

Abstract

Springs are natural groundwater discharge areas emerging in many forms and are said to be windows into the Earth. They have associated unique dependent ecosystems and are sensitive indicators of global climate changes, land-use practices and variations in water quantity and quality. In addition, they often hold great socio-cultural significance playing a vital role as sentinels of sustainable development.

The Water Framework and Groundwater Directives recognise their importance, but very little research has focused on springs' aquatic ecosystems or their dependent species. Nor has there been a systematic effort to establish a standardized methodology for monitoring and comprehensive ecological status assessment resulting in an erratic inventory, classification and data analysis of springs in Europe.

The existing information is often minimal, fragmented and largely unavailable to researchers, land managers and nature conservation organizations with negative implications for the development of resource and aquatic ecosystem protection strategies.

Springs are pivotal gateways between groundwater and aquatic ecosystems and are themselves a dynamic and hence vulnerable ecosystem. The quantitative and chemical status of springs supports the ecological status of their groundwater-dependent aquatic ecosystems in inland, transitional and coastal waters and we believe springs can serve as sentinels of global climate and land use change impacts on aquatic ecosystems services. SentinelSpringS strategically uses an integrated approach to two often separately assessed water systems, groundwater and aquatic ecosystems by focusing on monitoring springs' water and biodiversity status of associated ecosystems. Springs may represent a significantly greater catchment area than monitoring wells and their monitoring can be more cost-effective if they also integrate spring water participatory monitoring.

The main goal of the project will be to link systematic hydrological and participatory spring monitoring results to provide early warning signals of spring and dependent aquatic ecosystem health under present-day global changes and biodiversity crises. The question arises as to which factors are responsible for the sustainability of springs—habitats for unique biodiversity and providers of their aquatic ecosystem services.

The scientific goals are to:

- develop consistent terminology, classification and spring monitoring methodology towards its sustainability;
- identify and characterise springs-dependent ecosystems;
- identify main threats to springs sustainability and that of their aquatic ecosystems services across highly diverse habitat types in Europe;
- develop management frameworks under differing climate change scenarios.

The strategic goals include creating a standardized framework for monitoring springs and an open-access European database for these data. Our policy goal is to: promote the integration of spring quantity, quality and ecology data into EU and national groundwater status assessment and monitoring programs and improve the holistic integration of hydrology and ecology in EU policies and the implementation of the Water Framework Directive.

SentinelSpringS aligns with the European Green Deal, the Biodiversity Strategy and UN SDGs (especially the SDGs 6 and 12-15), addressing the climate crisis and biodiversity loss, providing groundwater quantity, quality and biodiversity monitoring data that support cost-efficient EU policy-making. It contributes to international research on maintaining Earth's viability for human life and assists Environmental Agencies and CIS working groups on Ecological Status, Groundwater, Data and Information Sharing and Task Group on Water Scarcity and Droughts. The project ultimately aims to enhance the management and conservation of Europe's spring aquatic ecosystems.

KEYWORDS



► Project coordinator

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► Project partners

- GEOLOGICAL SURVEY OF DENMARK AND GREENLAND - DENMARK
- UNIVERSITÀ DEGLI STUDI DI TORINO - ITALY
- UNIVERSITY OF LODZ - POLAND
- BUREAU DE RECHERCHES GEOLOGIQUES ET MINIERES - FRANCE
- ENERGY AND WATER AGENCY - MALTA

► Funding organisations

FCT (PORTUGAL) / IFD (DENMARK) / MUR (ITALY) / NCBR (POLAND) / ANR (FRANCE) / MEEC (MALTA)

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3 years

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spring hydrology
groundwater monitoring
aquatic biodiversity
spring-dependent ecosystem dynamics
localized ecosystem resilience