SCORE innovative citizen science activities to tackle climate change in coastal areas

The EU-funded SCORE project is developing and carrying on various citizen science activities to involve local communities in innovative co-warning and co-monitoring activities for improving resilience to extreme weather events.

Numerous cities from Europe are grappling with climate change-induced sea-level rise, double the global average. Acknowledging the pressing need for action, the SCORE project introduces an innovative approach to coastal monitoring. Faced with the financial constraints of traditional methods, SCORE proposes a cost-effective solution—leveraging low-cost sensors and engaging citizen scientists to create a network that complements official monitoring structures. By empowering local communities to contribute data and promoting ecosystem-based adaptations (EBAs), SCORE aims to elevate awareness and resilience against extreme weather events. The initiative envisions a future where Europe's coastal cities are equipped with comprehensive early warning systems, a testament to the power of community engagement and cutting-edge technology.

DIY framework

Citizen science involves non-experts collaborating with scientists, actively contributing time, skills, and knowledge to research. The SCORE project embraces this inclusive approach, focusing on leveraging technology and online platforms to enhance public participation. It not only boosts research capacity but also promotes public engagement, scientific literacy, and environmental awareness. By democratizing knowledge creation, citizen science empowers individuals to address scientific challenges, fostering a sense of connection and responsibility. SCORE adopts a DIY framework, encouraging stakeholders to install, operate, and maintain sensors to address local needs. The project offers community support during installation, custom instructions, and makes the data publicly accessible on the SCORE data platform, (https://platform.score-eu-project.eu) accompanied by guidance for interpretation.

Catalogue of low-cost sensors

In our coastal living labs (CCLLS), a diverse array of sensors is strategically deployed to cater to specific requirements such as measurands, costs, and accessibility. The unifying factor among these sensors is their dual emphasis on affordability and seamless integration with the SCORE platform. These sensors were selected by a group of stakeholders who were assigned a theoretical budget of €20,000 to choose sensors best suited to the climate hazard identified. Locations were subsequently proposed by the stakeholders and shortlisted by the SCORE team. A web version of the catalogue is currently being designed with feedback from the SCORE's Coastal City Living Labs (https://sensors.score-eu-project.eu/).

Citizen science playbook

The SCORE team is developing a comprehensive citizen science playbook to share their expertise and experience with other projects undertaking similar initiatives. This guide will cover all aspects of citizen science, from crafting engagement strategies to devising action plans and conducting retrospective reviews. Elements of the playbook have been incorporated into the MOOC (Massive Open Online Course) "Ecosystem-Based Approaches: Introduction to Implementation," which is freely accessible to the public (https://score.thinkific.com/).

Ongoing citizen science projects

1. Smart pebbles

Embarking on our commitment to community engagement, one of our pioneering projects involves 3 beaches from Dublin and Sligo (Ireland) and Massa (Italy). Our team, focused on monitoring coastal erosion and comprehending coastal dynamics, has introduced an innovative approach using smart pebbles. This citizen science activity engaged students and experts in an experiment involving smart pebbles and advanced 3D scanning technology. Each pebble, equipped with radio-frequency identification technology, undergoes a meticulous process of weighing, scanning, and determining equilibrium and disequilibrium points. Collaborating with local schools, students painted and strategically placed these pebbles on the beaches, their locations precisely logged via GPS. In a collaborative effort with students and local citizens, radio-detectors were employed to locate the pebbles, and a new GPS position is taken. The subsequent data, including new locations, weights, and scans, provides valuable insights for students to analyse and understand coastal dynamics in the area. More details here: https://www.irishexaminer.com/news/arid-41235505.html

2. Water quality

In the heart of the UNESCO-designated Booterstown Marsh, near Dublin, a once oil-polluted mire transformed into an area of outstanding natural beauty, a sense of community pride flourishes. Local governmental organizations and residents alike cherish this biodiverse salt marsh. To further its preservation, SCORE has introduced a MINKE water quality sensor strategically placed at a sluice valve near a railway station. This sensor, a vital tool for monitoring and protecting this cherished site, is being unveiled to the community in a local pub. Witnessing significant interest from various groups deeply connected to the marsh and local area, a community event is being held at the pub by University College Dublin's SCORE team to educate stakeholders on sensor usage and maintenance. During citizen engagement events and talks in Sligo, many individuals shared their experiences with degraded water quality as it is one of the main concerns of the local community. Spot water samples collected from Sligo and nearby areas for SCORE project also proved that local water quality is not showing promising standards. Seasonal changes in precipitation patterns and local land use activities mainly shape these incidences. MINKE water quality sensors installed in Sligo and nearby regions helping the ATU (Atlantic Technological University) Sligo-based research team in

understanding the background scenarios (for the water quality) with their capability to monitor the water quality with a temporal resolution of as large as one minute. The engagement of local communities serves as a platform to foster connections and build links with local groups, reinforcing the collective commitment to safeguarding this natural treasure. This event includes guest lectures from active local groups, PhD students from related fields, and local government representatives.

3. Drone Survey

A DJI Phantom 4 Pro V2.0 drone has been chosen for a coastal erosion study at Enniscrone, Dunmoran, and Streedagh beaches in Sligo, Ireland. It offers advanced Real-Time Kinematic (RTK) positioning, which provides centimetre-level accuracy in capturing georeferenced aerial images. These images will be used to create a digital twin of the coastline, which is essential for monitoring and analysing erosion patterns and shoreline changes. The project is cost-effective, which is a significant advantage. Initially, the drone's standard camera will capture high-resolution images to provide an overview of the shoreline. For more in-depth analysis, Multi-Spectral Cameras like Mapir Survey3 or Micasense RedEdge-MX will be attached. These cameras are chosen over LiDAR for their cost efficiency. This approach not only aids coastal managers in visually assessing and tracking erosion but also engages citizens in the scientific process. By integrating the CoastSnap tool, the public can actively participate in monitoring the coastline. They will have access to the Digital Elevation Models (DEMs) and can observe and understand the changes occurring along the coast. This engagement through citizen science enriches community involvement and enhances awareness and education about coastal conservation efforts.

4. CoastSnap initiative

The CoastSnap initiative, a global citizen science project, will be implemented at Enniscrone, Dunmoran, and Streedagh beaches in Sligo to monitor coastal changes. By installing camera brackets at these locations, locals and visitors are encouraged to use their smartphones to capture and upload images of the coastline. These repeated photographs from fixed points will help in tracking shoreline changes and beach morphology, providing insights into patterns of coastal erosion and other environmental changes. This data, once uploaded to a web-based platform, will enable a deeper understanding of the dynamic coastal processes in Sligo, aiding in effective coastal management and conservation efforts.

Useful links: https://www.coastsnap.com/;https://citsci.whoi.edu/project/CoastSnap; https://coastalmonitoring.org/coastsnap-imagery/

5. Water level sensors

As compared to a conventional tide gauge which could cost up to several thousands of euros, low-cost water level sensors from HOBO (https://www.onsetcomp.com/products/data-loggers/mx2001) have been identified from the scientific literature with performance comparable to a conventional tide gauge. These sensors will be used within the SCORE project to continuously monitor the water level and consequently the surges in complement to the extant tide gauges. A number of these sensors will be installed across the Donegal Bay coastline and Dublin to continuously record water level data. Data can be downloaded easily within 30 metres of the device using Bluetooth directly into an app (https://www.onsetcomp.com/products/software/hoboconnect) easily downloadable on laptops and mobile phones. Such sensors will prove beneficial for citizen science allowing citizens to download the data via Bluetooth and visualise the data in the app.

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ABOUT SCORE

SCORE (Smart Control of the Climate Resilience in European Coastal Cities) is a €10m Horizon 2020-funded research project to increase climate resilience in European coastal cities lead by Dr Salem Gharbia of the School of Engineering & Design at ATU Sligo.

The overall aim of SCORE is to design, develop, monitor, and validate robust adaptation measures in coastal and low-lying areas to protect them from increasing climate and sea level risks, including coastal flooding and erosion, to enhance their overall long-term resilience.

SCORE outlines a co-creation strategy, developed via a network of 10 coastal city 'living labs' (CCLLs), to rapidly, equitably and sustainably enhance coastal city climate resilience through Ecosystem-Based Approach (EBAs) and sophisticated digital technologies. SCORE will establish an integrated coastal zone management framework for strengthening EBA and smart coastal city policies, creating European leadership in coastal city climate change adaptation in line with The Paris Agreement.

SCORE will provide innovative platforms to empower stakeholders' deployment of EBAs to increase climate resilience, business opportunities and financial sustainability of coastal cities.

The SCORE interdisciplinary team consists of 28 world-leading organisations from academia, local authorities, RPOs, and SMEs encompassing a wide range of skills including environmental science and policy, climate modelling, citizen and social science, data management, coastal management and engineering, security and technological aspects of smart sensing research.

SCORE is a four-year project which started in July 2021.

List of coastal city living labs involved in the SCORE Horizon 2020 project:

Sligo and Dublin, Ireland; Barcelona/Vilanova i la Geltrú, Benidorm and Basque Country, Spain; Oeiras, Portugal; Massa, Italy; Piran, Slovenia; Gdansk, Poland; Samsun, Turkey.