

THE INNOVATIONS

- **Innovation 1:** Indicators for sustainable water management model (Partner: AGC); **Area:** Remote sensing, Forecasting models, Water management, Decision Support System (DSS).
- **Innovation 2:** Advanced soil sensors (Partner: AGD); **Area:** Remote soil sensing, Irrigation optimisation.
- **Innovation 3: Smart Drop:** Automated low-cost soil moisture control system, Partner: LU; **Area:** Irrigation control, soil saturation, and data collection
- **Innovation 4: Digital platform for drinking water management** Partner: AmoreAqua (AA); **Area:** AI-powered data analysis & modeling for water quality
- **Innovation 5: COBET water treatment** Partner: CBT; **Area:** water quality
- **Innovation 6: Nutricontrol - Water and nutrient sensors**, Partner: NCT; **Area:** AI, data analysis for agriculture
- **Innovation 7: Biochar-based soil and water amelioration system**, Partner: UPWr; **Area:** Climate change adaptation, agri-waste management, nutrient recycling.
- **Innovation 8: RAINFO** - AI-assisted radar rainfall extensions for advanced precision-agriculture, Partner: LU **Area:** AI, remote sensing, DSS, and climate adaptation
- **Innovation 9: Innovative drainage and irrigation systems**, Partner: WU; **Area:** NBS to retain and store water while anticipating water quality impacts.
- **Innovation 10: Low-cost green biosensors for water contaminants**, Partner: UNIBO; **Area:** In-situ monitoring of water quality indicators
- **Innovation 11: DNA-based indicators**, Partner: LU; **Area:** Water mgmt., DSS.

THE CASE STUDIES

- **CS1 Location:** The Netherlands, Agroecological zone: 2 (Atlantic central). Operator: WU.
- **CS2 Location:** Poland, Agroecological zone: 3 (Continental/temperate) Operator: UPWr.
- **CS3 Location:** UK, Agroecological zone: 2 (Atlantic Central) Operator: UEA. Location:
- **CS4 Location:** Spain, Agroecological zone: 1 (Mediterranean north) Operator: CEBAS-CSIC.
- **CS5 Location:** Italy, Agroecological zone: 1 (Mediterranean north) Operator: CER.
- **CS6 Location:** Ukraine, Agroecological zone: 3 (Nemoral) Operator: ISSAR.
- **CS7 Location:** Finland, Agroecological zone: 3 (Boreal) Operator: UOULU.
- **CS8 Location:** Sweden, Agroecological zone: 3 (Continental)



FARMWISE

Future Agricultural Resource Management and Water Innovations for a Sustainable Europe



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THE PROBLEM

Population increase and continuing climate change pose increasing stress on water quantity and quality. Climate change induces a higher variability of extremes, causing seasonal flooding problems and extended drought periods with salinisation problems along coasts and semiarid areas. Agricultural needs for nutrients and protective pesticides cause eutrophication and water quality issues in environmental and drinking water contexts. Persistent Organic Pollutants (POPs) and other environmental pollutants, which spread through the food webs, pose a serious risk to wildlife and humans.

Research urgently needs to develop innovative methods to deal with non-point source contaminants and test innovations that contribute to meeting the Commission's emission goals by 2030 and 2050. The proposed 2030 New EU nutrient directive and the F2F strategy call for reducing nutrient losses to the environment by at least 50% by 2050, and fertiliser use should be reduced by at least 20% by 2030. Recent research has shown that there is a general agricultural nutrient crisis causing societal problems in, e.g., the Netherlands and the lack of sustainable food production and risk of biosphere damages will cost billions of euros to decrease the nutrient deposition such as nitrogen.

More efficient policy tools to handle natural areas' water and agricultural point and non-point pollution sources can save funds, increase sustainable production, and improve water quality through evidence-based policies.

SPECIFIC AIMS

To develop improved tools based on artificial intelligence (AI) for more efficient European water policy and decision-making founded on research-based technologies to solve the most burning water pollution problems. For this purpose, the FARMWISE consortium brings together the best European water, agricultural, climate and AI researchers to handle the sustainability of water resources, the natural environment, and efficient agriculture in the highly diverse European landscape in view of present and future climate change.



To use an integrated systems thinking approach to enhance sustainable water management, build resilience to extreme weather events, minimise contamination of natural habitats and water sources, and promote biodiversity and ecosystem health.



To develop and implement integrated strategies for agricultural risk assessment and mitigation that consider both technical and socio-economic factors to reduce the impact of extreme weather and climate change on agriculture, irrigation practices, and water quality and quantity management.



To establish comprehensive European-scale databases on water quantity, quality, and availability in natural and agricultural areas, projecting the effects of climate change on these variables for 2030, 2050, and 2100. Compare business-as-usual projections to potential management alternatives to contribute to the Commission's nutrient loss and pollutant release targets.

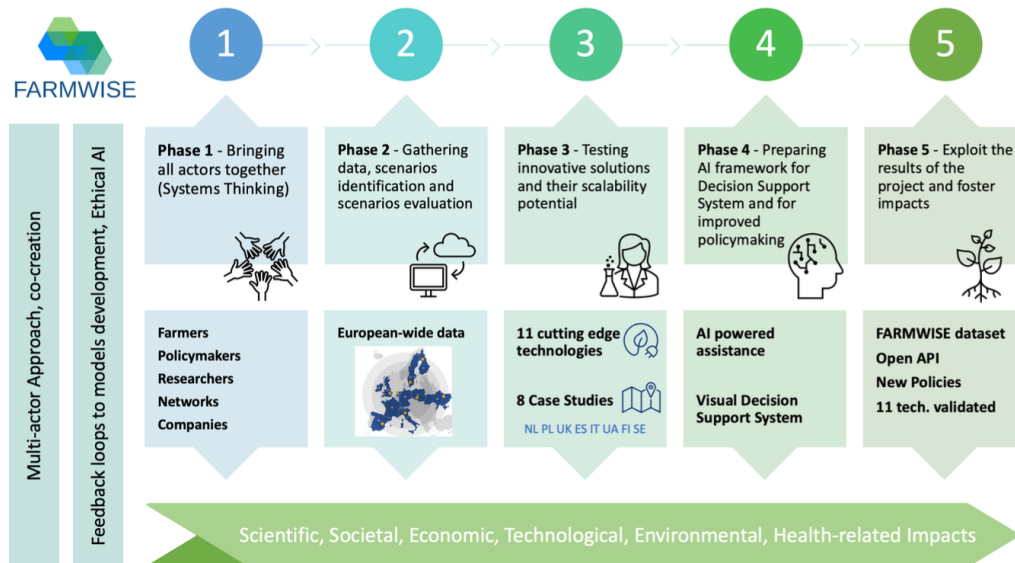


To assess the efficacy and scalability of the innovative solutions; through the advanced field tests at designated project case studies. Furthermore, through a rigorous evaluation, verify the solutions' impact in real-world settings and ensure applicability and scalability in different contexts.

To develop an interactive, highly visual decision support system for improved management in agriculture that can give water quantity and quality for agricultural and natural areas using AI and ML. The learning decision support platform is used to take decisions depending on different management and handling alternatives in agriculture and their effects by comparing business-as-usual with applied innovations by scenarios developed for 2030, 2050, and 2100.

To engage multiple audiences, promoting collaboration between research and practice and making research responsive to citizens' needs. Create win-win partnerships between researchers, citizens, farmers, businesses, industries, and policy-makers to facilitate the uptake of solutions and technologies.

THE APPROACH



KPI

- 5 stakeholder groups involved in the co-creation process for systems thinking-based solutions.
- 4 events to present and interact with stakeholder groups with mitigation and climate adaptation measures.
- +25 farmers and other stakeholders in each pilot case participating in the capacity building program.
- + 50 national, EU-based, and international investigated datasets or repositories for water quantity, water quality, and water availability in natural and agricultural areas linked to the project.
- +18 scenarios (6 agro-ecological zones and 3 different time horizon) defined.
- +15 successful innovative solution tests are conducted (TRL3 - TRL5), verifying their scalability potential.
- Analyse +5 combinations of extreme weather situations in terms of duration, frequency and magnitude at the European scale for analyses of water quality and quantity management;
- Develop + 5 mitigation or adaptation management strategies based on a combination of technical innovation and socio-economic developments to reduce extreme weather impact on agriculture.
- Develop integrated strategies for +3 climate scenarios representing different future socio-economic developments.
- +5 hydrological variables & +10 water quality parameters visualised as dynamic maps on the EU scale;
- +5 management strategies and combinations for identifying potential measures to contribute to the Commission's 2030 and 2050 nitrate and pollution release strategy.
- 3 water quality projections for future climate change, land use change, and management scenarios.
- +10 analytical visualisations for decision support using neural networks as an underlying model.
- AI-based policy platform including at least 1 neural network for scenario and options analysis.
- +15 scientific publications through the Open Research EU platform and other open access scientific journals.
- +4 collaborations with external projects including water quality and quantity.
- +3 Science Cafe events; and 1 hackathon supporting third parties' research/tools/applications to build awareness of project's achievements.