

Research Impact Case Study: Building Capability

Contaminant Movement and Attenuation along Pathways from the Land Surface to Aquatic Receptors (PATHWAYS)

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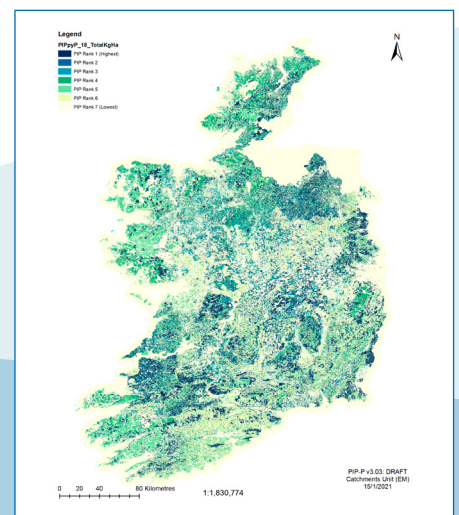
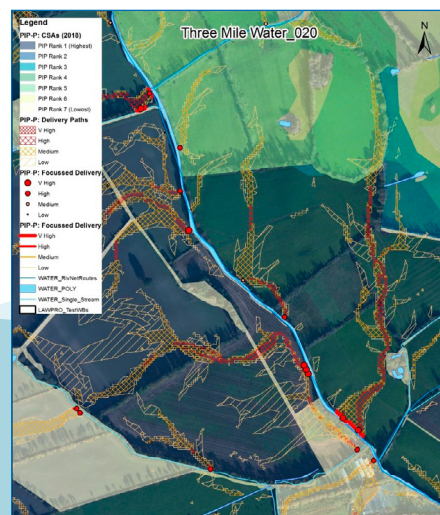
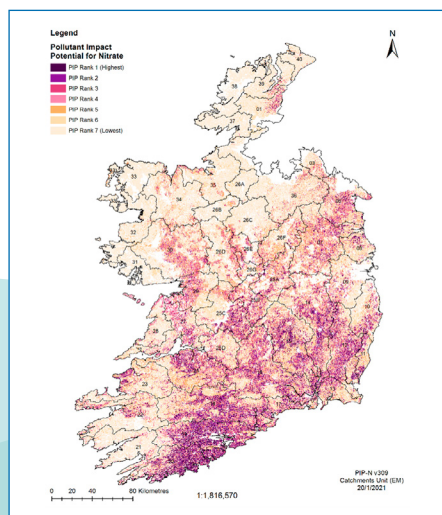
Impact Summary

- **Developed Capability:** Trained and developed researchers in the area of Catchment Management in Ireland, with project members going on to join the staff of national implementing Agencies and Government Departments.
- **Strengthened Evidence Base:** Advanced the conceptual understanding of hydrological and contaminant transport pathways in Irish catchments, including the role of artificial drainage and transition zones. This informed EPA's Water Framework Directive (WFD) implementation.
- **Developed Innovative Decision-Support Tools:** Delivered catchment management support tools which have supported local authorities, researchers and catchment managers in implementing targeted, evidence-based water quality actions.

Why Did We Fund the Research?

The Water Framework Directive (WFD) requires good quality of our rivers and lakes, groundwater, estuaries and coastal waterbodies. Ireland faces significant challenges in meeting its obligations under the WFD, particularly in addressing nutrient pollution from agricultural and other land uses. The EPA funded the PATHWAYS project to improve understanding of how contaminants move through different pathways from land to

water bodies. The goal was to develop a conceptual framework and practical tools to identify and manage areas that deliver a disproportionately high amount of pollutants (critical source areas), contributing to water quality degradation from agricultural nutrients. By integrating data on land use, soil, and water flow, the project aimed to support more effective, targeted strategies for managing catchments and to inform national policy and planning.



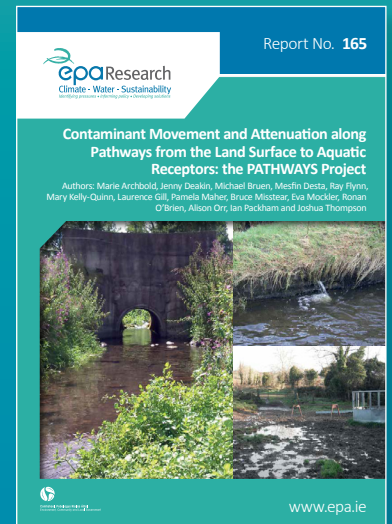
What Did the Research Find?

The PATHWAYS project developed a comprehensive understanding of how nutrients such as phosphorus (PO_4) and nitrate (NO_3) travel from land to our water bodies. It identified that nutrient transport is highly dependent on both surface and subsurface pathways, which vary across catchments. The project produced a suite of support tools, including preliminary Pollution Impact Potential (PIP) maps and integrated hydrological models, that will improve how a catchment is managed. These tools help identify critical source areas and simulate nutrient transport under different conditions. The research also provided a robust database of water quality and discharge data from four Irish catchments, highlighting the conditions under which nutrient losses are most likely to occur.

What Was the Impact of the Research?

As well as advancing knowledge and developing tools, the project developed expertise and capacity in the area of catchment science in Ireland. Team members and students who worked on the project have continued to work in the area, including in EPA and the Department of Housing, Local Government and Heritage, embedding the knowledge developed during the project into processes, assessments, plans and policies. Organisations such as EPA and the Local Authorities Water Programme apply the PATHWAYS conceptual model, working at catchment scale and employing catchment scientists.

The PATHWAYS project has had a significant and lasting impact on water quality management in Ireland, directly informing the EPA's risk assessments. The maps developed through the project have been refined and adopted nationally, guiding local authorities in identifying and implementing targeted mitigation measures. The tools and data from PATHWAYS have also supported further research and funding applications at both national and EU levels, including through the CatchmentTools, Siltflux, Diffuse Tools, ESManage and WaterFutures research projects.



"The Pathways project brought a team of researchers together from multiple scientific disciplines from Queen's University Belfast, Trinity College Dublin and University College Dublin. The team worked in an integrated manner across various work packages. This collaborative approach resulted in the project delivering impactful research. Many team members have continued to work in this integrated manner across multiple organisations to embed catchment science and management as a core scientific and policy approach in managing Ireland's water quality."

Dr. Marie Archbold, Project Manager, PATHWAYS Project



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