ENVIRONMENT DAY 2026

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MULTIFUNCTIONAL DITCHES

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PARK FARM

Restoring wetland biodiversity in the Fens:

what can drainage ditches do for us?

Laurie Friday

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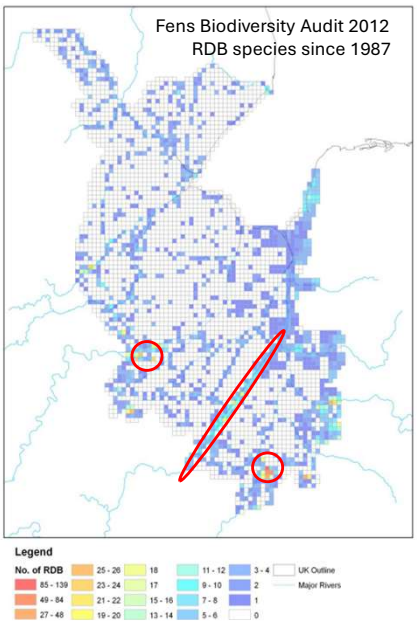
What is the problem?

Fen biodiversity loss due to drainage

4,500 km^2 → **45 km^2**

How can we get biodiversity back into this landscape?

Could a solution be hiding in plain sight?



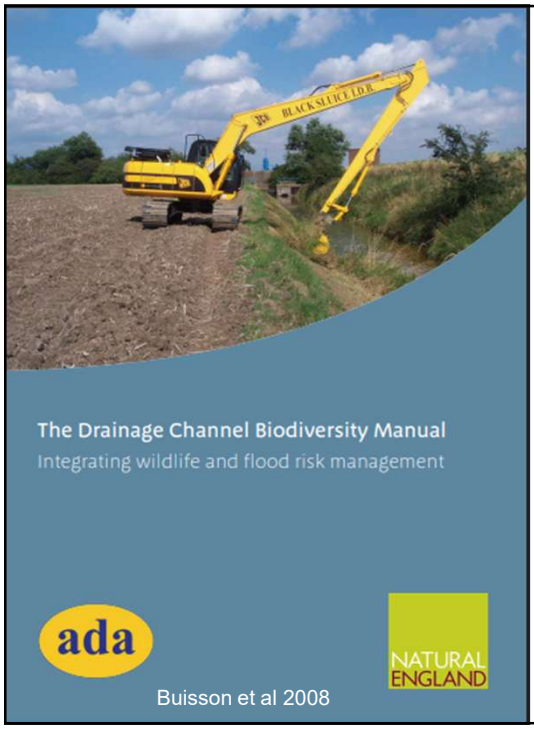
There are a LOT of ditches in the Fens.....

Swaffham IDD

Pink = low-level IDB drains and field ditches

Blue = high-level catchwater drains, Lodes, rivers, Floodplain ditches

c. 50 km^2
c. 80 km IDB drains
+???km field ditches



Could drainage ditches be used to reintroduce and repopulate the Fens with wetland biodiversity?

This is not a new idea!

Buisson et al 2008
Mayer et al 2017…..

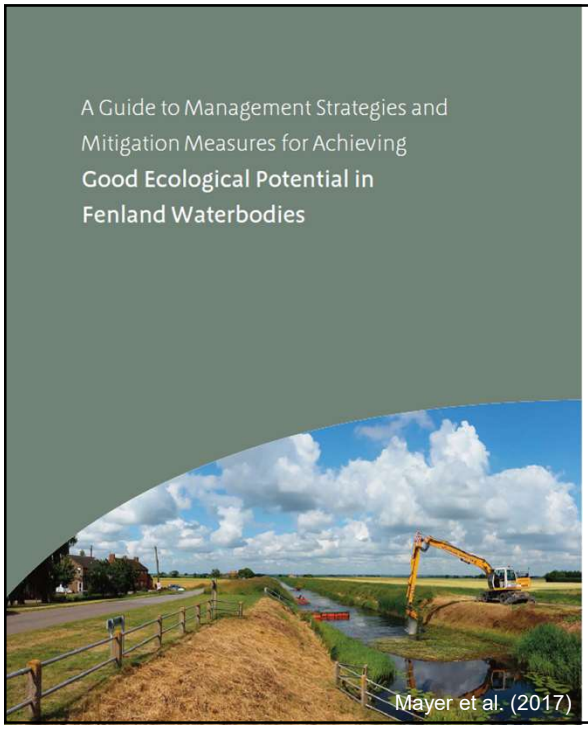
What do we need to know to get started?

Baseline questions:

Q1: Are modern drainage ditches rich in biodiversity?

Q2: Do current drainage ditches contain species characteristic of old fen?

Q3: Is species richness related to ditch type? (and, if so, why?)



18 Mitigation Measures

Working with form and function by improving the marginal habitat alongside Fenland watercourses and increasing their connectivity:

C Preserve and, where possible, restore historic aquatic habitats
D Increase in-channel morphological diversity, e.g. install in stream features and two-stage channels

What evidence do we have that these measures can work?

Can we use existing datasets to address these questions?

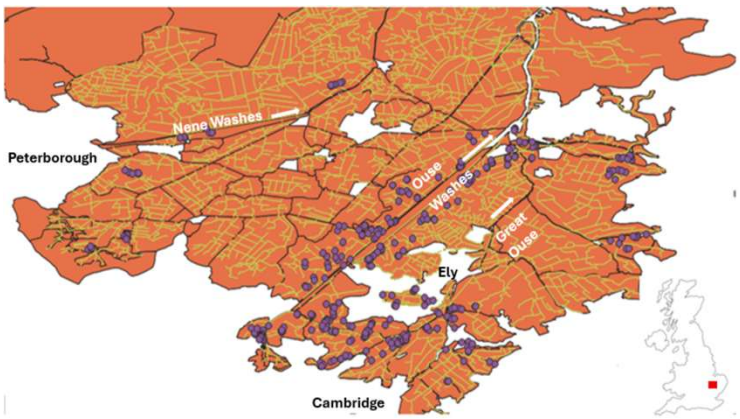
The Big Fen Ditch Survey

365 ditches
sampled 2012-23

by Martin Hammond, Jonathan Graham & CLR researchers

306 plant spp
23 'Local' or 'National'

138 water beetle spp
21 'Nationally Scarce'



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The Big Data Crunch - looking for patterns

H1: Not all species are likely to respond in the same way!

We divided the plants into ecological groups (by reference to *Fenland Flora*):

- **Aquatic** (submerged and floating)
- **Emergent** (feet in or near water level, heads above)
- **Fen & marsh** (above water level but may be flooded seasonally)
- **Ruderals** (bankside 'weeds')
- **Dry grassland** (bankside)

And we divided the beetles into suborders that largely reflect ecology:

- **Hydradephaga** (mostly carnivorous, free-swimming)
- **Polyphaga** (mostly detritivorous/herbivorous, crawlers)

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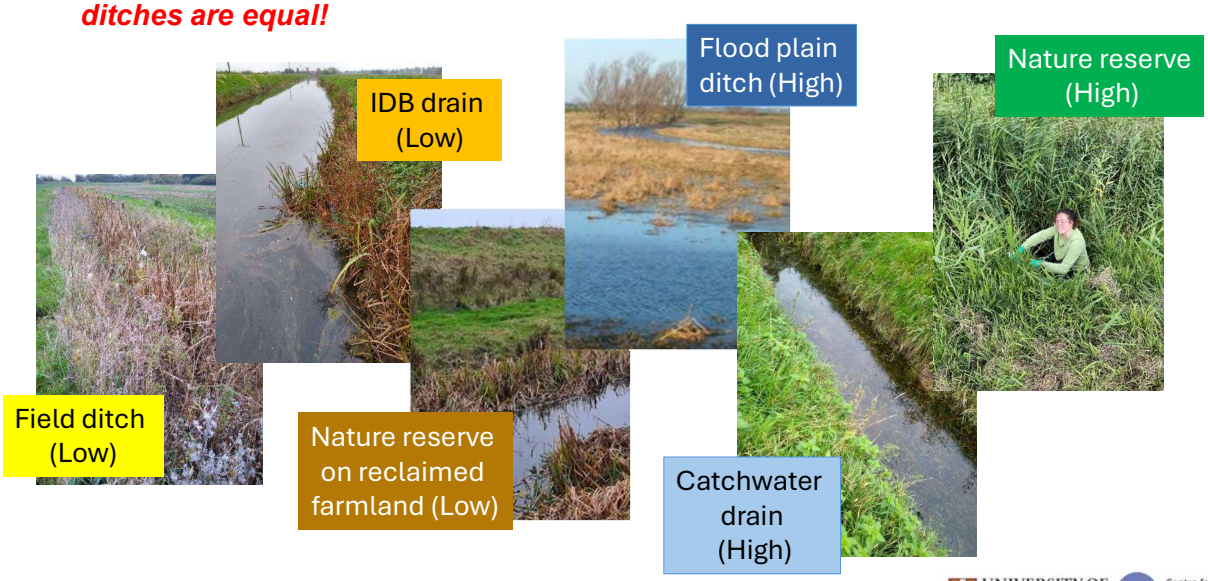
H2: Not all fenland ditches are equal!

We identified six ditch 'types', 3 high-level, 3 low-level:



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Q1: Are modern drainage ditches rich in biodiversity?

Yes *- the ditch system is* ***biodiverse*** *at a* ***landscape*** *scale*

But *- plant and water beetle species are very sparsely distributed*

- Most ditches have few species
- Variation between ditches is high

Biodiversity richness emerges only by looking at a ***large number*** *of ditches*

This has implications for how we study ditch habitat restoration

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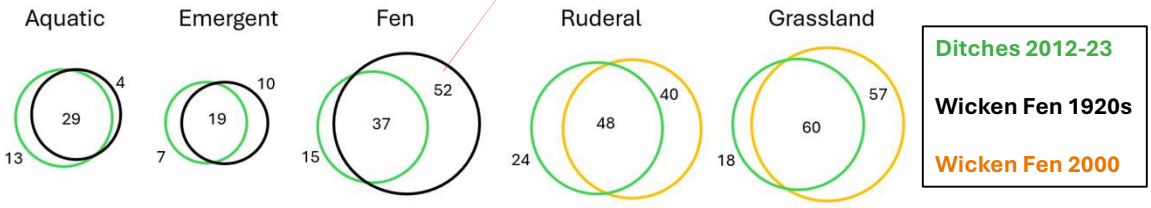
Q2: Do current drainage ditches contain species characteristic of old fen?

Yes they do!
for aquatic & emergent spp

but the modern ditches are missing 52 species of groundwater-fed fen & marsh



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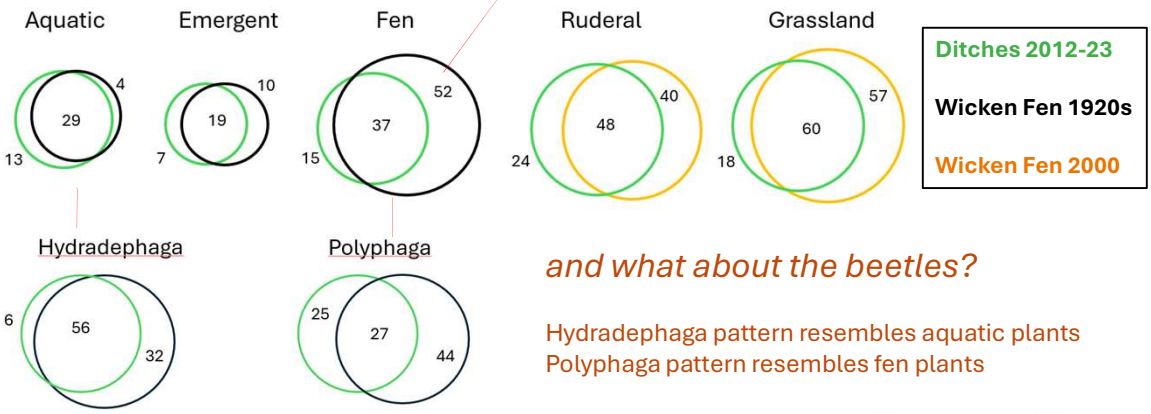

and what about the beetles?

Hydradephaga pattern resembles aquatic plants
Polyphaga pattern resembles fen plants

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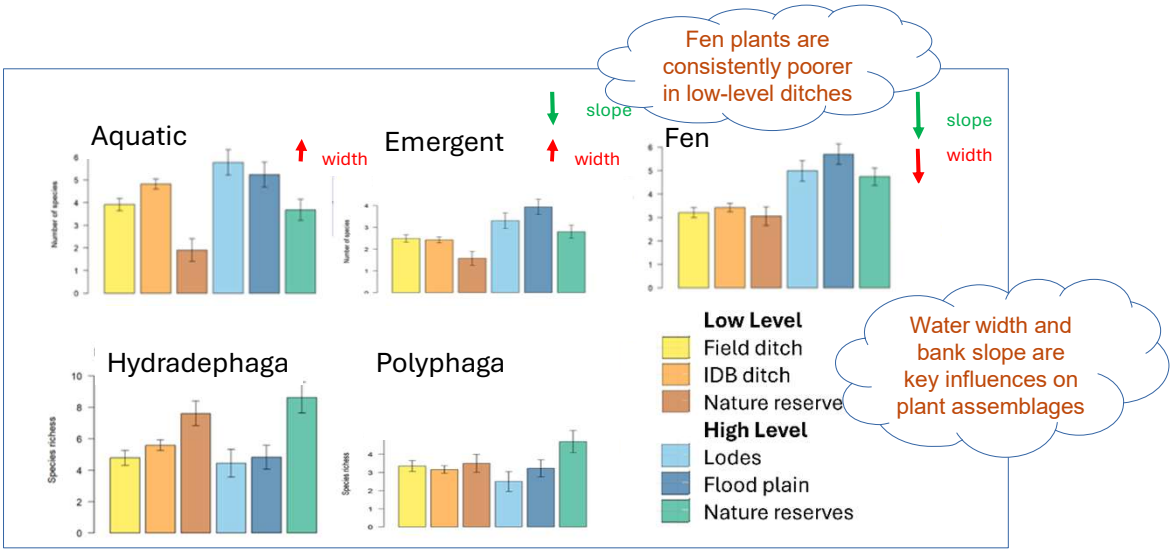
Q3: Is species richness related to ditch type? (and, if so, why?)



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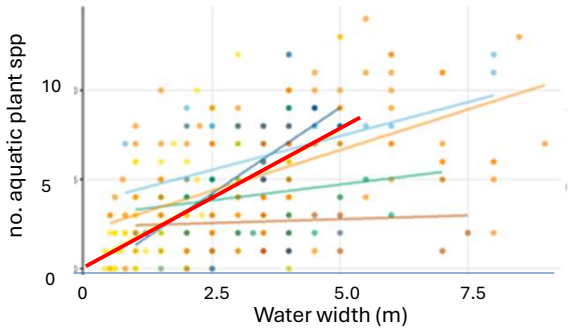
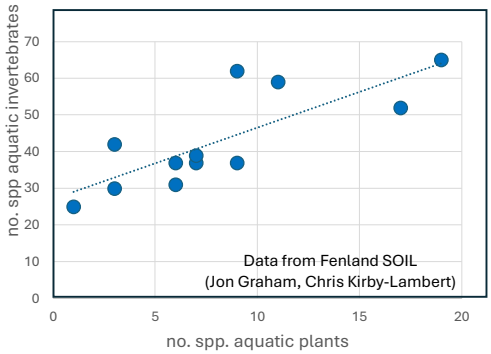
Wider ditches have more *aquatic* plant species …
especially in narrow, low-level ditches

+ 1m width in **field ditches** (red) = 2 extra species
+ 1m width in **IDB drains** (orange) = 1 extra species



Increased aquatic plant diversity, invertebrate species richness:



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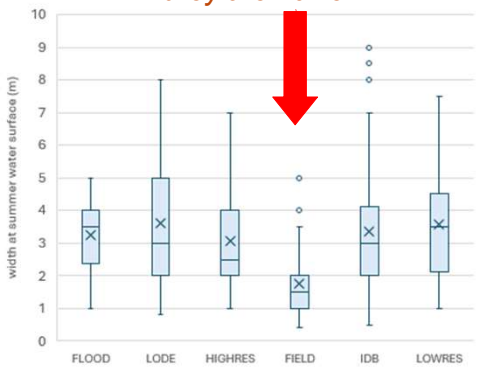
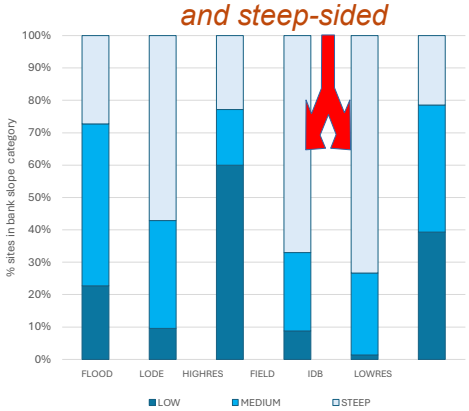
Q4: Why are low-level ditches so poor in fen/marsh plant species?

they are narrow



and steep-sided



Once lost, how can fen/marsh species recolonise ditches?

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*Q5: Does this study show that modifying ditches will **increase** biodiversity in the low-level system?*

No, but...

It helps us understand what ditch features may be associated with biodiversity

Modification experiments will be needed:

'Before' and 'after' studies on the *same* ditch
+ follow-up surveys over several years to allow for colonisation

EXPENSIVE!!

*So, can we compare 'paired' ditches **'with' and 'without'** modification?*

Data suggest this is *unlikely* to reveal significant results because ditch assemblages differ widely from each other

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Q6: What are the pros and cons of modifying ditches for biodiversity?

*Surely ditches are primarily for **drainage**?*
- will **discharge** be compromised?
- will there be more summer **storage potential**?

*Which **species** and **habitats** benefit the most?*
- are these beneficial or maybe detrimental (invasive?)?

*What about **greenhouse gas** emissions from ditches?*
- will these increase? How much?

*Can we draw up a **balance sheet** of pros and cons?*

*Can **+/- effects** be **balanced** across the landscape by using a mix of approaches?*

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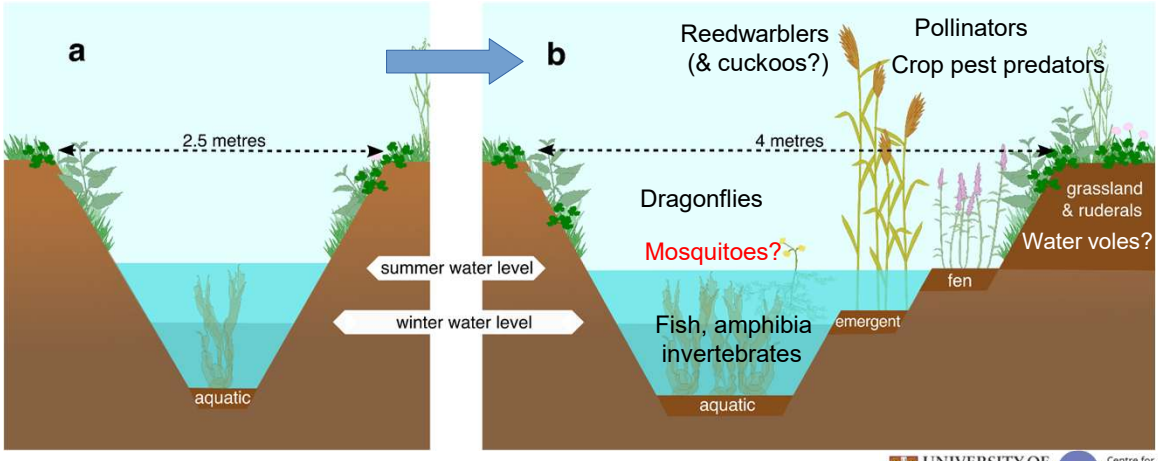
Biodiversity, drainage & agriculture

Here's a maximalist approach:

+ aquatic habitat = 0.5m (+50%)
+ emergent fringe = 0.5m (+100%)
+ fen habitat = 0.5m (+100%)
+ channel X-section = increased bank-full discharge & storage potential
+ spoil (create ditch-side bank for ruderal/grassland spp)
- crop land = 1.5m



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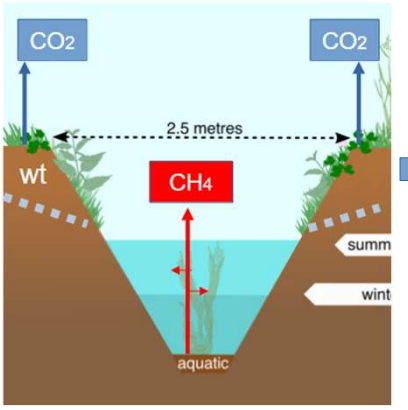
Greenhouse gases

*How will the **balance** between CO_2 and CH_4 – and **NET** carbon emissions change?*



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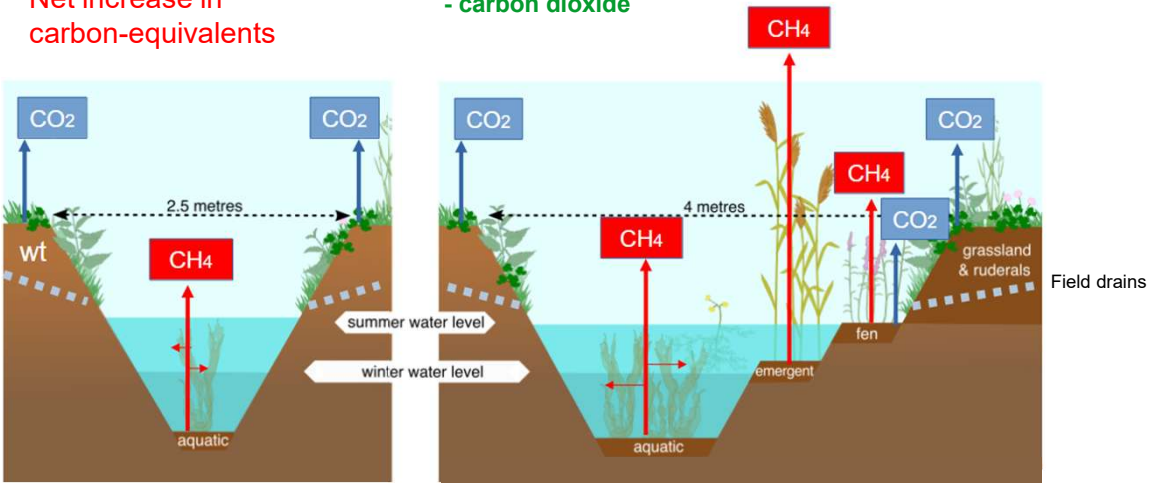
Greenhouse gases

Net increase in carbon-equivalents

+ methane
channelled via emergents
but partly mitigated by submerged vegetation
- carbon dioxide



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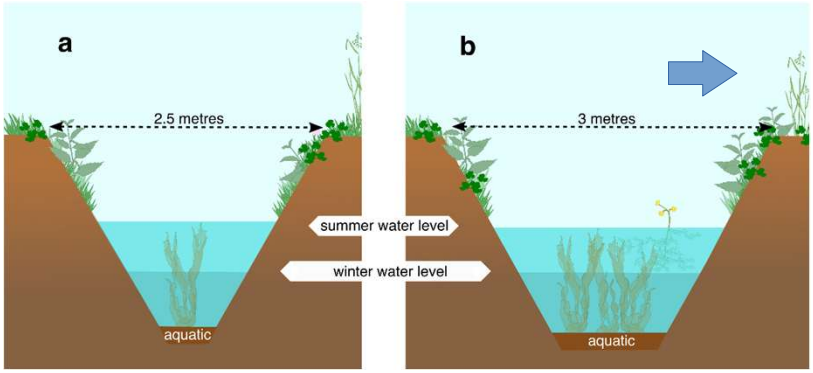
A landscape/catchment scale approach

Not all ditches need be approached in the same way – **diversity across** the landscape
All or any of these modifications are possible:



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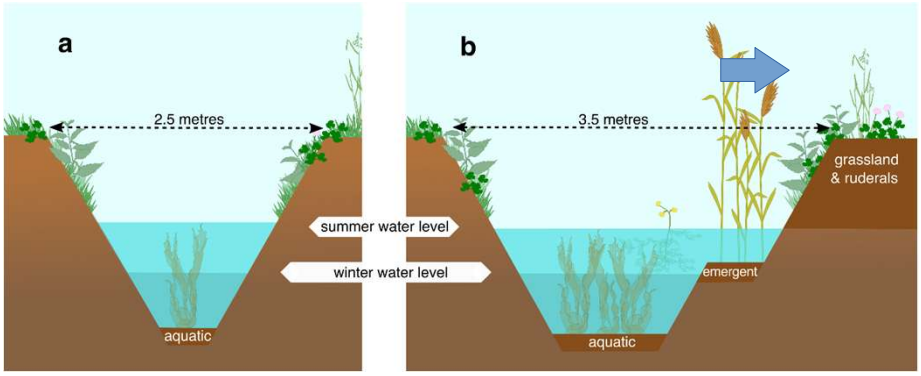

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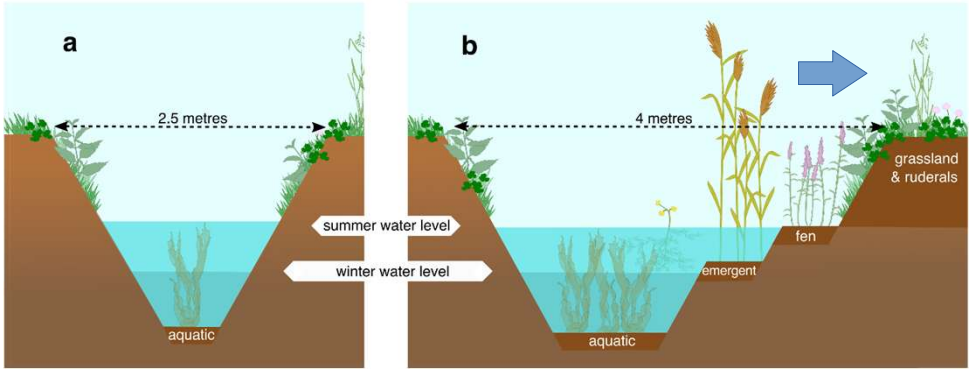

Please tell us what you think!

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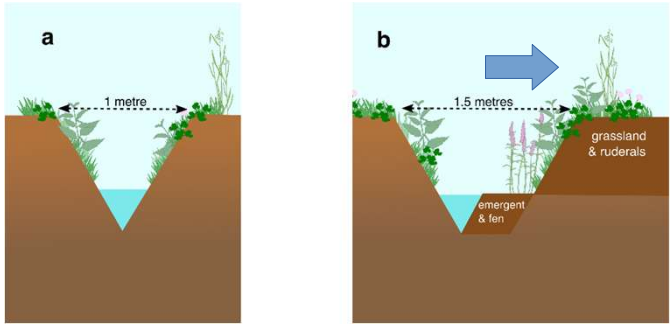
Not all ditches are the same:

Narrow field ditches

- little aquatic habitat
- minor modification can enhance emergent/fen habitat



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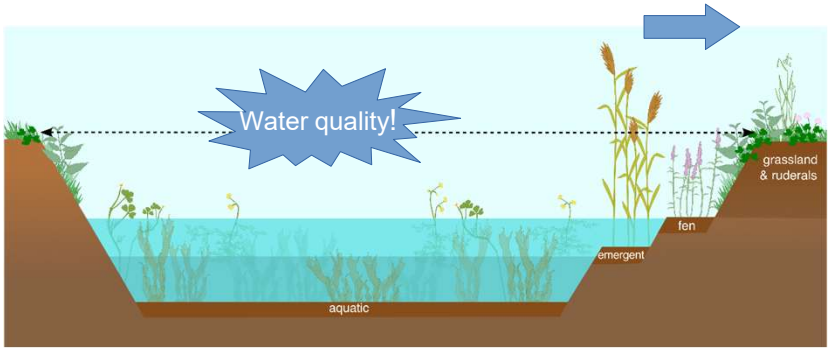
Main IDB drains

- aquatic habitat is already extensive

- reprofile the bank +/or add coir roll for emergent/fen habitat



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Q6: Do the benefits outweigh the downsides?

	Aquatic spp & habitat	Emergent spp & habitat	Fen spp & habitat	Fish, amphibia	Birds, Invert-ebrates	Pollinator /predator services	Water discharge & storage	Net GHG emitted	Main-tenance	Crop area - gross margin
Widen water channel	+			+	+	+	+ + summer roughness	+	+	-
Step at winter water level		+ + invasive			+		+ ++ summer **& winter** roughness	+	+	-
Step at summer water level			+ colonis-ation?		+	+	+	+	+	-
Is there evidence ?	*Ditch survey (CLR)*	*Ditch survey (CLR)*	*Ditch survey (CLR)*	*???*	*CLR*	*CLR*	*Modelled CLR*	*CLR (Silverthorn et al 2026)*	*??? **ADA***	*Calculated (CLR farm survey)*

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Q7: Would you rather... rewet a field .... or modify some ditches?

10,000m² (1 ha) of crop land	Rewetted field
Substitute wetted habitat	100 x 100m
Alternative income?	Paludiculture? Grants
Net increase GHG emissions	+ methane
Engineer water table and land surface to be closer together	Raise water table - retaining structure needed
Independence from neighbour	Hard to achieve
Spoil	None?
Local biodiversity impact	Bloc of fen & emergent vegetation - planting
Landscape scale impact	Local focus

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Q7: Would you rather... rewet a field .... or modify some ditches?

10,000m² (1 ha) of crop land	Rewetted field	Widened/modified ditches
Substitute wetted habitat	100 x 100m	1m x 10km
Alternative income?	Paludiculture? Grants	None **as yet**
Net increase GHG emissions	+ methane	+ methane
Engineer water table and land surface to be closer together	Raise water table - retaining structure needed	Bring surface down to water level – no retaining required
Independence from neighbour	Hard to achieve	Easy
Spoil	None?	Disposal, but + ruderal habitat?
Local biodiversity impact	Bloc of fen & emergent vegetation - planting	Aquatic & emergent gains. Fen species planted?
Landscape scale impact	Local focus	High connectivity - vary across catchment

*Not really alternatives – incorporate both in a **whole-catchment biodiversity strategy***

**why limit yourself to a 1m strip? Why not push back the bank by 100m?*

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Restoring wetland biodiversity in the Fens:

are ditches (part of) the answer?

CLR team: David Coomes, Laurie Friday, Hannah Porcher, Elizabeth Stroud, Hamidreza Rahimi, Neha Joshi, Lynn Dicks, Jack Shutt, Neil Mahon, Jeremy Fonvielle, Tom Marquand, Katy Faulkner, Brenda D'Acunha, Barbara Neto-Bradley, Vanessa Cutts, Rekha Bhangaonkar
In collaboration with: Martin Hammond, Jonathan Graham & Owen Mountford (*Fenland Flora*) **& Fenland SOIL**