Root soil binding capacity in the field

Can increased root diversity retain more soil and reduce sediment loss in cover crop systems?

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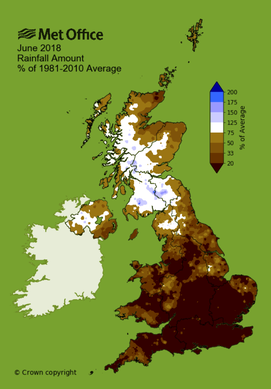
The problem

Agricultural intensification has simplified landscapes in the UK, thereby:

- Reducing biodiversity
- Depleting natural resources
- Threatening ecosystem services

This has **reduced resilience to abiotic stress**, thus:

- Threatening agricultural production
- Causing environmental degradation

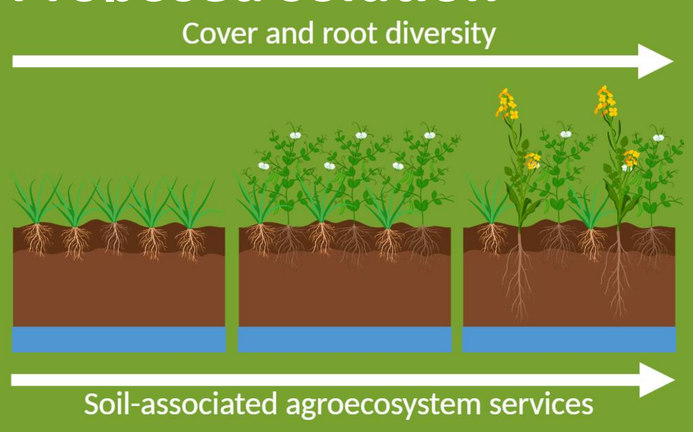


UK climate predictions:

- **Hotter and drier summers** can improve sowing and harvesting conditions but increase drought risk.
- **Wetter winter and spring** can lead to waterlogging and erosion.

UK climate reality: yields decreasing with 2018 drought, 2023 floods.

Proposed solution



Research lacking in quantifying plant diversity effects on soil-associated agroecosystem services regulated by **root systems:**

- Limiting soil erosion
- Building soil carbon stores

How **cover crops bind soil** through root and rhizosheath development has attracted little attention despite their soil erosion control capacity.

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Aim

Determine below-ground mechanisms leading to reduced water flow and erodibility in cover crops of increasing diversity.

Hypothesis:
Increased cover crop diversity increases root biomass and thus rhizosheath mass, that decreases soil loss by binding more soil.

Species:
- *Brassica juncea* (B)
- *Secale cereale* (G)
- *Vicia faba* (L)

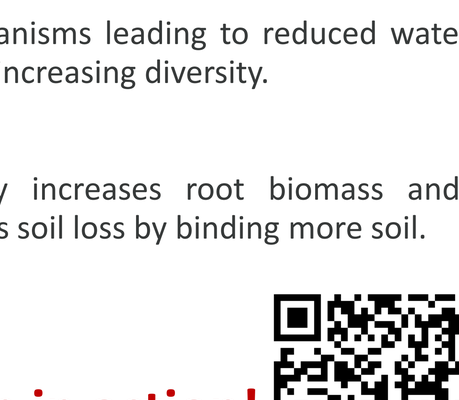
Method:
- Overland flow simulations

Watch in action!

Key findings

1. Increased cover crop diversity did not increase root biomass.

Presence of **legume** determines root biomass.

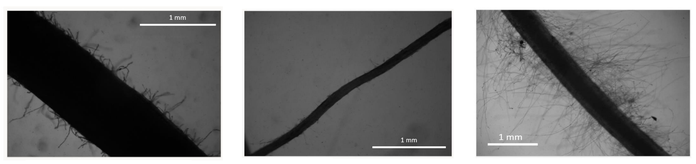


Vicia faba (L)

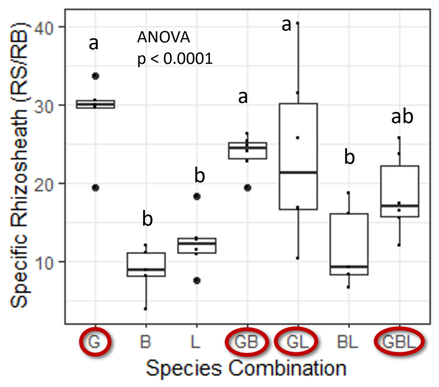
Brassica juncea (B) *Secale cereale* (G)

2. Increased root biomass increased rhizosheath dry mass.

Treatments containing **grass** form a greater rhizosheath per unit root biomass.
Possibly because of root hair length and density:

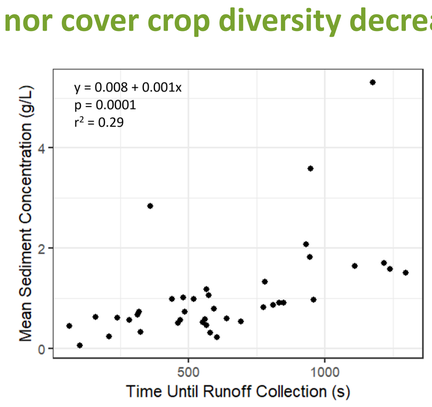


Vicia faba (L) *Brassica juncea* (B) *Secale cereale* (G)



3. Neither increased rhizosheath nor cover crop diversity decreased sediment loss.

Fundamental differences between soil properties across plots. The field is variable!



In this cover crop mixtures field trial:

- The presence of individual species, rather than diversity *per se*, determined root biomass weight and rhizosheath formation.
- A greater rhizosheath mass and increased cover crop diversity did not reduce sediment loss.
- Fundamental differences between soil properties across plots influenced sediment loss more than plant diversity.

Future Steps

Future work is needed to help bypass field variability and clarify the effect of increasing crop diversity on sediment loss by further investigating the soil binding capacity of additional species combinations that can complementarily use resources in time and space.