore storage sites. Before implementing such a method, Luxembourg needs to reach a critical mass and cooperate with other European initiatives. Research and guidance are thus necessary.

/ WHAT WE ARE SEEKING

In order to develop an efficient Luxembourgish strategy on CCUS, national authorities can refer to LIST's research regarding technologies, policies and support measures.

/ HOW WE ARE DOING IT

LIST collects technological and regulatory data on the implementation of CCUS within the European Union. At the Luxembourgish level, the teams also collect feedback from relevant stakeholders on the adequacy of current and future strategies, laws, standards and regulations for CCUS.

/ WHAT WE HAVE ALREADY ACHIEVED

As part of its preliminary study on this subject, LIST presented the CCUS technological and regulatory overview to relevant public and private stakeholders to raise awareness of its potential for decarbonisation, and gathered feedback on the implementation potential of CCUS in Luxembourg. Additionally, the teams interviewed voluntary stakeholders for more detailed feedback on the CCUS implementation potential.

Overall, the project contributes to:

- providing a technical overview of the CCUS regulation;
- initiating discussions on the geological storage potential for CO₂ in Luxembourg;
- delivering initial feedback on the CCUS implementation potential for industrial stakeholders.

/ WHAT'S NEXT?

LIST will provide its recommendations for the next steps of the CCUS study.

Current legislation

Loi du 27 août 2012 relative au stockage géologique du dioxyde de carbone

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THE COMMODO LAW

Establishments that can cause pollution, inconvenience neighbours or harm the health and safety of individuals are referred to as classified establishments and require specific authorisation. For this, it is necessary to comply with complex and constantly evolving regulations in the framework of the Commodo law. Many sectoral activities and companies in Luxembourg are affected by this law and need to undergo numerous modifications.

/ WHY RESEARCH MATTERS

Implementing and enforcing the Commodo law can be difficult for businesses and policymakers. Indeed, these rules need to ensure the competitiveness of Luxembourgish companies while protecting workers, citizens and the environment. In this context, LIST provides tailored support and guidance according to new environmental legislation or topics of interest raised by the Ministry of the Environment, Climate and Biodiversity and delegated agencies.

/ WHAT WE ARE SEEKING

In order to support both policymakers and businesses, LIST's research themes seek to answer two main questions: How can we create regulatory boundary conditions that foster the most promising technologies? What is the best regulatory strategy to serve the interests of the environment?

/ HOW WE ARE DOING IT

LIST provides an informed vision and scientific expertise on environmental issues, field practices and behaviours in line with best available techniques while following the environmental policy strategies of the European Union. Moreover, the Institute searches for the most relevant performance indicators for the development of effectiveness criteria and ensures the monitoring of results.

/ WHAT WE HAVE ALREADY ACHIEVED

In 2023, the Commodo/CLP toolkit, developed by LIST and available free of charge, continued to support companies in carrying out a thorough inventory of their chemical products and managing their Commodo status. Insights into fluorinate gas recovery in the automotive sector were also provided, as well as recommendations on regulatory aspects of the EU Industrial Emission Directive.

Overall, the project contributes to:

- streamlining administrative procedures and supporting companies in fulfilling their obligations;
- disseminating best practices and raising awareness on environmental issues related to the activity of companies.

/ WHAT'S NEXT?

LIST plans to contribute to the development of new regulatory criteria for the efficiency of heat pumps and to the adaptation of the Commodo inventory to other legislation. It will also offer training on the use of CLP/Commodo tools and integrate the Commodo law into the digitisation procedure.

Current legislation

Loi du 10 juin 1999 relative aux établissements classés (known as "Commodo")

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CONTRIBUTING TO SAFE BATHING WATERS IN LUXEMBOURG

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The occurrence of cyanobacteria blooms in Luxembourg waters not only poses a health risk to bathers, domestic animals and livestock due to the toxins in these blue-green algae, but also undermines the environmental health of the aquatic ecosystem. Likely fuelled by climate change, this worldwide phenomenon requires active surveillance.

/ WHY RESEARCH MATTERS

The continuous monitoring of the proliferation of harmful cyanobacteria blooms is especially critical during the bathing season in Luxembourg because of their highly variable dynamics in space and time. An accurate assessment of the risk of exposure to potential cyanotoxins is therefore required to ensure safe bathing.

/ WHAT WE ARE SEEKING

Within the framework of the CYANOMON project, LIST is implementing a new toolbox for the more efficient and automated monitoring of cyanobacteria in Luxembourg's official bathing waters.

/ HOW WE ARE DOING IT

Alongside the national cyanobacteria alert plan for managing access to bathing site beaches, LIST is applying a multi-parameter toolbox to better understand highly fluctuating bloom dynamics and provide early-warning signals of potential bloom onset. As soon as a potential risk of exposure is identified (i.e. toxin threshold exceeded), the Water Management Authority takes the appropriate actions to restrict beach access and inform the public of the associated public health risks.

/ WHAT WE HAVE ALREADY ACHIEVED

LIST presented its tiered multi-parameter approach at the 21st conference on Health-Related Water Microbiology, illustrating the added value of technological solutions that enable the automated and real-time monitoring of bloom dynamics. LIST's research also illustrated the contrasts in bloom dynamics between the 2022 (severe drought) and 2023 seasons for the Upper-Sûre and Weiswampach lakes. Finally, a rapid *in situ* assay of semi-quantitative dosage of cyanotoxins in recreational waters has been further validated.

Overall, the project contributes to:

- managing beach access and public health risks during the annual bathing season (as demonstrated in 2022, 2023);
- publishing field reports on the (bi)-weekly status of official bathing sites on eau.gouvernement.lu (since 2023);
- performing rapid toxin testing using simple *in situ* assays that can be transferred to resource users to monitor the risk.

/ WHAT'S NEXT?

Continuation of operational monitoring and implementation of innovative technological solutions for improved risk assessment and early warning capabilities. Perspectives on forecasting and nowcasting using dedicated modelling approaches.

Current legislation

Règlement grand-ducal du 19 mai 2009 (national transposition of Bathing Water Directive 2006/7/EC)

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LUXEMBOURG POLLINATOR MONITORING SCHEMES



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Largely attributable to human activities, wild pollinators are facing an alarming decline that threatens overall biodiversity, jeopardises food security and signals broader environmental health issues.

/ WHY RESEARCH MATTERS

Long-term monitoring provides valuable insights into pollinator population dynamics and thus allows the detection of decline, guides both policies and conservation strategies, and contributes to promoting public awareness.

/ WHAT WE ARE SEEKING

The Luxembourg Pollinator Monitoring Scheme (LUPoMS) combines the Wild Pollinator Monitoring Programme Luxembourg (MONIPOL) and the Luxembourg Butterfly Monitoring Scheme (LUBMS as part of BIODIV). By coordinating these programmes, LIST aims to collect robust population trend data for pollinating insects on a national scale. Complemented with technology-based monitoring methods, these programmes extend to smaller-scale initiatives such as species-focused monitoring in the Minette area (AURINION) or assessments of the effectiveness of biodiversity compensation measures (BUTTECCO).

/ HOW WE ARE DOING IT

LUPoMS surveys are conducted in randomly stratified 1-kilometre squares by LIST teams, consulting companies and citizen scientists, employing standardised collection methods in alignment with the the proposed European Monitoring Scheme (EUPoMS) and the European Butterfly Monitoring Scheme (eBMS).



/ WHAT WE HAVE ALREADY ACHIEVED

In collaboration with national partners, LIST's MONIPOL project enhances knowledge of the diversity of Luxembourg's pollinators, uncovering new and rare species records. Insect counts from pan traps and transects span 30 monitored 1-km squares. LUBMS data has contributed to the [EU Grassland Butterfly Indicator 1990-2020](#) and is being used to develop a national grassland butterfly indicator (BIOLYS).

Overall, the LUPoMS project contributes to:

- plan management measures on the field for the preservation of pollinator species;
- national atlases and red lists;
- European databases;
- the development of indicators such as the European Butterfly Indicator for Grassland Species.

/ WHAT'S NEXT?

Pollinator data will continue to be collected annually to estimate long-term abundance and occupancy trends.

Current legislation

[Plan National concernant la Protection de la Nature 3](#)
[Communication on the revised EU Pollinators Initiative: A new deal for pollinators](#)
[Nature Restoration Law](#)

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ASSESSING AIR QUALITY

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Ensuring good air quality is of major importance for our health, ecosystem services and food security. Numerous air pollutants, such as particulate matter, ammonia, heavy metals, nitrogen oxides or ozone, can indeed pose severe threats.

/ WHY RESEARCH MATTERS

In this context, it is crucial both to quantify air pollutants and better understand their effects on our health, the environment and climate, as well as on the economy. This enables policymakers to make well-informed decisions.

/ WHAT WE ARE SEEKING

In this project, LIST assists national authorities in obtaining additional information on the concentration levels of air pollutants that affect human health over different meteorological seasons and at different locations in Luxembourg. The teams also prepare scientific reports to assess the representativeness of the permanent air quality network, thus supporting environmental policy decisions.

/ HOW WE ARE DOING IT

LIST measures various air pollutants with the help of using the environmental measurement vehicle and other certified mobile sensors. These measurement tools are able to provide a detailed assessment of the concentrations of air pollutants in rural and urban locations in Luxembourg, which enables the teams to identify so-called hot spots, i.e. locations potentially causing adverse effects on human health and the environment. Finally, the researchers also contribute to evaluating the effectiveness of new environmental regulations (e.g. [regarding ammonia emissions from agriculture](#)).

/ WHAT WE HAVE ALREADY ACHIEVED

Over the 2022-2023 period, LIST's research provided data on the daily, seasonal and spatial distribution of air pollutant concentration (e.g. toxic minerals and metals/metalloids) in rural and urban areas of Luxembourg. For example, their findings highlighted that the Vianden reservoir had an influence on the near-surface ozone concentrations. Additionally, since 2019, the project has produced a first dataset on the seasonal and spatial distribution of ammonia concentrations in the air.

Overall, the project contributes to:

- providing scientific justification for environmental policy decisions concerning air quality;
- improving the national monitoring network;
- assessing and improving the situation of farmers by evaluating emission reduction measures.

/ WHAT'S NEXT?

LIST plans to continue the monitoring and data evaluation activities, strengthen cooperation with the Environment Agency (AEV) and identify policy needs, including health-related aspects.

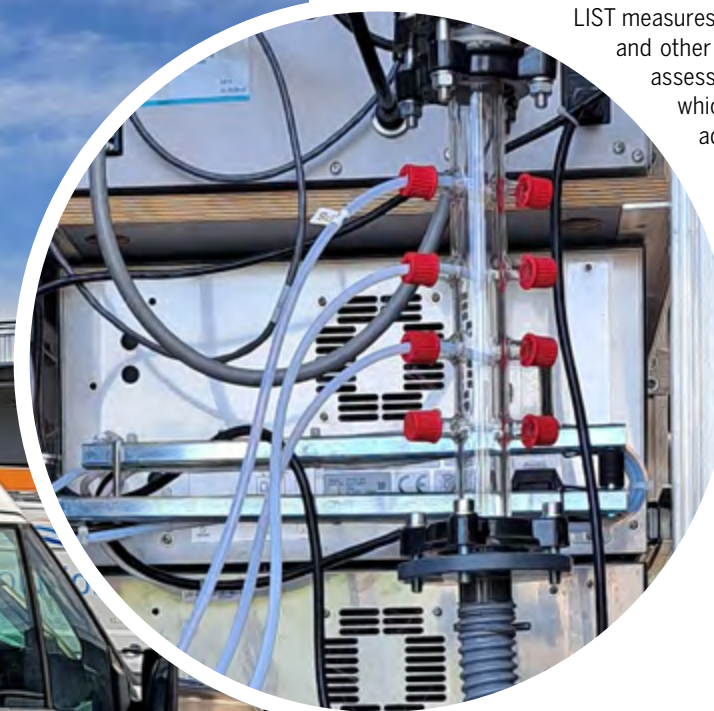
Current legislation

EU Directive 2004/107/EC, EU Directive 2008/50/EC, National Emission Ceilings (NEC) Directive (2016/2284/EU)

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HOW FRESHWATER INVERTEBRATES UNVEIL STREAM HEALTH



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Benthic invertebrates are aquatic animals that provide essential ecosystem services such as nutrient cycling, organic matter decomposition, water filtering and energy provision to higher trophic levels. Often used as biological indicators, their abundance and diversity of taxa provide a reliable indication of stream health.

/ WHY RESEARCH MATTERS

As freshwater invertebrates are sensitive to pollution, habitat degradation and other components of global change, monitoring the community composition and its change over time is of particular interest for characterising the health status of streams.

/ WHAT WE ARE SEEKING

The SYNERGIE project aims to support the Luxembourgish government in fulfilling European obligations by:

- contributing to the ecological status assessment of Luxembourgish rivers;
- documenting the long-term trends in site-based collections of caddisfly data, a group of insects exhibiting a diverse range of biological and ecological traits;
- giving warnings on the establishment and spread of invasive alien species in Luxembourg;
- improving knowledge of species of community interest.

/ HOW WE ARE DOING IT

Benthic invertebrates are sampled using a net (surber sampler), following the procedure in AFNOR NF T90-333. After sorting, taxa are identified at species (e.g. caddisflies), genus (most groups) or family and higher levels.

/ WHAT WE HAVE ALREADY ACHIEVED

LIST's research enables the evaluation of ecosystem services and the development of national state indicators of nature. The project contributed to show that European rivers have been biologically recovering from historical impairment, but that this recovery has slowed in the past 20 years (Haase et al. 2023 in Nature). While the ecological quality of Europe's rivers has improved overall, the ecological rating required, "good", has not yet been achieved (Sinclair et al. 2024 in Nature Ecology & Evolution).

Moreover, LIST's work demonstrated that cold-adapted caddisfly species in Luxembourg have declined while generalist and warm-adapted species have increased (Dohet, Vray, L'Hoste 2023 in Contributions to Entomology) over the last 60 years. The average invasion velocity of an invasive crayfish species (*Pacifastacus leniusculus*) has gradually decreased over the long-term (Soto et al. 2023 in Science of the Total Environment).

Overall, the project contributes supporting water authorities in:

- adopting legislation (i.e. protection of headwater streams as critical habitats for endangered and specialised species);
- changing land use practices and reducing exploitation.



/ WHAT'S NEXT?

Upcoming report on the second monitoring cycle (2021-2023).
Publication of an atlas of caddisflies in Luxembourg.

Current legislation

Water Framework Directive 2000/60/EC
Council Directive 92/43/EEC
EU Regulation n°1143/2014 on invasive alien species

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CONTRIBUTING TO MONITORING HARMFUL CYANOBACTERIA IN LUXEMBOURG

LAYMAN'S REPORT 2023

Blue-green algae blooms are harmful cyanobacteria that proliferate due to high temperatures, among other things. Since this seasonal phenomenon occurs every year in the official bathing areas of Luxembourg, it needs to be monitored to avoid bathers being exposed to harmful cyanotoxins.

/ WHY RESEARCH MATTERS

The routine monitoring of these cyanobacteria blooms is constrained by budget, time and human resources, and thus significant pollution events are likely to be missed. At the same time, a large potential source of valuable field data that can be leveraged by the community (residents, tourists, farmers, and fishermen) remains untapped to date. Driven by the proliferation of smart mobile devices, online social media and cloud computing, the active participation of citizens in cyanobacteria bloom monitoring can thus become key in managing associated risks and increasing our understanding of the highly heterogenous bloom dynamics in water bodies.

/ WHAT WE ARE SEEKING

Within the framework of the CYANOWATCH project, LIST aims to foster the active involvement of the community in the assessment and monitoring of risks related to cyanobacteria blooms in bathing areas.

/ HOW WE ARE DOING IT

Before launching the Bloomin'Algae app, LIST reviewed existing mobile apps for reporting cyanobacteria blooms, and then adapted an existing app specifically for Luxembourg. Available since 2023, the app enables a participatory reporting of cyanobacteria blooms. Furthermore, the researchers also constituted a group of sentinels for the additional participatory monitoring of cyanotoxins in bathing water using rapid in situ assays. In order to foster citizen science in Luxembourg, the project also organised a photo contest to reward bloom reports submitted by citizens and sentinels during the 2023 bathing season.

/ WHAT WE HAVE ALREADY ACHIEVED

The Bloomin'Algae App (European initiative using the iRecord platform) enables a rapid notification (within hours) of bloom occurrence in official bathing waters and other water bodies in Luxembourg using a dedicated website (cyanowatch.lu) with an interactive and continuously updated map of the submitted citizen reports. In addition, the researchers received rapid notifications of the presence of microcystins (cyanobacterial toxins) in the Remerschen lake by local staff during the blooming period.

Overall, the project contributes to:

- leveraging unprecedented data to contribute to a more accurate risk assessment;
- improving the protection of public health while raising public awareness on an important environmental issue.

/ WHAT'S NEXT?

In a follow-up action, the mobile app will be further promoted nationally to increase the number of participants and reports. Moreover, participatory testing of cyanotoxins will be generalised at official bathing sites in Luxembourg using local sentinels.

Current legislation

Règlement grand-ducal du 19 mai 2009 (national transposition of Bathing Water Directive 2006/7/EC)

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CAMERAS TO HELP TRACK HARMFUL CYANOBACTERIA BLOOMS

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Harmful cyanobacteria bloom formation and dynamics have a high spatiotemporal variability, meaning they can appear very differently and at varying times and places in freshwater bodies. This variability underlines the importance of implementing tools to enable their monitoring and forecasting. While the remote sensing of water bodies using satellite imagery has proven useful in many contexts, it is greatly limited in the context of cyanobacteria by cloud cover and low revisit times. Ground-based remote sensing, using automated cameras installed at strategic locations, is an interesting alternative and was successfully tested at the Upper-Sûre Lake in 2021 and 2022.

/ WHY RESEARCH MATTERS

LIST conducts operational monitoring of cyanobacteria blooms at official bathing sites, at weekly to bi-monthly intervals. With this frequency of monitoring, blooms could be overlooked. While the CYANOWATCH project enables citizen participation in monitoring, complementary technological solutions provide active surveillance of water bodies 24 hours a day, 7 days a week. This approach helps gather relevant high-resolution data on cyanobacteria blooms to develop early-warning systems and improve public health protection.

/ WHAT WE ARE SEEKING

The CYANOPHOTO project aims to enhance the current camera setup to develop it into an early-warning system with real-time image transmission.

/ HOW WE ARE DOING IT

LIST researchers are improving the existing camera setup to reduce or remove light reflection interferences. To test these new camera prototypes, they collect high-resolution data on blooms at strategic spots of the Upper-Sûre Lake. Finally, the team analyses images for improved and faster decision making before, during and after blooming conditions.

/ WHAT WE HAVE ALREADY ACHIEVED

This project enabled the continuous acquisition of pictures (every 30 minutes) at three strategic spots in the Upper-Sûre Lake during the 2023 bathing season. Moreover, the researchers were able to demonstrate real-time transmission of images.

Overall, the project contributes to:

- modelling in combination with other datasets (satellite imagery, in situ data) for the nowcasting and forecasting of cyanobacteria blooms;
- a better understanding and modelling of cyanobacteria blooms to protect public health;
- developing solutions to mitigate this phenomenon.

/ WHAT'S NEXT?

In a follow-up action, researchers will install the new setup at additional sites for the high-resolution monitoring of cyanobacteria blooms at official bathing sites in Luxembourg. They will also continue efforts to improve image quality by reducing or removing light reflection interferences.

Current legislation

Règlement grand-ducal du 19 mai 2009 (national transposition of Bathing Water Directive 2006/7/EC)

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NAVIGATING CHEMICAL RISKS IN EUROPE



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Chemicals are ubiquitous in our daily lives, supporting the foundations of modernity. Therefore, ensuring their safe usage is paramount to protecting both human health and the environment. This responsibility falls under the purview of the European Union's (EU) robust chemicals legislation.

/ WHY RESEARCH MATTERS

The European Chemicals Agency (ECHA) is responsible for implementing REACH, the cornerstone legislation designed to safeguard human and environmental well-being. Central to this effort is the Risk Assessment Committee (RAC), which meticulously evaluates chemical risks within the framework of key legislative instruments.

/ WHAT WE ARE SEEKING

Experts nominated by EU Member States serve as vital components of the RAC, bringing their expertise to the complex task of risk assessment. An expert from LIST, nominated by Luxembourg's Ministry of the Environment, Climate and Biodiversity, is currently making a significant contribution to this collective endeavour.

/ HOW WE ARE DOING IT

Member States or the ECHA submit dossiers proposing classifications, restrictions and authorisations to ensure the safe usage of chemicals. The RAC meticulously scrutinises these dossiers through a scientific lens, providing well-founded opinions based on REACH and CLP regulations, which inform the final decisions made by the European Commission.

/ WHAT WE HAVE ALREADY ACHIEVED

Based on a five-year average, the RAC adopts 104 opinions per year covering both industrial chemicals and those used in cleaning and cosmetic products, fragrances and pesticides.

Overall, it contributes to:

- protecting workers, consumers and the environment;
- facilitating recycling;
- developing safer alternatives.

/ WHAT'S NEXT?

The RAC remains committed to evaluating dossiers on classification, labelling, restrictions, and authorisations. Additionally, new tasks, such as the assessment of materials in contact with drinking water and the regulation of hazardous chemicals in batteries, arising from new or updated regulations, will create new challenges in the ongoing pursuit of chemical safety.



Current legislation

Regulation (EC) 1907/2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) (current version 01/12/2023),

Regulation (EC) 1272/2008 on classification, labelling and packaging (CLP) of substances and mixtures (current consolidated version: 01/12/2023)

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CONTRIBUTING TO DRINKING WATER SAFETY IN LUXEMBOURG



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Luxembourgish drinking water resources are becoming increasingly contaminated with newly identified pesticide transformation products, necessitating managerial or regulatory action in drinking water safeguard zones, and for some compounds, treatment to make the water drinkable.

/ WHY RESEARCH MATTERS

Drinking water quality is regulated for human consumption, and quality standards must be met to allow for public distribution of the water.

/ WHAT WE ARE SEEKING

This project (Ground Water-Pollution panel) brings together experts from drinking water suppliers, agricultural services, agencies and health institutes to discuss the risks of emerging pollutants in ground water and ways to prevent their emission at the source. LIST provides scientific support through literature research, analytical method development, monitoring campaigns and treatment process testing to inform the decision-making process.

/ HOW WE ARE DOING IT

The panel proceeds through several consultation cycles, initially prioritising a list of compounds, which are then investigated by LIST in terms of analytics, pollution patterns and treatment. After each cycle, the panel discusses the findings and aims to reach decisions regarding the management of drinking water protection zones, monitoring requirements and treatment to make the water drinkable.



/ WHAT WE HAVE ALREADY ACHIEVED

The project, which started in autumn 2023, is currently in its first cycle and will continue for 5 years. It facilitates the gathering of national experts in an interdisciplinary panel to anticipate the evolution of problematic substance usage before the pollution occurs.

Overall, the project contributes to:

- introducing a scientifically rigorous approach accepted by all stakeholders;
- making anticipatory decisions regarding pesticide use before problems arise.

/ WHAT'S NEXT?

LIST and its partners will proceed with the expected 3 to 4 investigation cycles.

Current legislation

Loi du 23 décembre 2022 relatif à la qualité des eaux destinées à la consommation humaine

Règlement grand-ducal modifié du 9 juillet 2013 relatif aux mesures administratives dans l'ensemble des zones de protection pour les masses d'eau souterraine ou parties de masses d'eau souterraine servant de ressource à la production d'eau destinée à la consommation humaine

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MONITORING INVASIVE ALIEN SPECIES IN LUXEMBOURG

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Species introduced to new regions through human activities are termed alien species. Invasive Alien Species (IAS) represent a subset of alien species, encompassing animals, plants and other organisms known to have established and spread across new regions with negative impacts on native biodiversity and/or on society.

/ WHY RESEARCH MATTERS

IAS and their impacts are increasing rapidly and are predicted to continue rising in the future. However, future biological invasions and their impacts can be prevented through effective management and better integrated approaches.

/ WHAT WE ARE SEEKING

Within the framework of the LUXIAS project, LIST supports the Luxembourgish government in addressing these challenges through two main actions. On one hand, researchers have implemented a monitoring network to report on the establishment and spread of IAS in Luxembourg. On the other hand, they participate in the development of national strategies for the prevention and management of IAS.

/ HOW WE ARE DOING IT

LIST monitors a panel of IAS including mammals, plants, reptiles, fish and crayfish, by systematically adapting methods to the targeted species. For example, camera traps are used to survey invasive alien mammals in forests.

/ WHAT WE HAVE ALREADY ACHIEVED

In forests, LIST researchers have monitored 96 sites with camera traps over the years, regularly detecting the presence of IAS such as fallow deer (*Dama dama*), European mouflon (*Ovis aries musimon*) and raccoons (*Procyon lotor*). Additionally, 30 river sites were surveyed using baited crayfish traps from 2021 to 2023, detecting the presence of spiny-cheek crayfish (*Faxonius limosus*) and signal crayfish (*Pacifastacus leniusculus*) at 1 and 17 sites, respectively. In 2021, the red swamp crayfish (*Procambarus clarkii*) was detected for the first time in Luxembourg during the method testing phase. Finally, in 2022, a set of methods was applied to monitor ponds.

Overall, the project contributes to:

- defining priority actions to halt the spread of invasive alien species in Luxembourg;
- preparing national action plans.

/ WHAT'S NEXT?

LIST plans to improve IAS detection by implementing alternative technological methods (e.g. eDNA, automated sound recording systems).



Current legislation

EU Regulation n°1143/2014 on the prevention and management of the introduction and spread of invasive alien species

[Plan National concernant la Protection de la Nature 3](#)

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REACH&CLP HELPDESK LUXEMBOURG

In accordance with European regulations, every Member State must establish a national helpdesk, offering guidance to manufacturers, importers and downstream users of chemical substances. The REACH&CLP Helpdesk fulfils this role in Luxembourg, offering assistance on the implementation of REACH, CLP and POP regulations.

/ WHY RESEARCH MATTERS

Chemicals make up everything around us, and compliance with European chemical legislation is imperative for companies, regardless of their size. These regulations hold companies responsible for ensuring that chemicals pose only minimal risks to human health and the environment, while also promoting their safe use.

/ WHAT WE ARE SEEKING

Since 2007, LIST, acting on behalf of the Ministry of the Environment, Climate and Biodiversity and the Ministry of the Economy, has spearheaded the national REACH&CLP Helpdesk. This initiative helps companies to navigate into chemical-related regulations, aligning with European Union mandates.

/ HOW WE ARE DOING IT

The REACH&CLP Helpdesk responds to companies' requests (via contact forms, email, telephone, etc.) and disseminates all information related to chemical legislation via its websites (www.reach.lu and www.pop-chemicals.lu), newsletters and conferences. Moreover, the Helpdesk offers a user-friendly tool enabling companies to streamline their chemical inventory and identify their regulatory obligations. The Helpdesk forms part of the broader European network of national helpdesks (HelpNet), collaborating with other Member States' REACH and CLP helpdesks and the European Chemicals Agency (ECHA). This network facilitates direct communication with the ECHA, ensuring a coherent approach to providing information to companies.

/ WHAT WE HAVE ALREADY ACHIEVED

Today, the Helpdesk boasts over 500 newsletter subscribers and the website receives approximately 20,000 visits, annually. Since its inception, the Helpdesk team has addressed over 2,000 queries.

Overall, the project contributes to:

- disseminating information on legal obligations related to chemical legislation;
- providing information on future possible constraints for companies.

/ WHAT'S NEXT?

While continuing to support companies, the team behind the REACH&CLP Helpdesk is organising six events for 2024 and will launch its new inventory tool.

Current legislation

Regulation (EC) No 1907/2006 of the European Parliament and of the Council of 18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) (current consolidated version: 01/12/2023)

Regulation (EC) No 1272/2008 of the European Parliament and of the Council of 16 December 2008 on classification, labelling and packaging of substances and mixtures (CLP) (current consolidated version: 01/12/2023)

Regulation (EU) 2019/1021 of the European Parliament and of the Council of 20 June 2019 on persistent organic pollutants (recast) (current consolidated version: 28/08/2023)

CONTACT

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(DE)CONSTRUCTION WASTE MANAGEMENT

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The construction sector produces over 7.5 million tonnes of waste annually, including excavated materials. Transforming this waste into reusable or recyclable components presents a unique opportunity to nurture a circular economy.

/ WHY RESEARCH MATTERS

Rising concerns over resource scarcity, carbon footprints and Luxembourg's reliance on imported construction materials highlight vulnerabilities in the supply chain, as exemplified during the pandemic. Embracing urban mining principles, in which Luxembourg's buildings serve as both repositories and resources, is essential in addressing this challenge.

/ WHAT WE ARE SEEKING

LIST is actively involved in supporting authorities in establishing strategies and regulatory tools by providing analyses, best practice benchmarks and neutral inputs derived from feedback from field actors.

/ HOW WE ARE DOING IT

LIST researchers provide policymakers with an analysis of critical parameters and criteria for the application of laws. They collect feedback from Luxembourgish stakeholders on the adequacy of current and future strategies, laws, standards and regulations for construction and deconstruction. Finally, the teams produce guides and support documents to disseminate best practices in sustainable and circular activities within the construction industry.



/ WHAT WE HAVE ALREADY ACHIEVED

LIST has mainly contributed to the creation of a deconstruction waste inventory ([in French and German](#)) and a deconstruction guide ([in French](#)) to help stakeholders make informed decisions.

Overall, the project contributes to:

- disseminating best practices and technologies to stakeholders in the construction industry, including the general public;
- organising workshops, seminars (webinars), conferences, study trips, etc. to address specific issues and transfer specialised knowledge;
- making a direct impact to support innovation transfer and the transition to a more sustainable and circular construction industry.

/ WHAT'S NEXT?

LIST will apply and manage the end-of-waste status and link it to the sustainable construction principle (design for deconstruction, modularity, flexibility, lifespan increase, building logbook, etc.).

Current legislation

Waste Law (21/03/2012) modified on 09/06/2022

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CONTRIBUTING TO SOIL PROTECTION



LAYMAN'S REPORT 2023

Soil serves as a linchpin in our society, nurturing crops, filtering water, storing carbon and providing a habitat for myriad organisms. It is also crucial in various industrial processes, supporting manufacturing, agriculture and construction. Recognising its pivotal role, the Ministry of the Environment, Climate and Biodiversity (MECB) and its Environment Agency (AEV) are crafting a robust framework to safeguard Luxembourg's soil from various threats, including soil contamination.

/ WHY RESEARCH MATTERS

Addressing the complexities of contaminated land management requires sustainable policies and effective decision-making tools. This ensures the preservation of soil quality, prevents environmental degradation (e.g. groundwater contamination), safeguards human health, and fosters responsible land-use practices, which are all vital for long-term ecological and societal well-being.

/ WHAT WE ARE SEEKING

LIST actively supports the AEV and MECB in developing a new soil protection framework in Luxembourg. The goal is to enhance the assessment and management of contaminated sites in order to protect human health and the environment.

/ HOW WE ARE DOING IT

LIST researchers employ a scientifically grounded approach to assist the AEV in establishing parameters for the sustainable management of contaminated sites. This involves defining pollutant threshold values, devising methodologies to assess soil degradation costs and identifying national priorities in collaboration with public authorities such as the [MECB](#), [AEV](#), [AGE](#) and [ANF](#).

/ WHAT WE HAVE ALREADY ACHIEVED

In order to restore polluted sites, LIST has defined a science-based strategy building on risk assessment. It has also outlined national priorities concerning polluted sites and assessed the cost of soil degradation in Luxembourg.

Overall, the project contributes to:

- supporting landowners and accredited organisms in the management of polluted sites;
- disseminating findings on soil pollution costs;
- defining more sustainable strategies for the remediation of polluted soils, including the valorisation of excavated soils.

/ WHAT'S NEXT?

Moving forward, LIST teams aim to define the best remediation techniques and enhance risk-assessment methodologies through international collaboration. Furthermore, they seek to define and implement national and international partnerships to recover polluted sites in Luxembourg.

Current legislation

Projet de loi 7237 sur la protection des sols et la gestion des sites pollués

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IMPORTANCE OF ENVIRONMENTAL POLICIES FOR LUXEMBOURGISH COMPANIES



LAYMAN'S REPORT 2023

Luxembourgish companies are required to comply with a wide range of environmental policies and legislation. However, they are not always easy for companies to decipher, let alone apply.

/ WHY RESEARCH MATTERS

While fulfilling obligations stemming from legal texts is essential, companies should also view compliance as an avenue for innovation. Authorities aim to help companies meet these obligations efficiently, minimising the burden for both parties.

/ HOW WE ARE DOING IT

Within the B&E network, LIST researchers maintain close ties with national authorities and Luxembourgish stakeholders (institutions, professional federations and chambers) to identify and implement useful actions for companies. They also manage the [B&E website](#), which serves as a primary resource for companies seeking assistance from the Institute.

/ WHAT WE ARE SEEKING

To facilitate compliance and promote innovation, the B&E platform was established collaboratively by the Ministry of the Environment, Climate and Biodiversity (MECB), the Environment Agency (AEV) and the Luxembourg Institute of Science and Technology (LIST). This platform informs companies about their environmental responsibilities and provides guidance on efficient compliance.

Accordingly, the mission of the B&E platform is to raise awareness and proactively inform companies about regulatory and environmental topics. In doing this, LIST supports SMEs and very small companies that often lack the capacity to address all regulatory questions, and provides information and guidance to companies in general.

/ WHAT WE HAVE ALREADY ACHIEVED

Support for businesses also involves a wide range of communication and awareness-raising initiatives. These include events, news and newsletter services, tools and guidance on selected topics and documentation, such as basic information on selected topics (Commodo, best-available techniques, environmental management, etc.).

Overall, the project contributes to:

- raising awareness and proactively informing companies about regulatory and environmental topics;
- increasing regulatory compliance among companies;
- transforming various environmental policies and requirements into opportunities for innovation.

/ WHAT'S NEXT?

Future activities will take account of regulatory developments and the needs of Luxembourg players and companies

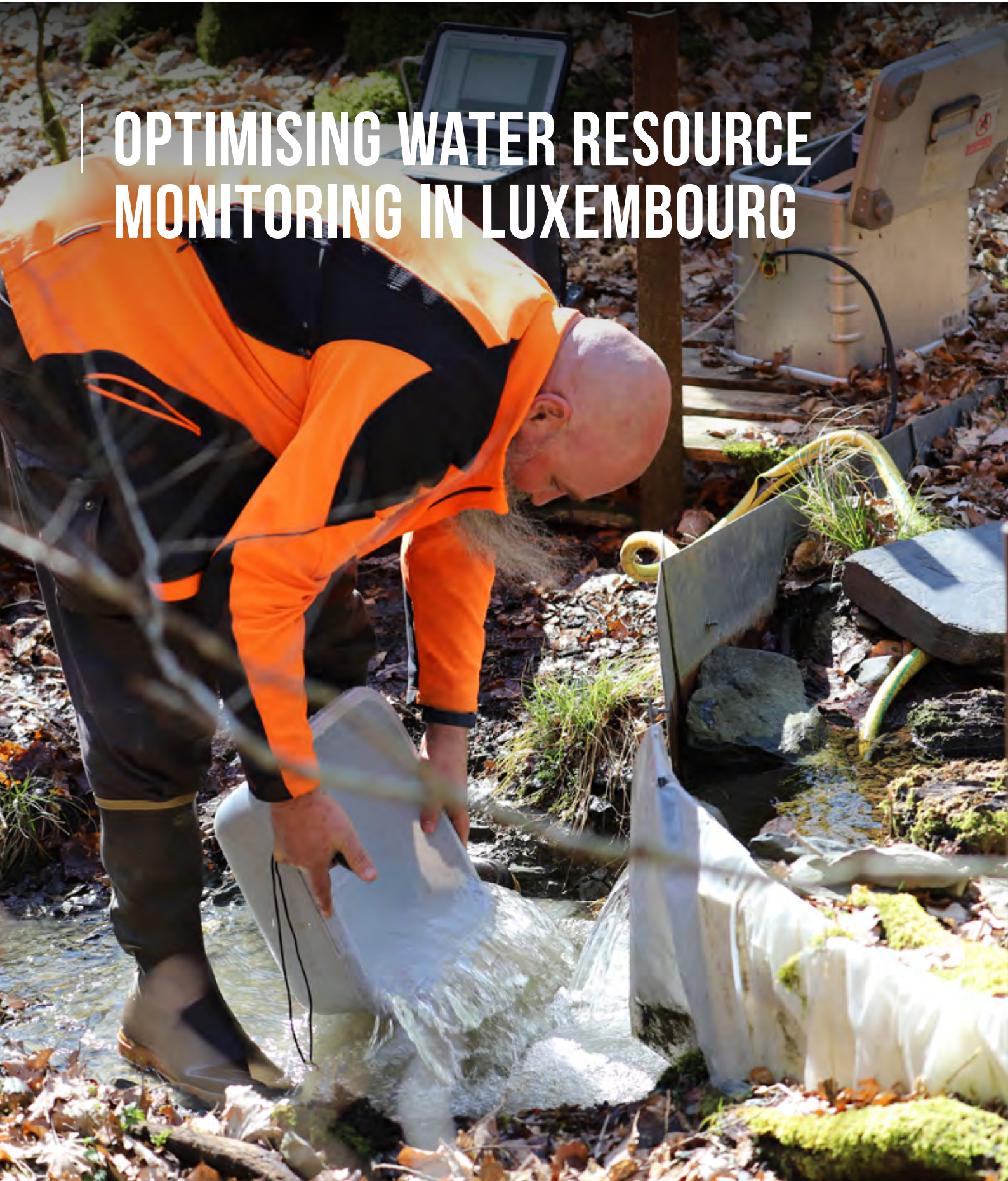
Current legislation

Upcoming national legislation on several topics, current legislation (e.g. Commodo, waste and deconstruction, etc.)

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OPTIMISING WATER RESOURCE MONITORING IN LUXEMBOURG



There is a pressing need for long-term time series observation aligned with both hydrological and meteorological parameters, from the catchment to the plot level. This requires specific monitoring and a data management plan to provide the necessary information across multiple stakeholder levels.

/ WHY RESEARCH MATTERS

Historical and current data on the environment, water resources, and climate are crucial for effective water resource management. They enable distribution and variability mapping, which helps in adapting to climate change by assessing trends and impacts. Furthermore, such data support risk assessment and disaster management efforts by identifying areas prone to hazards.

/ WHAT WE ARE SEEKING

Recent developments regarding climate change and water resources in Luxembourg are published in an atlas, facilitating informed decision-making and fostering resilience. LIST coordinates the implementation of the hydrological monitoring activities in Luxembourg and contributes to the development of a national hydrological atlas.

/ HOW WE ARE DOING IT

Hydrological monitoring activities entail collecting river water level data through a sensor observation network. Subsequently, the hydrological data undergo validation via gauging campaigns, facilitating the establishment of rating curves for each river. The analysis and specialised reports are then published in the atlas.



/ WHAT WE HAVE ALREADY ACHIEVED

Each year, LIST researchers report on events that occurred that year, such as flooding or droughts. Following the 2021 flood, they observed a dramatic shift in the flow regime, with nearly 70% of the rating curves having changed.

Overall, the project contributes to creating data series that are indispensable for:

- monitoring and investigating climate change;
- understanding its associated impacts on water resources in Luxembourg.

/ WHAT'S NEXT?

A digital web-based hydro-climatological atlas of Luxembourg will be created. This entails not only digitising existing data but also leveraging the latest technologies to enhance the monitoring process.

Current legislation

European Water Framework Directive (WFD), Article 8, The Member States must ensure the establishment of monitoring programmes, inter alia, for surface waters

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A WEB-BASED HYDROLOGICAL ATLAS PLATFORM FOR LUXEMBOURG

The current water management challenge, encompassing issues such as floods, droughts and water quality, must be addressed by providing enhanced access to high-quality hydrological data. Timely access to such data is essential to facilitate informed decision-making at the local level. Presently, Luxembourg lacks a centralised web platform offering comprehensive access to such crucial information.

/ WHY RESEARCH MATTERS

Given the challenges posed by climate change and the evolving policy environment, there has long been a need for an enhanced hydro-climatological information system.

/ WHAT WE ARE SEEKING

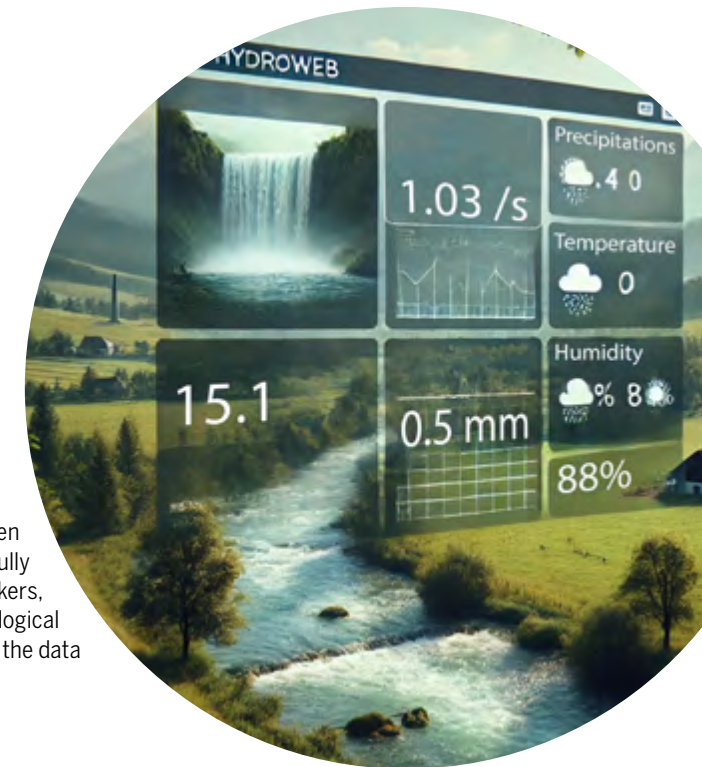
The current initiative seeks to conduct a comprehensive assessment and create documentation, outlining the steps required to establish a web-based hydrological atlas of Luxembourg. This endeavour aims to bolster the decision-making process and provide online access to the pertinent data and information crucial for effective water resources management.

/ HOW WE ARE DOING IT

Within the framework of this project, LIST is developing the concept of the future Hydroweb platform, including the definition of its technical specifications (including functionalities and content).

/ WHAT WE HAVE ALREADY ACHIEVED

The system architecture of the platform has already been developed, to enable a smoother implementation process. Once fully implemented, this new tool should enable researchers, policymakers, and the public not only to discover Luxembourgish hydro-climatological data quickly but also to access, analyse, interrogate and visualise the data through a single platform.



/ WHAT'S NEXT?

In a later stage, the project will transition from a conceptual framework to the implementation of a web portal. The latter will offer seamless access to diverse data and information through a geo-spatial-based system, enhancing the user experience and effectiveness of accessing critical resources.

Current legislation

European Water Framework Directive (WFD), Article 8, The Member States must ensure the establishment of monitoring programs, inter alia, for surface waters and provide information to wider public

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This report is the result of a fruitful collaboration between the Luxembourg Institute of Science and Technology (LIST), the Ministry of the Environment, Climate and Biodiversity (MECB) and its agencies. We extend our sincere gratitude to the Ministry for its unwavering support, guidance and funding, which have made it possible to undertake these crucial research, innovation and monitoring projects. The Ministry's dedication to tackling the pressing environmental and climate challenges facing Luxembourg has been a driving force behind this work.

We also wish to acknowledge the tireless efforts of the researchers, engineers and technicians at LIST, whose expertise and commitment have been instrumental in advancing scientific knowledge on key issues such as biodiversity monitoring, water management and support for environmental policies and businesses. Their work not only highlights the importance of preserving Luxembourg's environment and public health but also demonstrates how research can contribute to a stronger and more sustainable economy.

Special thanks go to our numerous stakeholders, whose collaboration has enhanced the impact of this research. Their shared commitment to environmental stewardship reinforces the importance of working together for a better future. The inclusion of citizen science initiatives reflects the collaborative spirit that drives these efforts.

This report, covering nearly a decade of research, would not have been possible without the collective efforts of all those involved, including everyone who contributed to the production of this report. We hope that making this knowledge accessible to the public will promote informed decision-making and inspire continued collaboration in building a more resilient and sustainable Luxembourg.

IMPRESSUM

Editor

Luxembourg Institute of Science and Technology
Ministry of the Environment, Climate and Biodiversity
and its delegated agencies

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