Title (Short and engaging) stop the spread: reducing agri-based water pollution

Background Context (Why it matters). Nearly half (46%) (EPA, 2022) of Irish rivers are not ecologically healthy, and this is primarily due to human activities. Agriculture is one of the most significant pressures on Ireland’s aquatic environment. (1)The main issue associated with agriculture is the loss of excess nutrients (primarily nitrogen and phosphorus) from farming activities, both in the yard and across the farm. (2) Hazardous chemicals such as those found in pesticides and animal health products have a significant impact on water quality when carried into rivers from run-off and excess rain, which is all the more common as climate change worsens. This is of particular concern in the Shannon river basin as over 70% of the land area is farmed, with livestock grazing on pasture land is the most widespread type of farming.

Nutrients (phosphorus and nitrogen) can be carried into waters from farmyards, from manure store leaks or from fields treated with nutrient-rich organic and chemical fertilisers. (1) Animal slurry, manure and silage effluent can cause organic pollution. These chemicals tend to move overland, carried by run-off on wet and heavy soils after heavy rain. When phosphorus or nitrogen enter waterways they can cause excessive growth of plants and algae. This overgrowth can clog up those waterways and lead to oxygen loss from the water, which harms the ecology. Slurry can also contaminate drinking water with bacteria, parasites and viruses.

Problem Framing (The guiding question)

Chemicals like those in pesticides and animal waste affect water quality when they wash into rivers due to run-off and heavy rain, a situation that's becoming more frequent with climate change. This is especially worrying in the Shannon river basin, where more than 70% of the land is used for farming. Using weather prediction models as well as satellite imaging, identify farmland that borders the Shanon and is at high risk of polluting the river, and create an information system that monitors weather predictions to warn farmers when high levels of rainfall are expected.

Expected Outcomes (Examples, not prescriptions)

An app that uses weather and map API’s to identify high risk areas and weather patterns that pose a risk of high rainfall and therefore water pollution.

A simple and clear information system that sends out real time alerts to farmers in high risk areas, to warn them to stop spreading pesticides before periods of high rainfall.

Clear examples and guidelines for farmers concerning the spreading of pesticides and animal management in order to reduce pollution.

Could include the training of an AI /ML model that can monitor weather patterns and soil density to find high risk areas and times.

Difficulty (Beginner, Intermediate, Advanced)

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Scope (What’s included and what’s excluded)

Included:

weather monitoring using weather API’s and satellite images

AI/ML learning models

Public communication and data sharing

An early warning system

App or website development

Excluded:

Soil or water quality monitoring

The building/ideation of run-off prevention methods

Investigation into cleaner farming methods

Resources/ Inspiration:

https://www.epa.ie/publications/monitoring--assessment/assessment/state-of-the-environment/EPA-SOE-Report-2024-BOOK-LOWRES.pdf

https://www.catchments.ie/download/shannon-river-basin-district-river-basin-management-plan-2009-2015/

https://open-meteo.com/

https://www.openstreetmap.org/#map=7/53.465/-8.240

https://teagasc.ie/environment/water-quality/agriculture-and-water-quality/

<https://www.epa.ie/environment-and-you/freshwater-and-marine/water-quality-and-agriculture>