

## Introduction:

- Agricultural drainage ditches promote grass growth and productivity, yet their existence can increase the risk of nutrient loss to water bodies.
- The concentration, type and loss pathway (surface and subsurface) of such nutrients are influenced by soil type, climate and hydrological factors.
- A recent study by Moloney et al. (2020) ranked phosphorus (P) risk connectivity, but did not consider nitrogen (N) risk or associated connectivity with roadways, infield drains, springs and groundwater upwelling to ditches.
- This study seeks to introduce and rank connectivity pathways of both N and P for ditches into the existing ranking.

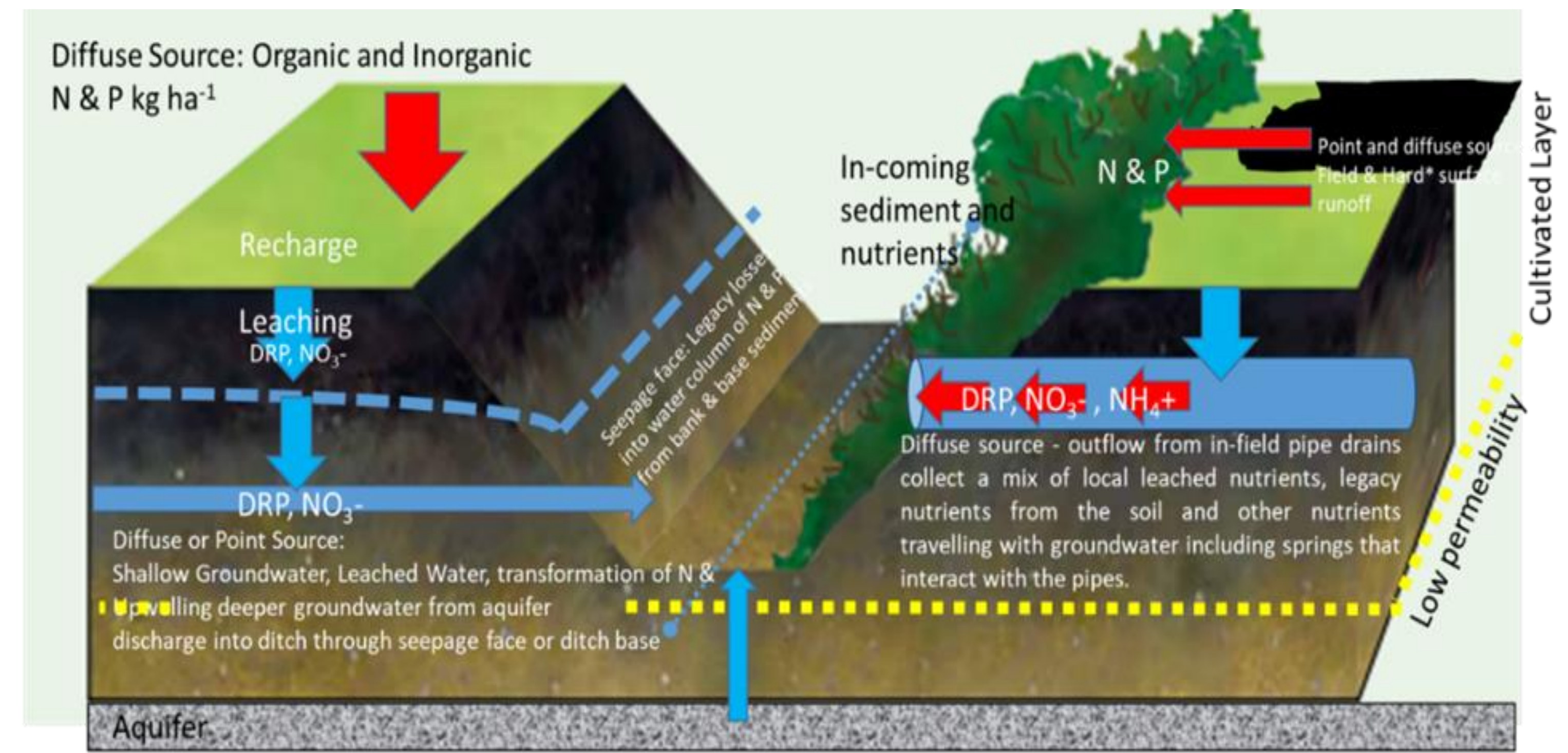


Figure 1. Drainage ditch cross section indicating N and P transport

## Objectives:

- To improve the existing ditch ranking with N and P connectivity pathways to establish a new N and P connectivity risk ranking system.

## Materials & Methods:

- Seven study farms were mapped using the existing ditch risk ranking system (farmyard connection, outlet, outflow, secondary, and disconnected), including connecting in-field drains, roadways, springs and groundwater upwelling to ditches.
- Grab water sampling was conducted within ditches for N and P hydrochemistry analysis.

Table 1 Existing ditch rank system (Moloney et al., 2020)

Ditch Category	Description
1. Farmyard	Connects a farmyard to main drain or directly to a surface water body
2. Outlet	Connects the drainage network to a surface water body
3. Outflow	Carries drainage water to/through neighbouring land
4. Secondary	Connects two larger ditches, or run through a field excess for excess water removal.
5. Disconnected	Not connected to the overall drainage network

## Results and Discussion:



Figure 2. Digitised map of ditch ranks and connectivity pathways

- Nitrogen mainly comprised nitrate at connectivity pathways across ditch categories 2-4 (except at roadways, where ammonium was measured) (Fig. 3a).
- Total phosphorus varied considerably across ditch categories 2 – 4. It was highest in category 4 ditches, and was dominated by particulate phosphorus (Fig 3b).

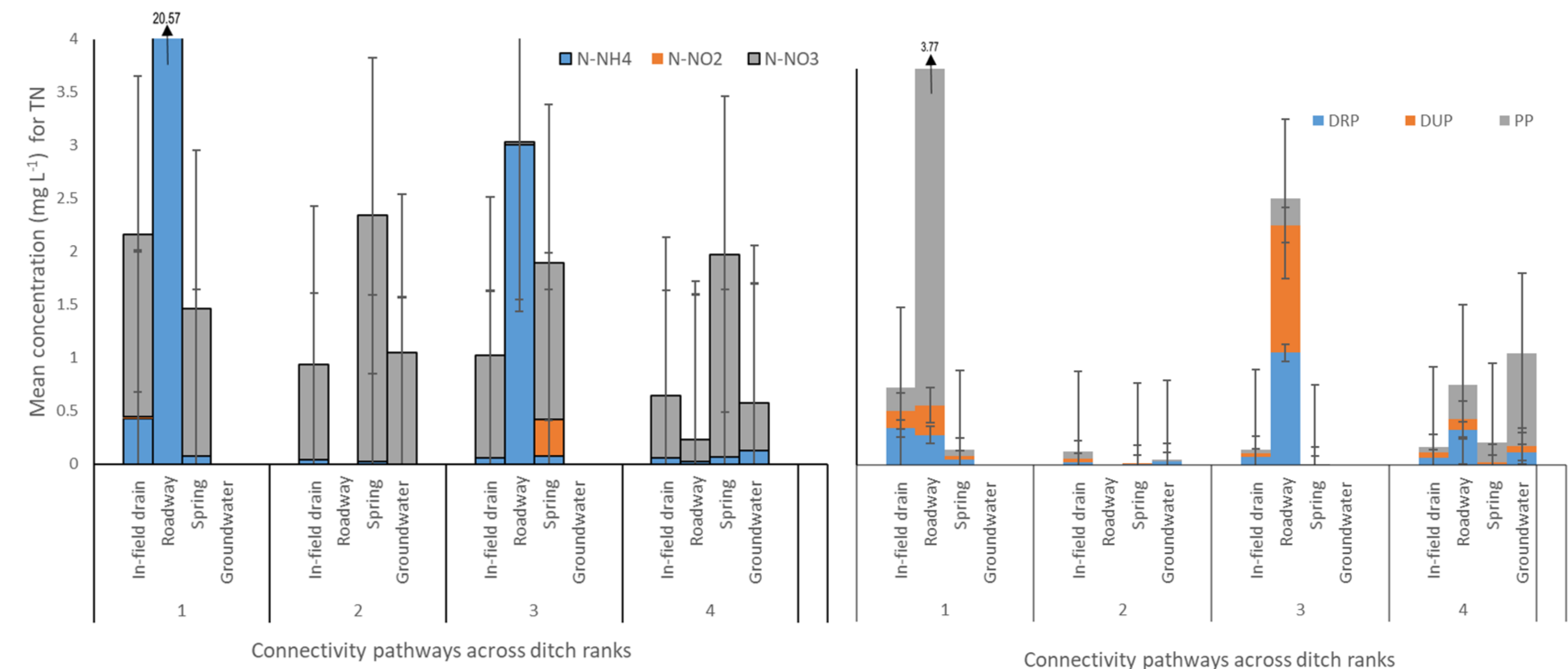


Figure 3. Mean concentrations for (a) TN and (b) TP at connectivity in ditch categories 1-4

## Improved ditch risk rank system:

Ditch Rank	Weight	Ditch type	Connectivity	Weight		Overall risk
				N	P	
1	5	Farmyard connection		4	4	40
2	4	Outlet				
		A	Roadways	-	-	
		B	Springs	4	2	24
		C	Infield drains	3	4	28
		D	Groundwater	2	3	20
3	3	Outflow				
		A	Roadways	4	4	24
		B	Springs	3	2	15
		C	Infield drains	2	3	15
		D	Groundwater	-	-	
4	2	Secondary				
		A	Roadways	1	3	8
		B	Springs	4	2	12
		C	Infield drains	3	1	8
		D	Groundwater	2	4	12
5	1	Disconnected		1	1	2

Aside from ditch Category 1, Category 2 ditches with connecting infield drains have the greatest risk of transporting nitrate and P into watercourses.

Aside from Category 1, Category 4 ditches with roadways and infield drains are the least risky on the farms.

Some ditches may pose higher risk with multiple connectivity pathways. More connectivity and ditch length does not necessarily pose risk, unless ditch is directly connected to watercourse.