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A Sustainable Freshwater Competence Centre in Finland

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A competence center of the water sector for boreal and subarctic catchment, river and lake environments was highly needed, as impacts of climate change on river basins, adaptation, and resilience request detailed analysis of the behavior of river basins under extreme conditions. This further demands detailed measurements in time and space of morphological, hydrological, and biological variables. A consortium of private and public institutions in Finland have been formed to establish a Sustainable Freshwater Competence Centre to support detailed monitoring, research, development of new techniques and equipment innovation.

The complete venture structure includes a network of public and private institutions that supports measurement the development of instruments; a research infrastructure, composed of eight sites (three supersites), and the development of digital solutions, such as digital twins and data transfer, to generate cost-effective monitoring and model river connectivity, hydrological processes, as well as nutrient and carbon loads from different land use in multi scale river basins.

Hydro-RDI-Network was inaugurated in 2021 to serve as the first Finnish competence center of the water sector. It aims to improve and implement river and catchment measurement, mapping, modelling approaches, and innovation. The Hydro-RI-Platform research infrastructure (2022 onwards) will facilitate solving environmental issues (e.g. erosion, flooding, water quality) of these fragile boreal and subarctic freshwater environments. A pool of unique instruments for bathymetric, hydrological, hydraulic, morphodynamic and water quality measurements, with a variety of autonomous under- and above-water sensor platforms, a mobile field laboratory facility, and a data sharing platform are developed to study essential scientific questions in present and future hydrology.

Green-Digi-Basin (2022 onwards) aims to develop state-of-the-art understanding on green and digital transform in river basin and provide new tools and integrated modelling approaches for sustainable water resource management to assess impacts of nature-based solutions (e.g.

peatland restoration, wetland and gypsum treatment) and land use changes through boreal-subarctic river basins. These will be done by utilizing remote sensing technologies, laser scanning high-resolution water quality and flow sensors, river basin 3D-mapping and geospatial analyses. Online data transfer systems, automatic data analysis will serve processed data to modelling software such as national wide river basin model WSFS-VEMALA to develop digital twins for river basin management.

The holistic concept of the Sustainable Freshwater Competence Centre in Finland will create a broad and reliable source of hydrologic monitoring, research, development, and innovation to support the adaptation of the hydrology of the Baltic Region to climate change.