

R4C and environmental monitoring in the Sterpaia Coastal Park: how technology supports climate resilience



A European project for territorial resilience

Climate change is severely challenging vulnerable territories such as coastal areas, where marine weather phenomena, erosion, and flooding occur with increasing frequency and intensity.

To address these challenges, the **Regions4Climate (R4C)** project was launched in **January 2023**. Funded by the European Commission as part of the “EU Mission Adaptation to Climate Change,” it aims to develop concrete and replicable solutions for **climate resilience at the regional and local levels**. Involving 44 partners from 13 European countries, the project aims to build scalable, cross-sectoral solutions that enable regions to adapt equitably and effectively, particularly addressing inequalities and integrating the needs of the most vulnerable groups.

Among the pilot areas identified is **Tuscany**, specifically the stretch between the ENEL thermoelectric power plant in Torre del Sale and Carbonifera in the municipality of Piombino, corresponding to the **Sterpaia Coastal Park**. Here, the collaboration between **RINA Consulting SpA**, the **Tuscany Region**, and other stakeholders has resulted in a bio-engineering project to protect the coast through the restoration of the adjacent dune system. The project's resilience is monitored through three several monitoring systems installed both on the dune body and in the

surrounding area, including an advanced **environmental monitoring system** by **LSI LASTEM**.

The context: Sterpaia Coastal Park, a fragile area to be protected

The Tuscan demonstration site is located in one of the most sensitive areas of the Tyrrhenian coast. The **dune system** designed within the **Sterpaia area near Pirelli**, in addition to its high environmental value, represents a natural defence to address and mitigate the risks of coastal erosion that have affected it for many years. However, its effectiveness is jeopardized by growing climate uncertainty, characterized by increasingly frequent **extreme weather events** and the anthropogenic pressure it is subjected to.

The project therefore aims to create a **reinforced natural barrier**, based on **Nature-Based Solutions (NBS)**, capable of reducing coastal erosion and mitigating the effects of storm surges. To verify its effectiveness and adapt its evolution over time, a **continuous environmental monitoring** system has been implemented.

The role of environmental monitoring: data at the service of resilience

Environmental monitoring is a key component of the project. It allows for experimental monitoring of the microclimate within the study area, providing the ability to monitor the meteorological conditions that influence the dune system and assessing – through a multi-risk analysis – whether a given weather event may have significantly impacted the dune.

LSI LASTEM's sensors installed: precision and reliability for critical measurements

Several **meteorological and climate sensors** have been installed at the Sterpaia Coastal Park site:

- **Ultrasonic anemometer** for measuring wind speed and direction;
- **Thermohygrometer**: high precision in measuring temperature and humidity;

- **Rain gauge:** essential for monitoring heavy rainfall events, which are increasingly frequent due to climate change;
- **UV-A radiometer:** useful for analyzing solar radiation and its effects on the dune ecosystem.

These sensors, connected to the Alpha-Log data logger, collect **continuous and reliable environmental data**, essential for evaluating the performance of the reconstructed dunes and for **early warning** in case of extreme events.

Why was LSI LASTEM chosen?

The **environmental monitoring system provided by LSI LASTEM** was selected for its **modularity, reliability** and **operational autonomy**. The technical characteristics perfectly meet the needs of a long-term project in a harsh environment subject to extreme events.

Technology and data for a more resilient future

The work carried out at the **R4C pilot site in Tuscany** is not just a local case study: it represents a replicable model for addressing climate challenges in coastal areas in an integrated and sustainable way.

In fact, by combining bioengineering, advanced monitoring technologies and a participatory approach, the project demonstrates how it is possible to generate effective solutions that can be adapted to other regional contexts. The Sterpaia thus becomes not only a virtuous example of climate resilience, but also a starting point for future initiatives along the Tuscan coast and in other areas of Europe exposed to growing environmental risks.