AGRICULTURE AND FOOD DEVELOPMENT AUTHORITY

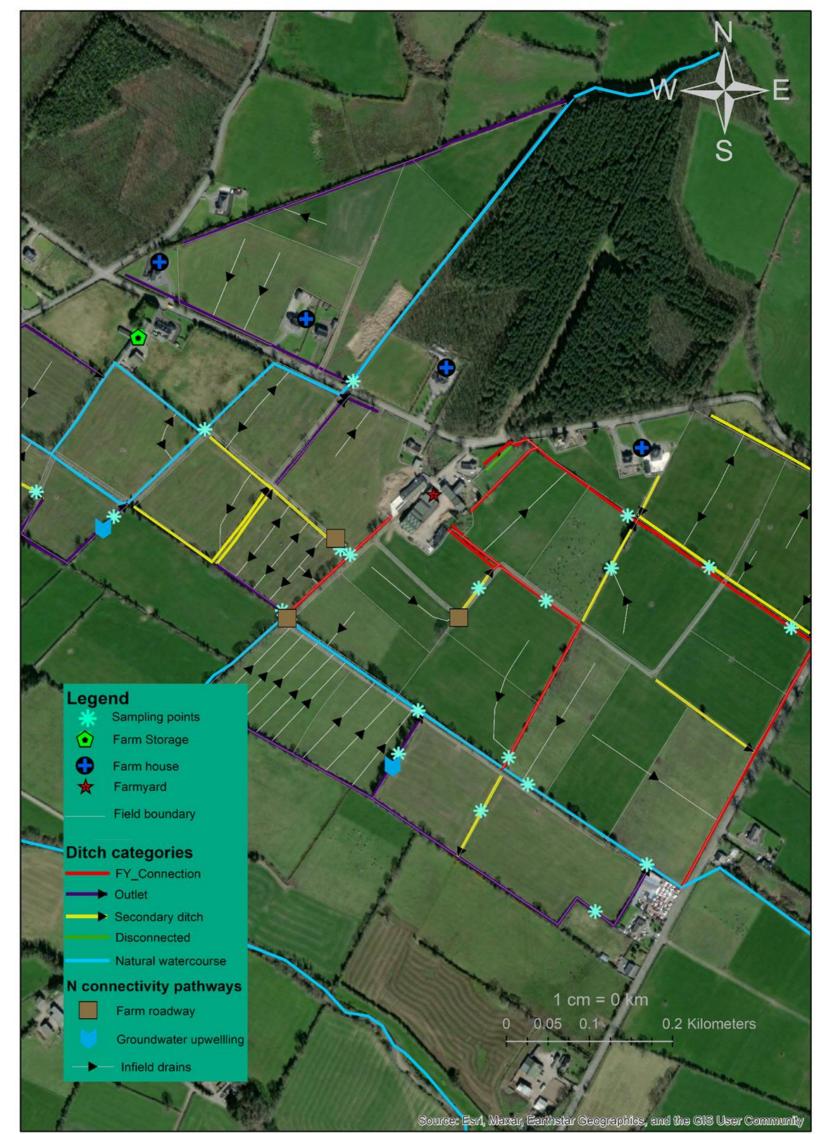
Ranking connectivity risk for both phosphorus and nitrogen along COSOSC agricultural drainage ditches to inform future mitigation management

D.G. Opoku,^{1,2}, M.G. Healy², O. Fenton³, K. Daly³, T. Condon¹, P. Tuohy¹ ¹Teagasc, Animal and Grassland Research and Innovation Centre, Moorepark, Fermoy, Co. Cork; ²Civil Engineering and Ryan Institute, College of Science and Engineering, NUI Galway; ³Teagasc Environment Research Centre, Johnstown Castle, Co. Wexford.



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



Results and Discussion:

- Category 4 ditches (46%) had the greatest amount of connectivity pathways.
- Infield drains was the dominant connectivity pathway (64%).
- Higher TN and TP was

upwelling to ditches.

• This study seeks to introduce and rank connectivity pathways of both N and P for ditches into the existing ranking.

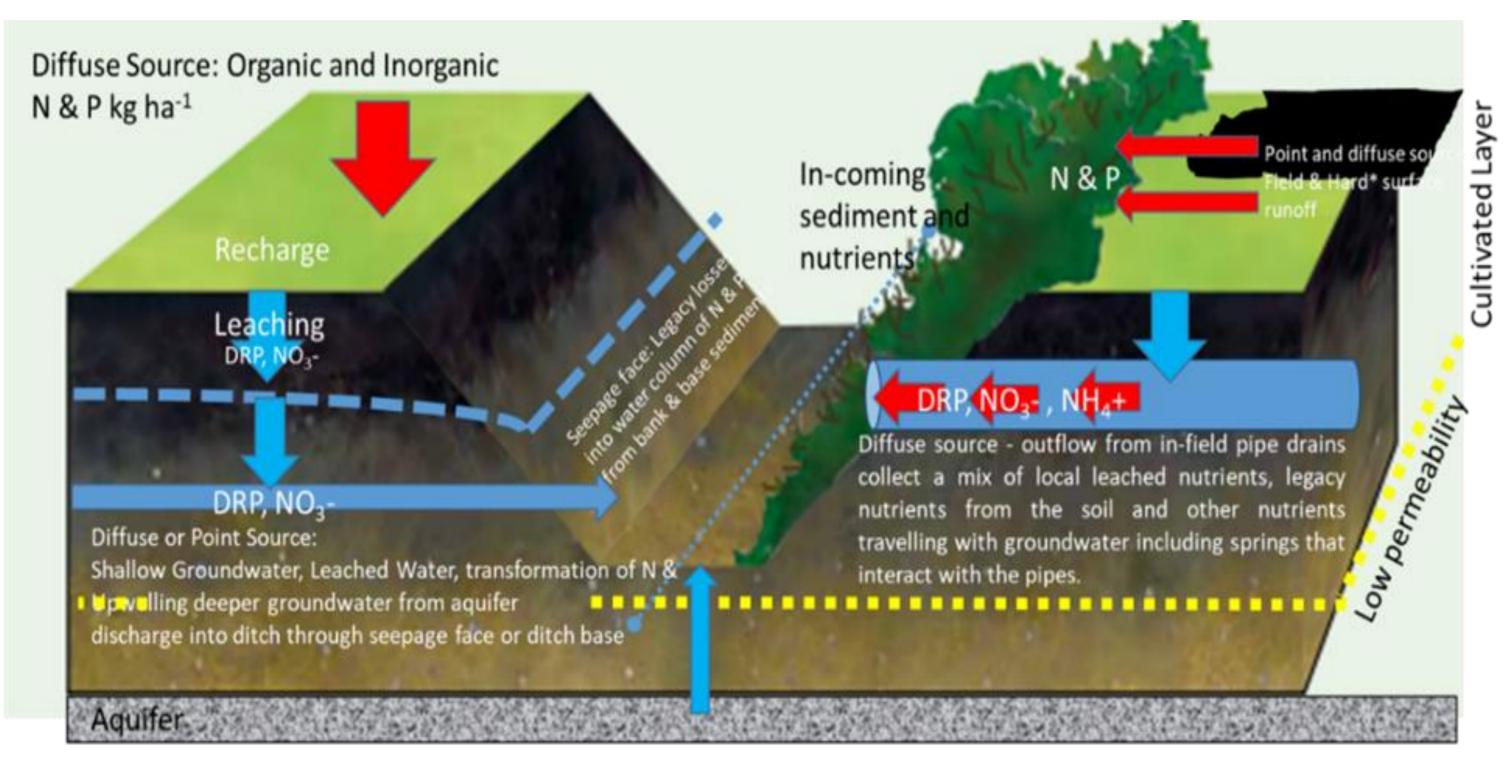


Figure 1. Drainage ditch cross section indicating N and P transport

Figure 2. Digitised map of ditch ranks and connectivity pathways

- measured in ditch category 1 than the other ditch categories, and were differentiated by their point and diffuse sources for rank 1 and 2-4, respectively.
- 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).

T N-NH4 N-NO2 N-NO3

Objectives:

 \bullet

• 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

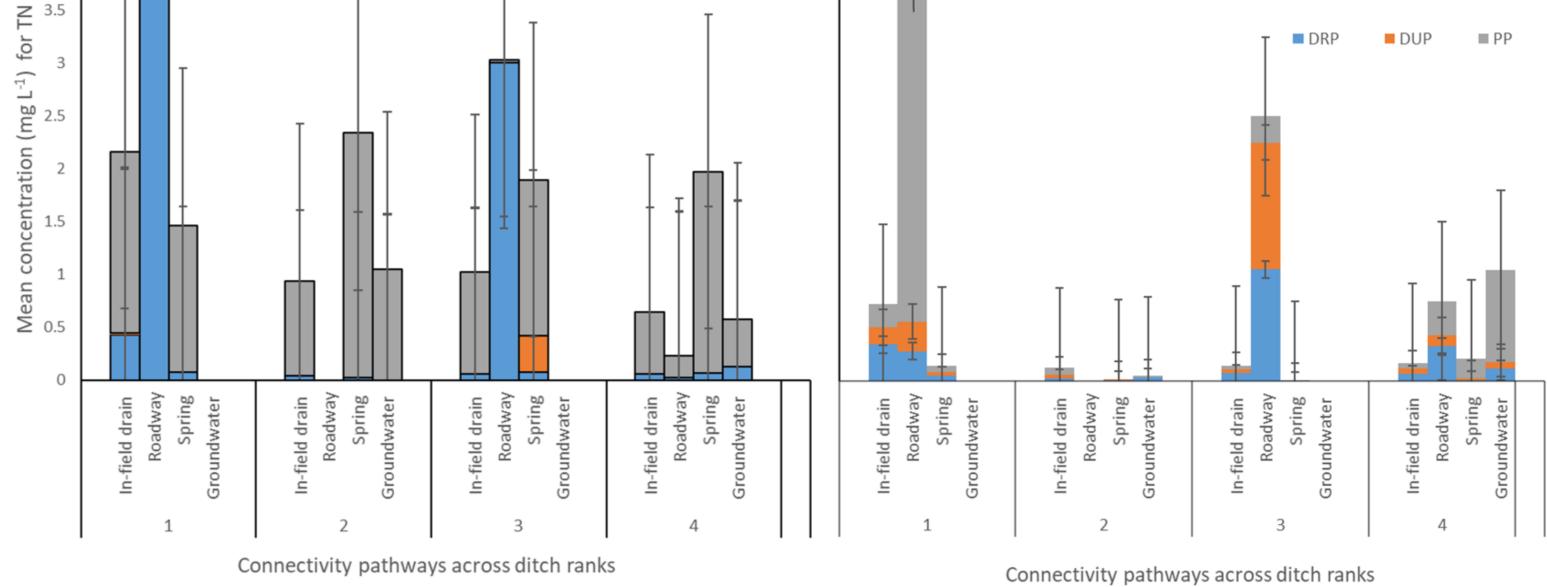


Figure 3. Mean concentrations for (a) TN and (b) TP at connectivity in ditch categories 1-4

mproved ditch risk rank system:

Ditch				Weig	aht	Overall	Aside
Rank	Weight	Ditch type	Connectivity	N	P	risk	Cate
1	5	Farmyard o	connection	4	4	40	
2	4	Outlet					infiel
		A	Roadways	-	-		of tr
		В	Springs	4	2	24	UT U
		С	Infield drains	3	4	28	wate

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

1. Farmyard	Connects a farmyard to main drain or directly to a	
	surface water body	3
2. Outlet	Connects the drainage network to a surface water body	
3. Outflow	Carries drainage water to/through neighbouring land	4
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	

		D	Groundwater	2	3	20
	3	Outflow				
		А	Roadways	4	4	24
		В	Springs	3	2	15
		С	Infield drains	2	3	15
		D	Groundwater	-	-	
	2	Secondary				
		А	Roadways	1	3	8
		В	Springs	4	2	12
		С	Infield drains	3	1	8
		D	Groundwater	2	4	12
5	1	Disconnected		1	1	2

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.