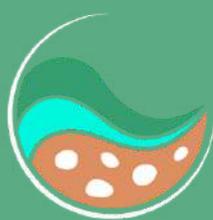




LAYMAN'S REPORT



LIFE GREEN
ADAPT

November 2025



The LIFE GREEN ADAPT project has received funding from the LIFE programme of the European Union under Grant Agreement no. LIFE20 CCA/ES/001795.

INTRODUCTION

Green and Nature-based solutions for climate change-resilient waste infrastructure

Climate change is a serious problem that affects people and nature all over the world. Extreme weather, made worse by climate change, is also putting our infrastructures and environment at risk. Waste infrastructures, like landfills, are especially vulnerable, and damage to them can cause problems for both the environment and human health.

LIFE GREEN ADAPT aims to increase the resilience of the landfills in the European Union against extreme weather events.

The effects of extreme weather events at landfills

- Heavy rainfall results in landfills being a potential source for severe pollution (leachates) from flash flooding and run-off, and it increases landslide risks.

- Droughts and unusual heatwaves increase the risk of fires and explosions.

How LIFE GREEN ADAPT is addressing landfill vulnerabilities

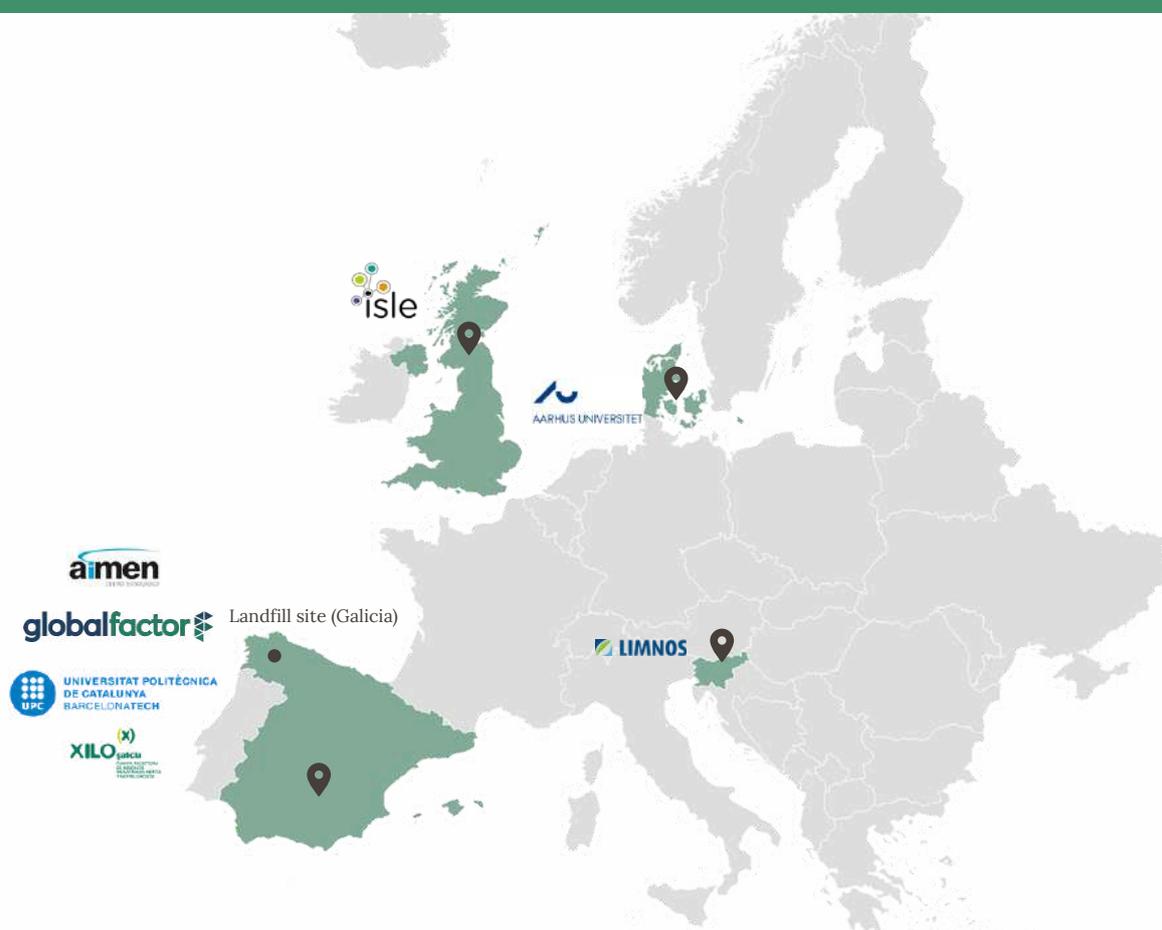
By deploying blue-green infrastructure solutions and ecosystem-based approaches at waste infrastructure sites to protect them from climate impacts and promote circular economy frameworks.

Why LIFE GREEN ADAPT matters

- **Landfills are vulnerable to climate change** as heavier rainfall and rising temperatures can increase long-term leachate production and the risk of environmental contamination even decades after closure.
- It **demonstrates an integrated approach** combining wastewater and soil management with strategies to adapt to climate change.
- **Key EU policy goals** are supported: circular economy, adaptation to climate change, green infrastructure, and resource efficiency.
- It demonstrates an **innovative concept for other sectors** (e.g., mining, old industrial sites) to adopt to deal with similar climate risks.

PROJECT DETAILS

Key facts



KEY FACTS AT A GLANCE

Demonstration site: Landfill in As Somozas, Galicia, Spain

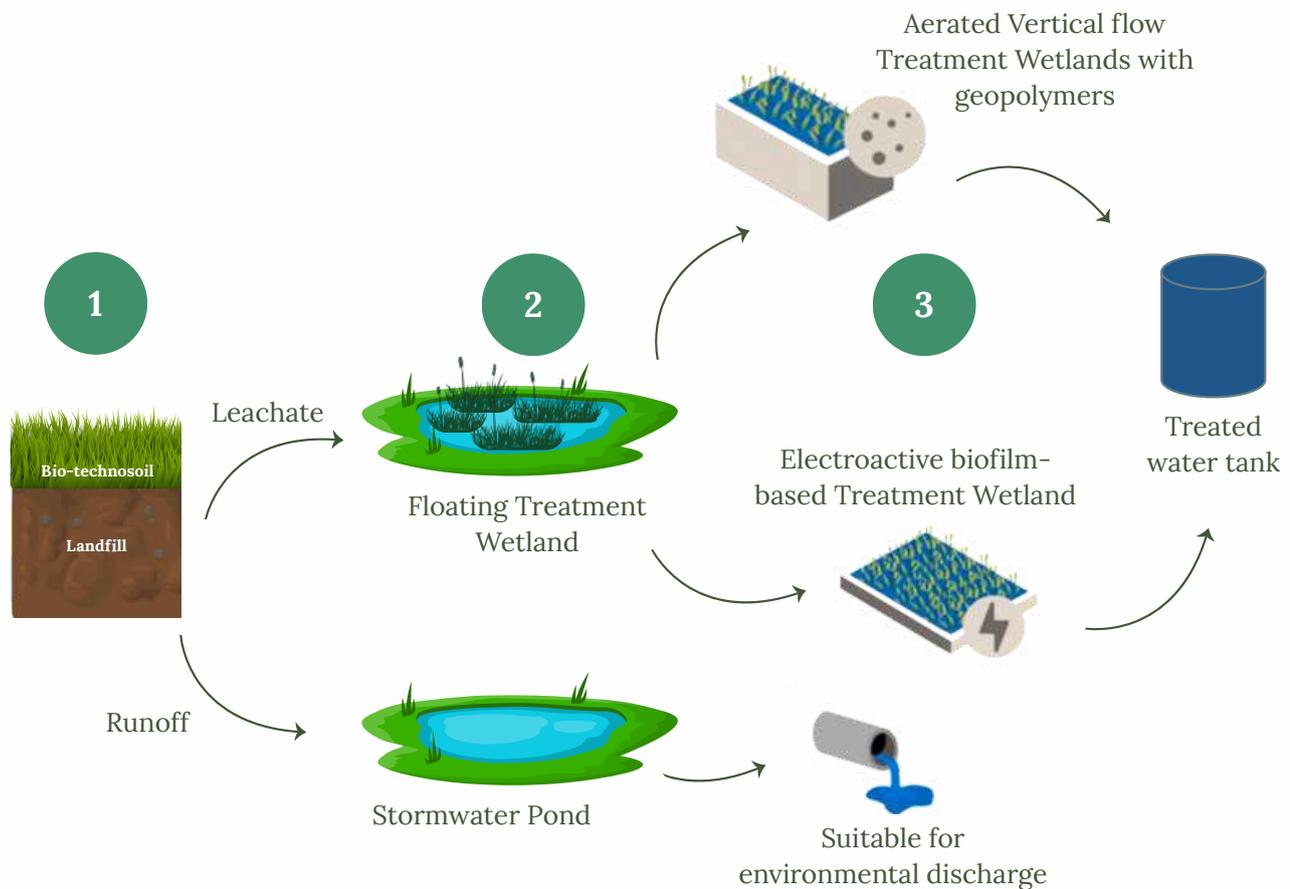
Project budget: ~ €3 million for the project

Project partners: 7 partners from Spain, Denmark, United Kingdom, Slovenia

Project timeline: July 2021 – December 2025

THE CONCEPT

LIFE GREEN ADAPT process and innovations



LIFE GREEN ADAPT has demonstrated how **blue-green infrastructures** and **ecosystem-based approaches** can help control flash floods and run-off caused by heavy rain, and reduce the risk of fires and explosions during droughts and heatwaves. This was successfully tested at real scale at a landfill site in Spain.

THE CONCEPT

LIFE GREEN ADAPT process and innovations

1

The LIFE GREEN ADAPT uses a multi-step process to manage landfill waste and water safely. It starts with **bio-technosoils**, made from a mix of organic and inorganic landfill waste, which are used to cover landfill cells. These soils are designed to mimic natural soil, helping prevent erosion and stopping rainwater from percolate into the landfill.



2

Rainwater runoff is collected in a pond and eventually released safely into the environment. At the same time, leachate (the liquid that drains from landfills) from the capped cells is treated in a **Floating Treatment Wetland**, where aquatic plants naturally remove harmful substances like organic matter, nitrogen, phosphorus and heavy metals.



3

The treated leachate is then sent to **two parallel systems** where running these systems side by side allows their effectiveness to be compared. In the **Aerated Vertical-Flow Wetland**, leachate is further treated using special **geopolymers** along with aeration, which works together with the natural wetland treatment. In the **Electroactive Biofilm Wetland**, electroactive bacteria work with the natural wetland to remove additional contaminants.



These **innovative treatment steps** significantly reduce harmful pollutants in landfill leachate, making the water safer for the environment. While the treated water does not yet meet full reuse standards, it is stored on-site and can be used in controlled ways, demonstrating a practical and environmentally friendly approach to managing landfill waste and water.

RESULTS AND IMPACT

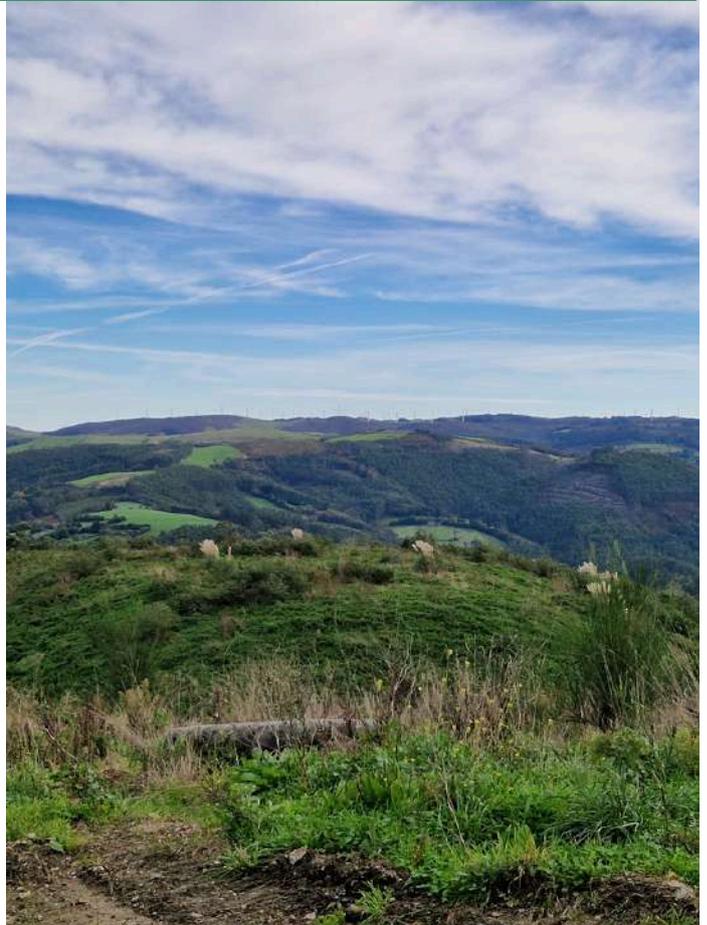
Technical impact and stakeholder reach



The LIFE GREEN ADAPT project shows real results in protecting landfill sites from extreme weather while promoting recycling and reuse of waste. Its innovative solutions provide a practical, scalable way to adapt to climate change, delivering multiple benefits—longer-lasting waste infrastructure, reduced pollution, safer sites, and more efficient use of resources.

RESULTS

Key technical results



BIO-TECHNOSOILS

At the demonstration site, **bio-technosoils** have successfully sealed the landfill, stopping rainwater from percolating, and reducing leachate production. They have also supported the growth of grass and other plants, helping the landfill blend into the landscape and creating new habitats for wildlife.

RESULTS

Key technical results



FLOATING TREATMENT WETLAND

The **Floating Treatment Wetland** treated leachate by removing most of the harmful substances: it gets rid of around **50-60% % of organic matter**, **50-60 % of total nitrogen**, and **40% of total phosphorus**, while also keeping the pH level stable.

RESULTS

Key technical results



AERATED VERTICAL FLOW TREATMENT WETLAND WITH GEOPOLYMERS

Using the **Aerated Vertical Flow Treatment Wetland with geopolymers** after the Floating Treatment Wetland can treat leachate even more, removing more than **80% of organic matter**, more than **70% of total nitrogen**, and around **60-70% of total phosphorus**.

RESULTS

Key technical results



ELECTROACTIVE BIOFILM TREATMENT WETLAND

After pre-treatment with Floating Treatment Wetland, the **Electroactive Biofilm Treatment Wetland** can further treat leachate very effectively, removing over **95% of organic matter**, and around **90% of total nitrogen and phosphorus**.

KEY EXPLOITABLE RESULTS

Main innovations and practical solutions



INNOVATIVE SOLUTIONS

BIO-TECHNOSOILS

Innovative soils made from landfill wastes to seal the landfill and recover the ecosystem

FLOATING TREATMENT WETLANDS

First-step treatment system for cleaning landfill leachate

AERATED VERTICAL WETLANDS WITH GEOPOLYMERS

Second-step treatment using polymers as filter media for enhanced leachate treatment

GEOPOLYMER GRAVEL FROM METAKAOLIN

Developed as sustainable filter media for treatment wetlands

ELECTROACTIVE BIOFILM-BASED TREATMENT WETLAND

Advanced treatment for landfill pre-treated leachate



TOOLS & KNOWLEDGE

RISK & VULNERABILITY ASSESSMENT SERVICES

Tools and services for the waste sector and public authorities to evaluate environmental risks

OPERATION & VALIDATION OF BIO-TECHNOSOILS

Demonstrated application and effectiveness of bio-technosoils in real conditions

OPERATION & VALIDATION OF TREATMENT WETLANDS

Successful testing of treatment wetlands for landfill leachate and runoff management

MAINTENANCE AND MANAGEMENT PLAN

Comprehensive plan for long-term operation of the LIFE GREEN ADAPT system

GUIDELINES FOR DESIGN, CONSTRUCTION & MAINTENANCE

Practical guide for implementing blue-green infrastructures in landfills

The **10 Key Exploitable Results** highlight the **main innovations and practical solutions** developed to manage and clean landfill leachate and runoff. LIFE GREEN ADAPT focuses on creating safe, effective and sustainable ways to treat polluted water, improve soil quality, and help authorities and waste managers reduce environmental risks.

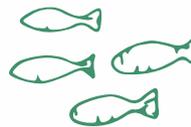
These **10 Key Exploitable Results** include advanced treatment wetlands, recycled materials for filtering and soil enhancement, and clear guidelines for building, operating, and maintaining these systems. Together, the **Key Exploitable Results offer solutions that make landfill management more cost-effective, safer, and more environmentally friendly.**

ENVIRONMENTAL AND ECONOMIC IMPACT

Key benefits



50%
Increase landfill infrastructure life span



1,065 m³/year
of polluted water spill overs avoided



21,300 m³/year
of water available to natural courses to improve resilience to flooding



21,300 m³/year
of water available to decrease landfill temperature and improve resilience to spontaneous fires



21,300 m³/year
of freshwater consumption savings



116,702 t CO₂eq
saved per year



27,507 tonnes
of waste recovered



€200-500k/year
saved in leachate external treatment costs

LIFE GREEN ADAPT brings **environmental benefits** by making landfills last longer and recycling a large amount of waste every year. It also helps manage water better, saving freshwater, preventing polluted water from spilling into the environment, and making more water available for rivers and streams, which helps reduce flooding. On top of that, it lowers carbon emissions and improves safety by using water to keep landfill temperatures down, reducing the risk of fires.

From an **economic point of view**, the LIFE GREEN ADAPT also saves a lot of money each year by reducing the need to treat landfill liquids off-site.

ENGAGEMENT IMPACT

Social media

4

Social media channels

24

Press releases

30

Videos produced

30,000+

People reached



LIFE GREEN ADAPT



<https://lifegreenadapt.com>



@LIFEGREENADAPT



@LIFEGREENADAPT1

ENGAGEMENT IMPACT

Targeted engagement

22

Stakeholder involved initiatives

3

Market-focused Innovation Workshops

1

Global event with 50 attendees

1,300+

Targeted stakeholders engaged with



LIFE GREEN ADAPT carried out a range of **targeted dissemination and engagement activities**, including participation in 3 industry events, 17 EU platform events and educational activities included an open day, a global event, primary school talk, and a final conference with over 150 participants.

Additionally, 3 market-focused innovation workshops connecting LIFE GREEN ADAPT innovators directly with end-users were delivered.

ENGAGEMENT IMPACT

Knowledge transfer

22

Knowledge transfer initiatives

4

Workshops and guided site visits

11

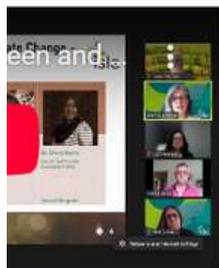
Training courses in 4 countries

800+

People reached



Universidad Militar Navea Granada
 Modalidad Presencial: 21 al 25 de octubre de 2024
 Hora : 9:00am a 4:00pm
 Lugar: Aula Especial I (Bloque D)
 Cra 11 # 101-80 , Bogotá.
 Evento sin costo
 Cupo limitado

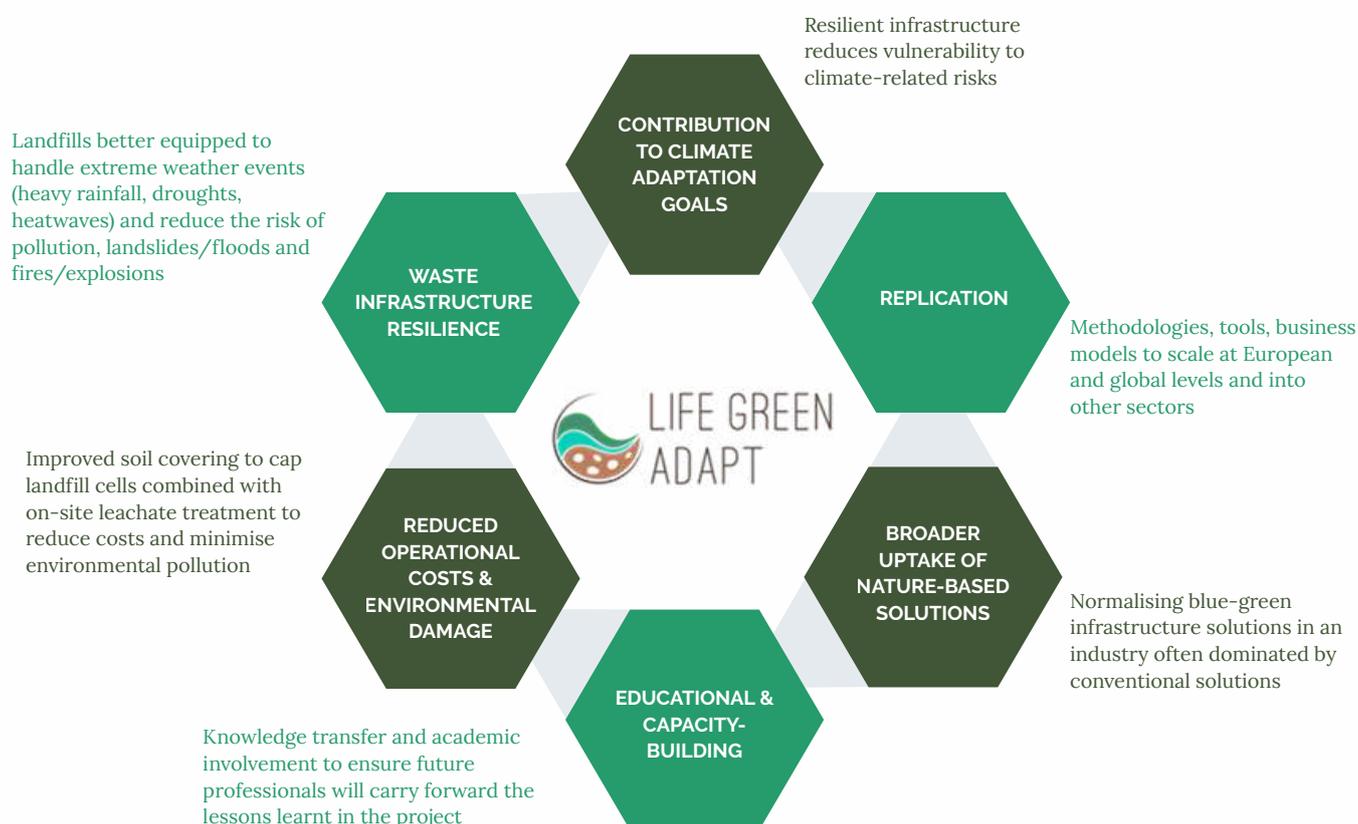


LIFE GREEN ADAPT’s **knowledge transfer initiatives** included 6 internal seminars, a webinar series, regional workshops on vulnerability assessment and blue-green infrastructure benefits, 4 workshops with demo site visits, and 11 professional training held across 4 different countries: Denmark, Columbia, China and Indonesia.

The training courses alone engaged more than 700 participants.

PROJECT LEGACY

Legacy and next steps



LIFE GREEN ADAPT strengthens landfill resilience against extreme weather events such as heavy rainfall, droughts, and heatwaves, reducing risks of pollution, landslides, floods, fires, and explosions. It promotes the use of nature-based, blue-green infrastructure solutions – **helping shift the waste management industry away from conventional methods.**

Innovative on-site leachate treatment and improved soil covers **lower operational costs** and **minimise environmental damage**. The LIFE GREEN ADAPT tools, methods, and business models are designed for replication across Europe, globally, and in other sectors.

Finally, by involving researchers and students, the LIFE GREEN ADAPT **supports education and capacity building**, ensuring that the knowledge gained contributes to future climate adaptation and resilient infrastructure goals.

NEXT STEPS

Legacy and Next Steps



LIFE GREEN ADAPT will continue to **explore opportunities to replicate, transfer, and scale** its innovative solutions across other sites, both within the waste sector and beyond. Applying these approaches for enhancing resilience through blue-green infrastructure will help manage the impacts of climate change at waste management facilities.

Extending these solutions to other economic sectors will strengthen their capacity to adapt to climate-related challenges. This strategy ensures a **sustainable roadmap for the continued application and impact of LIFE GREEN ADAPT innovations beyond the project's duration.**



PROJECT PARTNERS



LIFE GREEN
ADAPT

