



Today, economic development, growing populations and increasing degradation of the environment all make sustainable exploitation of resources a priority, and no resource is more fundamental to our well-being than water. The EU's Seventh Framework Programme supports research and innovation based solutions at transnational and international level.

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The importance of water-related research

Today, economic development, growing populations and increasing degradation of the environment all make sustainable exploitation of resources a priority, and no resource is more fundamental to our well-being than water.

Water is a precondition for human, animal and plant life on Earth, as well as an indispensable resource for the economy, playing at the same time a fundamental role in the climate-regulation cycle. Hence, the importance of water systems (from river basins up to individual stream level), for fresh water, food, energy and recreation is more than apparent.

The EU working within the context of the EU Water Framework Directive (WFD) and through its research programmes is channelling important resources into the struggle for a more sustainable water system. This includes funding for co-operative research initiatives in key areas, just a few of which are outlined here.

Research Priorities

The climate is changing. It is changing rapidly and probably beyond the range of normal variability increasing the overall uncertainty. Natural ecosystems, already under pressure due to land use and pollution, now face additional stress from climate change. More frequent water shortages are projected for many parts of Europe, for example in the Mediterranean region. In other places, flooding is expected to increase, particularly in Central, Eastern and Northern Europe. There is a clear need for better information about **climate change impacts, mitigation and adaptation.**

Management of water resources and aquatic ecosystems is a priority for the European Union, but this goes way beyond the simple understanding of how to use water. Today's water management encompasses the entire range of natural processes and complex dynamics that characterise water systems. It is also the new context of understanding the implications of global change, the forces of interdependences, and the complexity of interrelated physical and social systems. Hence, overpopulation, urbanisation, and impacts of climate change compound problems associated with the need for water of adequate quality and quantity require re-examination of traditional water resources planning and management considerations. All in all, the equitable water use and the search for more integrated water resources management face continuous changes in values, structural transformations in society and the environment as well as increasing economic and governance challenges.

With EU Member States now hard at work implementing the WFD, we must all be able to better assess the impact of chemicals and other key pollutants on marine and freshwater ecosystems, and on human health. Clear links need to be established between the ecological status of surface waters, physico-chemical quality factors and diverse external pressures.

Europe's economic growth is also largely based on intelligent resource use. How we use and misuse water has to be addressed, from improving industrial and agricultural practices to better waste treatment and sanitation, to responsible water use in our homes.

Today, many people around the world still do not have access to safe drinking water or basic sanitation.



The importance of water-related research

tion, and the problem is not limited to the developing world. Pollution, over-exploitation of water resources, damage to aquatic ecosystems, climate change and security issues are also challenging the sustainability of European water systems. Additionally, resource efficiency, water and energy challenges in water consuming process industries, ageing water infrastructure breakdowns and failures accompanied by fast technological development pose immediate needs to assess water technologies and their ability to meet current and future demands.

Advanced and innovative water technologies are now seen as absolutely essential for creating an optimised and truly integrated water-management framework in Europe, as well as for contributing to the Eco-innovation Action Plan and Europe 2020's Resources Efficient European and Innovation Union flagship initiatives. Therefore better research, technological development and **innovation in the water sector** can also present new opportunities for European businesses, contributing to the competitiveness of the EU's water industry and supporting the green growth of its economy.

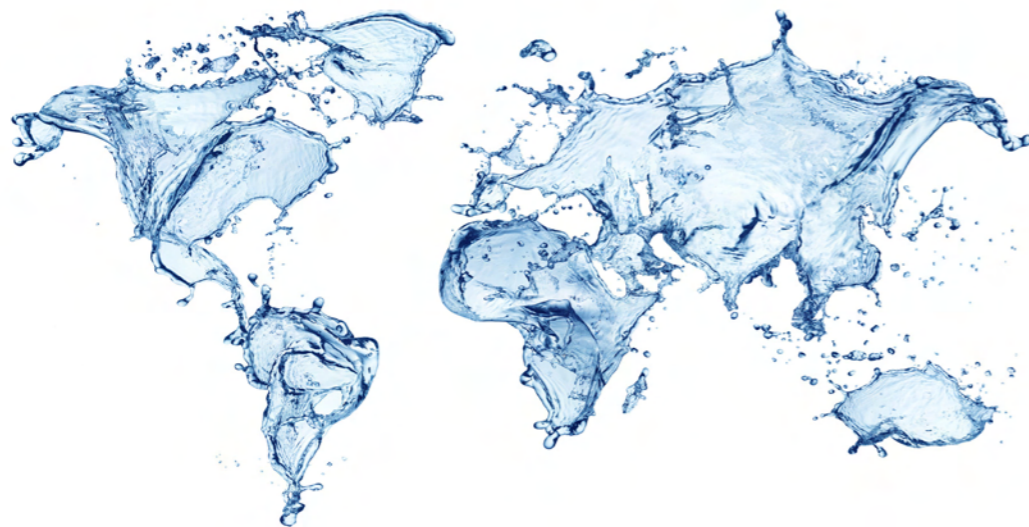
Meeting global water challenges means addressing the wider global water cycle. All of us are

linked by water, and European researchers need to study and co-operate with each other, as well as with third countries. International co-operation is especially relevant in developing countries, in Africa, Asia and Latin America, where socio-economic vulnerability represents an additional obstacle to sustainability.

Again, the EU believes that more strategic co-operation on water research between Europe and the rest of the world can result in scientific and technological breakthroughs that will genuinely help citizens, while also fostering European competitiveness and economic growth.

With competition between water users a growing source of conflict, with significant political and socio-economic consequences, Europe wants also to do everything it can to help ensure that everyone everywhere has the water they need to live better lives in peace and security.

Finally, with the importance water is taken in the context of international negotiations and fora, as demonstrated in the latest RIO+20 conference, research on global water resources management issues will help European Union to strengthen its negotiation position.



Climate change impacts, mitigation and adaptation

Climate change will have a direct impact on human society, affecting the quality and availability of fresh water, increasing the frequency and severity of droughts and flooding, and posing a serious threat to the functioning of our economies and ecosystems.

Knowing how to react to climate change means first improving our understanding of how it works. We need more precise and better quality data as well as improved access to existing data about the environment.

Where do we go from here?

Much of the research now being supported by the EU in the area of climate change revolves around improving our ability to model water use, water demand and other water-related socio-economic factors. The aim here is to better understand water management practices and develop adequate adaptation as well as options for mitigation. For example, the **ACQWA** project is modelling climate impacts on the quantity and quality of water originating in mountain regions, particularly where snow and ice melt represent a large, sometimes the largest, stream-flow component. The goal is to use advanced techniques to quantify the influence of climate change on the major determinants of river discharge on various time and space scales, and analyse their socio-economic impact.

Understanding means being prepared. With current drought projections showing trouble on the horizon, the EU-funded **Drought-R&SPI** project is working to improve drought preparedness through better knowledge, drought-management planning and an improved science-policy interface.

Meanwhile, increased flooding means more sewer system and toxic waste site overflows and an increase in pollutants washed from soils into rivers and aquifers. The key objective of the **Refresh** project is to develop a framework enabling the design of cost-effective restoration programmes for freshwater ecosystems.

Finally, the **KulturRisk** project aims to demonstrate the benefits of state-of-the-art water hazard prevention measures, including early-warning systems, better mapping and planning, insurance strategies and other initiatives. The aim is to develop and promote a stronger 'culture of risk prevention', to better guard against and respond to catastrophic water-related events.



Key innovative technologies for the Mediterranean Basin: CLIMB

According to current projections, Mediterranean countries will see an increase in the risk of severe droughts and extreme flooding, salinisation of coastal aquifers, degradation of fertile soils and desertification, all due to climate change and compounded by poor and unsustainable management practices.

CLIMB project is advancing the state of the art in several areas linked to hydrology and water-resource management, including geo-data management, hydro-geophysics, remote sensing, climate modelling, hydrological modelling, assessment of uncertainty, vulnerability and risk, and water conflicts.

Management of water resources and aquatic ecosystems

EU-supported research into integrated resource management enables us to more accurately predict the impacts of human activity and climate-related changes, with a view towards more intelligent and more sustainable development.

Essential to good water-resource management is the ability to identify the best tools and strategies to deal with pollution. Issues of particular concern include agricultural emissions, from agrochemicals, such as nitrogen and phosphorus from fertilisers, and pesticides and organic materials.



Water is beautiful: WISER

Europe's rivers and lakes are a precious resource, not just because of the role they play in the economy but also in terms of their ecological importance and as sources of natural beauty. The River Danube, for example, or Lake Ballaton in Hungary, have long provided much-needed retreats for local populations.

In recent years, these important spaces have suffered due to less than optimal management practices, especially in Central and Eastern Europe.

The WISER project is developing tools for the integrated assessment of the ecological status of European surface waters, focusing specifically on rivers and lakes, and coastal and transitional waters.

Meanwhile, waste-water discharge from industry and households, metals, pharmaceutical products, nutrients and pathogenic micro-organisms, all continue to threaten the ecological and chemical status of European freshwaters, as well as human health.

Progress through collaboration

One key aspect of EU-supported research is strengthened collaboration among scientists, academics and the water industry, working together to develop the advanced models, tools and technologies necessary for sustainable water management.

Key EU-funded initiatives include the **Twin2Go** project, reviewing, consolidating, and synthesising research on water management around the world, building on a selection of completed and ongoing research projects. Twin2Go's policy-relevant research results encompass adaptive water governance in the context of climate change.

The **Mirage** project has developed new water-scarcity scenarios, evaluating the impacts of climate and land-use changes as well as threats posed to ecosystems by flooding. Meanwhile, **WetWin** is working to ensure that wetlands are taken into account in basin-scale integrated water-resources management schemes.

Finally, the EU-funded **Reform** project is developing new tools to increase the cost-effectiveness of restoration measures. A major focus here is on procedures to monitor more precisely the effects to hydro-morphological changes, i.e. culverting and channelisation, removal of riverside vegetation, sand and gravel extraction and dam construction.

Strengthening innovation in the water sector

Water technologies encompass water-saving techniques, prevention and reuse approaches, clean processes, IT tools, monitoring and control systems, flood-forecasting techniques and much more.

Innovative water technologies are now seen as absolutely essential for an optimised water-management framework in Europe. But water is also an element of high strategic and economic importance. According to the EU-supported Water Supply and Sanitation Technology Platform (WssTP), the water sector provides close to 600 000 jobs among more than 70 000 water service operators.

Challenges and opportunities

The development of new water-related tools and applications represents an opportunity to take European innovation to the global market, especially for small and medium-sized enterprises (SMEs). Newly emerging economic powers such as India, China and Latin America are now seen as key potential users of state-of-the-art European water technologies.

The EU-funded **TRUST** project is an example of the kind of inclusive research in the area of water-related technologies, working on a range of innovative tools that will have an impact on how we use and manage water.

Meanwhile, the **Prepared** project is improving water supply and sanitation systems in ten European cities. Researchers are demonstrating specific technologies and measures, taking into account environmental, social and economic factors.

Along our shorelines, the EU-funded **Theseus** project is assessing the impact of conventional and more innovative coastal defence strategies, based on the Hamburg Port Authority's state-of-the-art model for sustainable development of the Elbe River and tidal estuary.

Other projects, such as **Aquarehab**, **Cleanwater**,

Hydronet and **Nametech** are developing new and exciting autonomous sensor systems, intelligent infrastructures for improving the monitoring of water bodies, and investigating nanotechnologies and new membranes for water detoxification and the recovery of contaminated sites.



Optimising the industrial water cycle: AquaFit4use

AquaFit4use is a large-scale EU-funded project working to find solutions in the area of sustainable water use in four water-intensive industries – paper, food, textiles and chemicals. By integrating key technologies, the project hopes to improve process stability and product quality in the different sectors.

AquaFit4Use is a flagship initiative in the area of industrial water technologies, playing a leading role in the development of synergies between ongoing EU research projects and identifying important research gaps.

Meeting global water challenges

With global population growth, urbanisation, pollution, over-exploitation and climate change all placing pressure on our water resources, especially in developing countries, it is more important than ever to recognise the interconnectedness of the world's water systems.

In addition to new scientific, technological and economic solutions, strong partnerships are required, between researchers, policy-makers, industry and other stakeholders, in order to address the global dimension of water. Moreover, in order to maximise the benefits from any water resource system, a larger analysis of the surrounding environment is needed, a broadening of the traditional narrow planning and management approaches, and an increased sensitivity to decision-making problems associated with a mix of such considerations as natural conditions, variety of uses, sources of supply and socio-demographic conditions.

Among the specific goals being pursued by the EU is the development, transfer and exchange of experience, methodologies and modelling tools between representatives of catchments and river



Water is a global resource: HighNoon

The global water cycle is already being affected by climate change. The HighNoon project brings together researchers from India, Japan and the EU to assess the impact of the Himalayan glacial retreat and the Indian summer monsoon on water distribution in northern India.

basins in Europe and in other partner countries. Innovative technologies and decentralised systems for water supply and sanitation also need to be developed and tailored to the specific needs of emerging and developing economies. And once the research is done, project results must be made available so that their benefits can be felt in the real world.

Getting to grips with the bigger picture

In countries around the world, small communities still suffer from water-related problems, due to their limited capacity to operate sophisticated water-supply and sanitation systems. The objective of the EU-funded **CLARA** project is to strengthen this capacity, assessing and adapting existing low-cost water-supply and sanitation systems in Africa. It is also developing a simplified water-supply and sanitation planning tool, tested and evaluated in different African regions which covers varying economic, cultural and social boundary conditions.

Sustainable water-resource management is still a distant goal across much of Latin America, with people, ecosystems and economies left increasingly vulnerable to future change. The EU-funded **Coroado** project is developing guidelines and a web-based toolbox that will help users identify solutions to problems posed by long-term climate change and water scarcity, while maintaining environmental and ecosystem integrity.

In Asia, floods in urban areas can damage important infrastructure and endanger lives directly, while also creating wider health hazards. The **CORFU** project brings together European and Asian partners to consider the consequences of urban flooding and the efficacy of different response strategies.

Project List

ACQWA – Assessment of climatic change and impacts on the quantity and quality of water
Shiva – Stratospheric ozone: Halogen Impacts in a Varying Atmosphere
www.acqwa.ch

AquaFit4use – Water in Industry, Fit-for-Use Sustainable Water Use in Chemical, Paper, Textile and Food Industry
www.aquafit4use.eu

AQUAREHAB – Development of rehabilitation technologies and approaches for multipressured degraded waters and the integration of their impact on river basin management
<https://aquarehab.vito.be/home/Pages/home.aspx>

ARCH – Architecture and roadmap to manage multiple pressures on lagoons
www.arch-fp7.eu

AWARE – How to achieve sustainable water ecosystems management connecting research, people and policy makers in Europe
www.aware-eu.net

BESSE – Brokering Environmentally Sustainable Sanitation for Europe
www.besse-project.info/besse

BioelectroMET – Bioelectrochemical systems for metal recovery
www.bioelectromet.eu

BioFresh – Biodiversity of Freshwater Ecosystems: Status, Trends, Pressures and Conservation Priorities
www.freshwaterbiodiversity.eu

CapHaz NET – Social Capacity Building for Natural Hazards: Toward More Resilient Societies
www.caphaz-net.org

CLARA – Capacity-Linked water supply and sanitation improvement for Africa's peri-urban and rural areas
www.cordis.europa.eu/projects/rcn/98911_en.html

CLARIS LPB – A Europe-South America Network for Climate Change Assessment and Impact Studies in La Plata Basin (CP-SICA)
www.claris-eu.org

CLEANWATER – Water Detoxification Using Innovative vi-Nanocatalysts
www.photocleanwater.eu

ClimateWater – Bridging the gap between adaptation strategies of climate change impacts and European water policies (CSA-SA)
www.climatewater.org

CLIMB – Climate Induced Changes on the Hydrology of Mediterranean Basins: Reducing Uncertainty and Quantifying Risk through an Integrated Monitoring and Modelling System
www.climb-fp7.eu/home/home.php

ConHaz – Costs of Natural Hazards
www.conhaz.org

CORFU – Collaborative research on flood resilience in urban areas
www.corfu-fp7.eu

COROADO – Technologies for Water Recycling and Reuse in Latin American Context: Assessment, Decision Tools and Implementable Strategies under an Uncertain Future
www.coroado-project.eu

DROUGHT-R&SPI – Fostering European Drought Research and Science-Policy Interfacing
www.eu-drought.org

ECOWATER – Meso-level eco-efficiency indicators to assess technologies and their uptake in water use sectors
www.cordis.europa.eu/projects/rcn/100813_en.html

ENDETECH – ENzymatic DEcontamination TEChnology
www.endetech.eu

ENORASIS – ENvironmental Optimization of IRrigAtion Management with the Combined uSe and Integration of High Precision Satellite Data, Advanced Modeling, Process Control and Business Innovation
www.enorasis.eu

Envirogrids – Building Capacity for a Black Sea Catchment Observation and Assessment System
www.envirogrids.net

EPI-Water – Evaluating economic policy instruments for sustainable water management in Europe
www.feem-project.net/epiwater

ESAWADI – Utilizing the Ecosystem Services Approach for Water Framework Directive Implementation
www.esawadi.eu

GENESIS – Groundwater and dependent Ecosystems: New Scientific basis on climate change and land-useimpacts for the update of the EU Groundwater Directive

GEOWOW – GEOSS interoperability for Weather, Ocean and Water
www.geowow.eu

HEALTHY FUTURES – Health, environmental change and adaptive capacity: mapping, examining and anticipating future risks of water-related vector-borne diseases in eastern Africa
www.healthyfutures.eu

HighARCS – Highland aquatic resources conservation and sustainable development
www.higharcs.org

HighNoon – Adaptation to changing water resources availability in northern India with Himalayan glacier retreat and changing monsoon pattern
www.eu-highnoon.org

HYDRONET – Floating Sensorised Networked Robots for Water Monitoring
www.hydronet-project.eu

Project List

HYPOX – In situ monitoring of oxygen depletion in hypoxic ecosystems of coastal and open seas, and landlocked water bodies
www.hypox.net

IMPACT – Developing an Integrated Model to Predict Abiotic Habitat Conditions and Biota of Rivers Application in Climate Change Research and Water Management
www.impact.igb-berlin.de

ISSOWAMA – Integrated Sustainable Solid Waste Management in Asia
www.issowama.net

KULTURisk – Knowledge-based approach to develop a culture of risk prevention
www.kulturisk.eu

LAGOONS – Integrated water resources and coastal zone management in European lagoons in the context of climate change
<http://lagoons.web.ua.pt/>

MIRAGE – Mediterranean Intermittent River Management
www.mirage-project.eu/news.php

Nametech – development of intensified water treatment concepts by integrating nano and membrane technologies

NEW ED – Advanced bipolar membrane processes for remediation of highly saline waste water streams
www.new-ed.eu

PREPARED – enabling change
www.prepared-fp7.eu

PROTOOL – Productivity Tools: Automated tools to measure primary productivity in European Seas. A new autonomous monitoring tool to measure the primary production of major European Seas
www.protocol-project.eu/default.asp

PSI Connect – Policy Science Interactions: connecting science and policy through innovative knowledge brokering
www.psiconnect.eu

RecoPhos – Recovery of Phosphorus from Sewage Sludge and Sewage Sludge Ashes with the thermoreductive RecoPhos-Process
www.recophos.org

REFORM – REstoring rivers FOR effective catchment Management
www.reformrivers.eu

REFRESH – Adaptive Strategies to Mitigate the Impacts of Climate Change on European Freshwater Ecosystems
www.refresh-fp7.eu

REWAGEN – Electrochemical WAtEr treatment system in the dairy industry with hydroGEN REcovery and electricity production
www.rewagen.eu

SAPH PANI – Enhancement of natural water systems and treatment methods for safe and sustainable water supply in India
www.saphpani.eu

STEP-WISE – Science, Technology and Policy interfacing using WISE-RTD
www.spi-water.eu/step-wise

STREAM – Sustainable Technologies and Research for European Aquatic Management
www.stream-project.eu

THESEUS – Innovative coastal technologies for safer European coasts in a changing climate
www.theseusproject.eu

TRUST – Transitions to the Urban Water Services of Tomorrow
www.trust-i.net

Twin2Go – Coordinating Twinning partnerships towards more adaptive Governance in river basins
www.twin2go.uos.de

URBANFLOOD
www.urbanflood.eu/Pages/default.aspx

VIROCLIME – Impact of climate change on the fate, transport and risk management of viral pathogens in water
www.viroclime.org

Wahara – Water harvesting of Rainfed Africa: investing in dryland agriculture for growth and resilience
www.wahara.eu

WASHtech – Water, Sanitation and Hygiene Technologies
www.washtechafrika.wordpress.com

WasserMed – Water Availability and Security in Southern EU and the Mediterranean
www.wassermed.eu

Waterdiss2.0 – Dissemination and uptake of FP water research results
www.waterdiss.eu

WETwin – Enhancing the role of wetlands in integrated water resources management for twinned river basins in EU, Africa and South-America in support of EU Water Initiatives
www.cordis.europa.eu/projects/rcn/89347_en.html

Whater – Water harvesting Technologies Revisted: Potentials for innovations, improvements and upscaling in Sub-Saharan Africa
www.whater.eu

WISER – Water bodies in Europe: Integrative Systems to assess Ecological status and Recovery
www.wiser.eu