Toward Integrated Agricultural Land and Water Management

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Wear Rivers Trust

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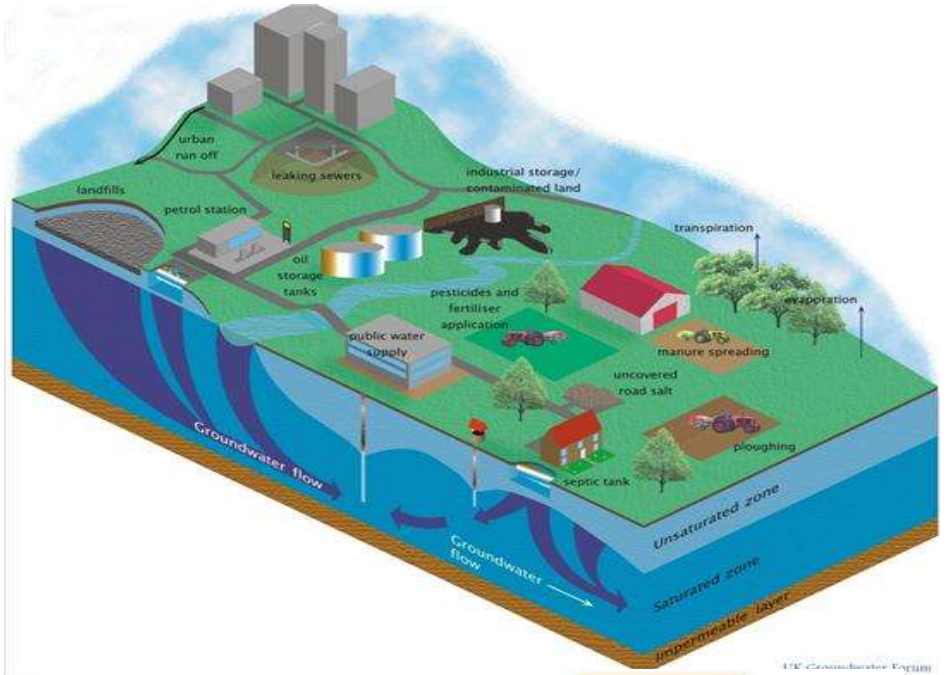

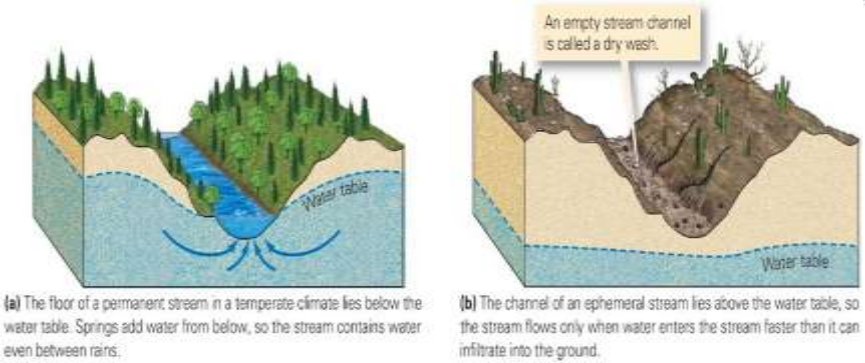

(a) The floor of a permanent stream in a temperate climate lies below the water table. Springs add water from below, so the stream contains water even between rains.

(b) The channel of an ephemeral stream lies above the water table, so the stream flows only when water enters the stream faster than it can infiltrate into the ground.

Topsoil Legacy

- 10-year horizon
- Long term data base
- Local Climate and soils
- Farmer-led
- Positive discussion forum
- Paid Ecosystem Services
  - Water quality
  - Flood resilience
  - Carbon storage

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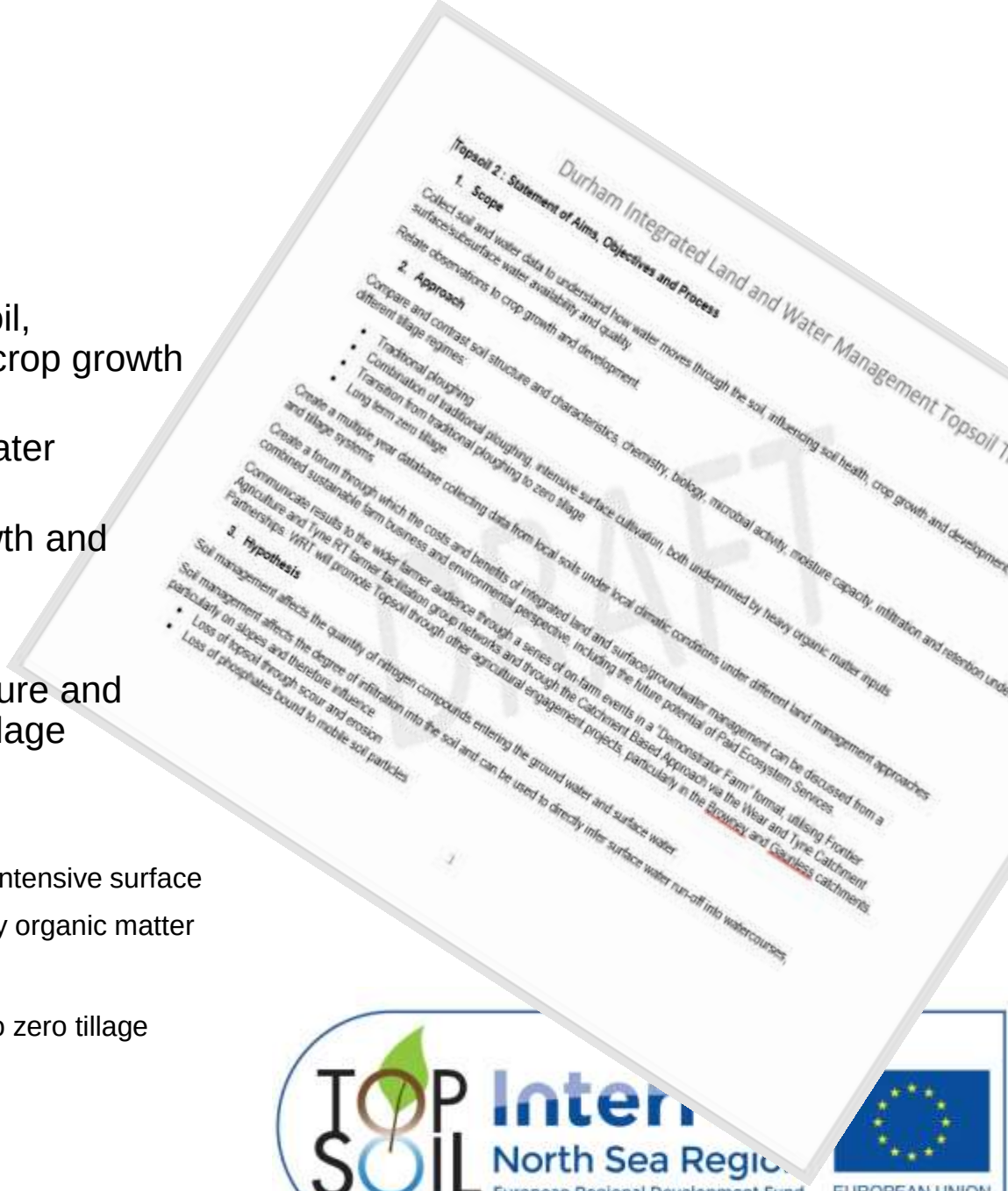
Overview

Scope

- How water moves through the soil, influencing soil health, nutrition, crop growth and development
- Influences surface/subsurface water availability and quality.
- Relate observations to crop growth and development

Approach

- Compare and contrast soil structure and characteristics, under different tillage regimes:
  - Traditional ploughing
  - Combination of traditional ploughing, intensive surface cultivation, both underpinned by heavy organic matter inputs
  - Transition from traditional ploughing to zero tillage
  - Long term zero tillage.



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Local Partners

1. Host Farmer: Edwin Taylor,

   Durham Fields Farm

2. Host Farmer: Keith Cook,

   Houghall College Farm

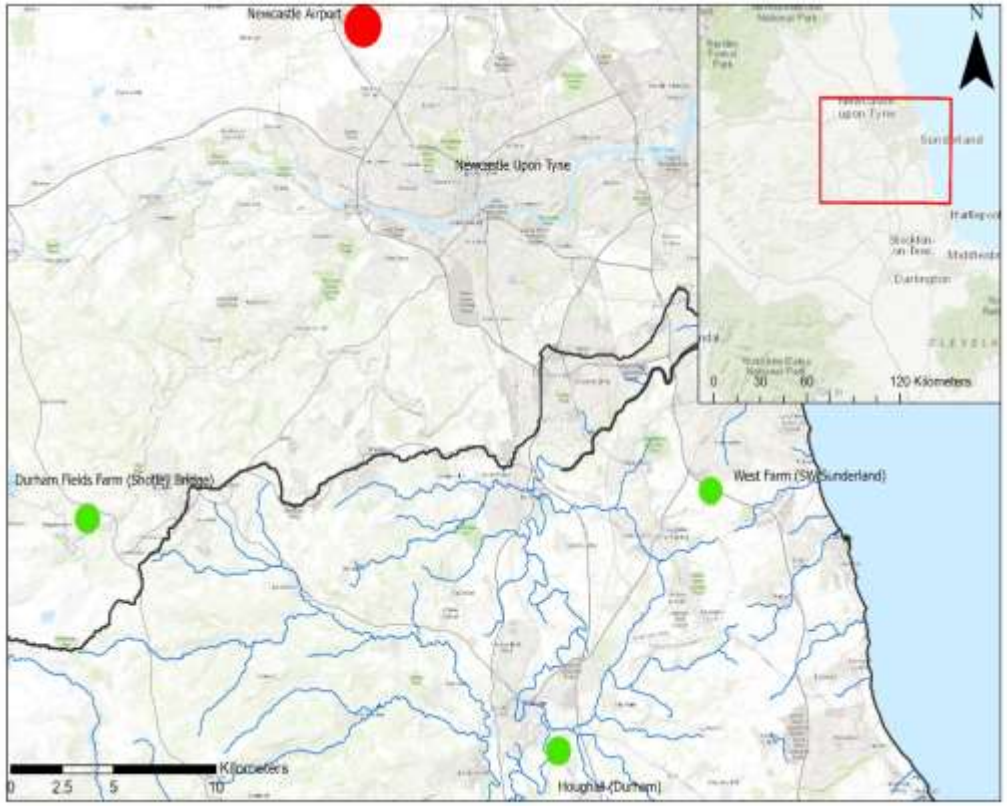
3. Host Farmer: Stephen Gregson,

   Old Burdon Farm High Sharpley

4. Frontier Agriculture Ltd.

5. Tyne Rivers Trust

6. Wear Rivers Trust: Topsoil Lead.



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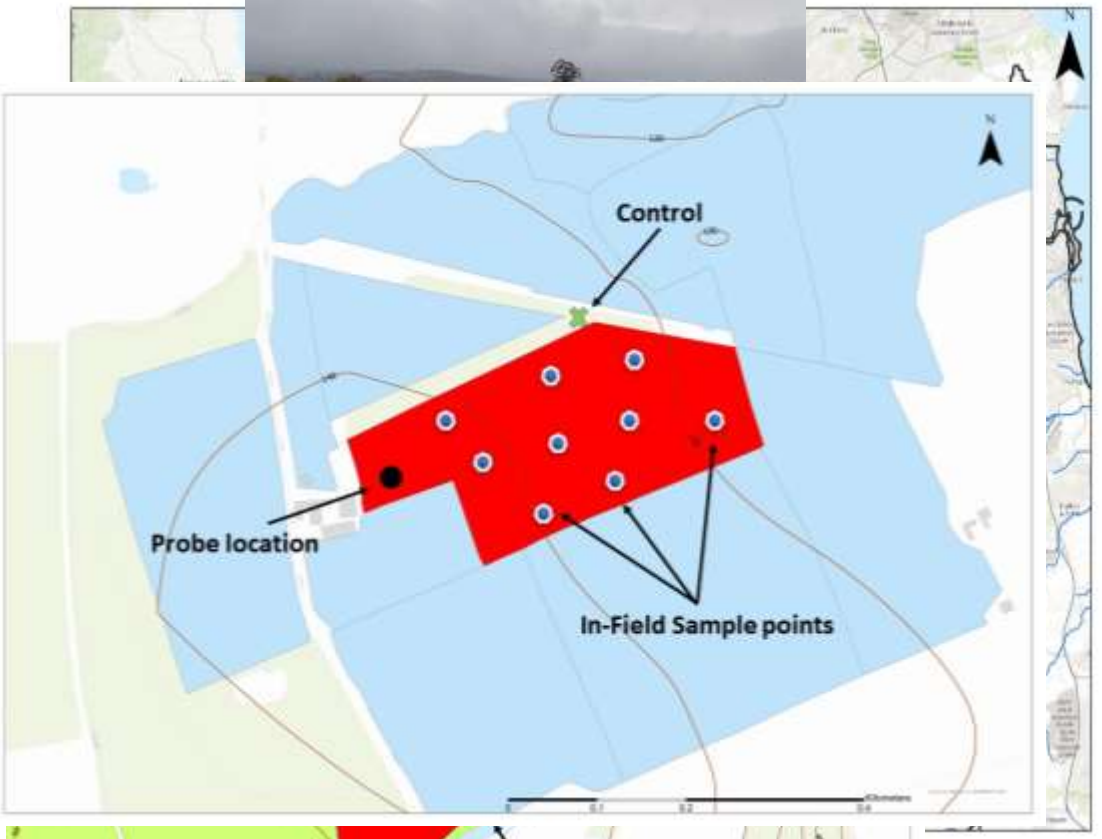
Site Investigations

- Durham Fields Farm
  - Tyne Catchment upland arable
  - Acidic loamy/clayey soils
  - Demo sites: two tillage methods
  - Existing Base UK and Frontier Trials
- Houghall College Farm
  - Durham Agricultural College
  - Free draining alluvial loamy soils
  - Change trad. plough to zero till. No transition
  - Lower Organic Matter inputs
- High Sharpley
  - Situated on the Magnesian Limestone Aquifer
  - Base rich loamy/clayey soils
  - Comb. of trad. plough & min tillage
  - Heavy annual Organic Matter input



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Trial Set up

- Soil samples 11 sites (10 in-field, 1 control) per field at 300, 600 and 900mm
- Control: uncultivated hedge line
- Infield: Primary site
- Infield: 9 Comparator sites

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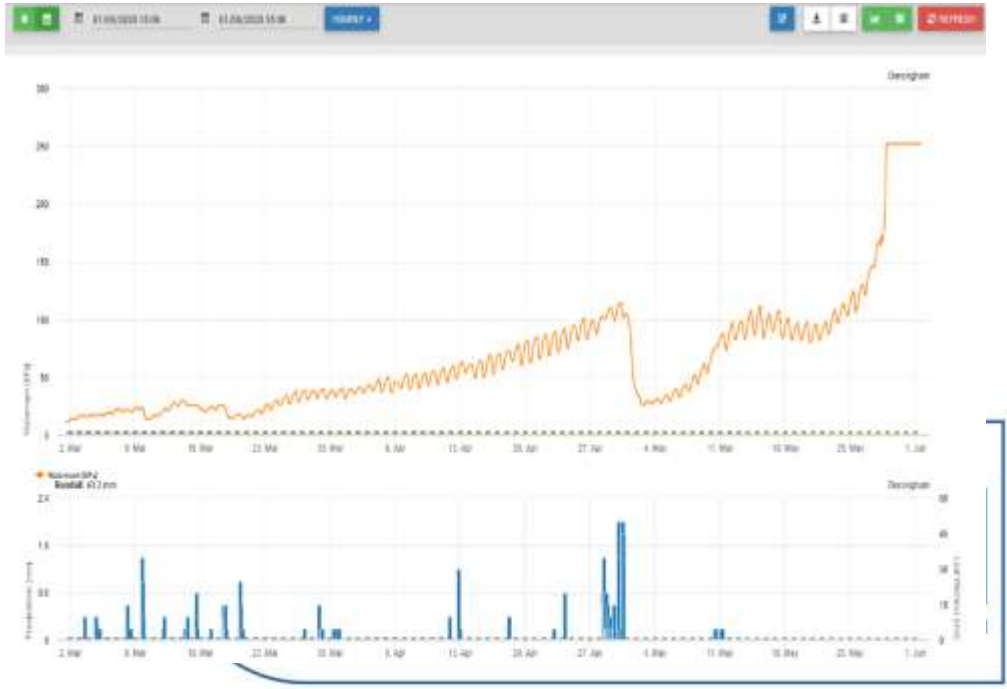
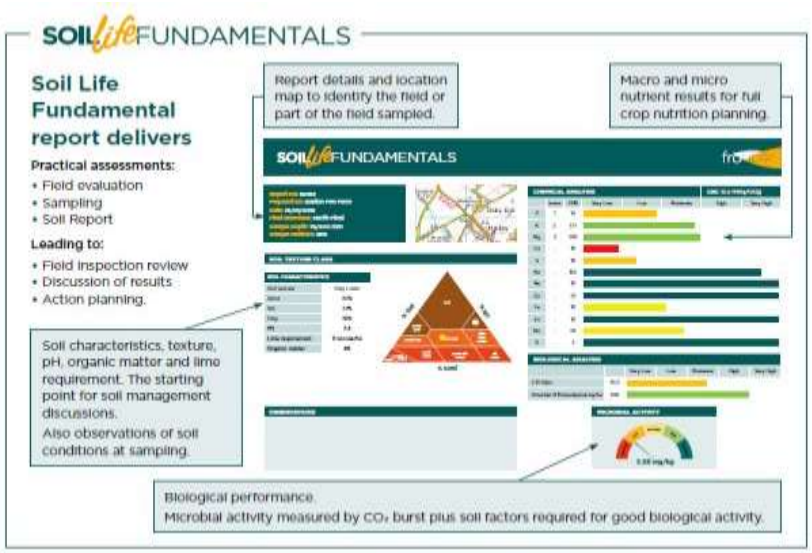
Primary Site Observations

- Remote Data Capture
  - Rainfall and air temperature.
  - Soil temperature and soil moisture every 100mm to 800mm
  - Soil pore-water at 200, 400, 600 and 800mm depths
- Data Used to
  - Calculate soil infiltration rate
  - Monitor soil pore water KPa through the soil profile and uptake by the crop
  - Monitor soil volumetric water content and temperature through the soil profile



Further Observations: All Sites

- Upper 300mm
- Soil Fundamentals analysis:
  - Soil characteristics,
  - Soil chemical analysis:
  - Soil biological analysis:
  - Soil microbial activity
- Visual Examination Soil Structure
- Worm Count



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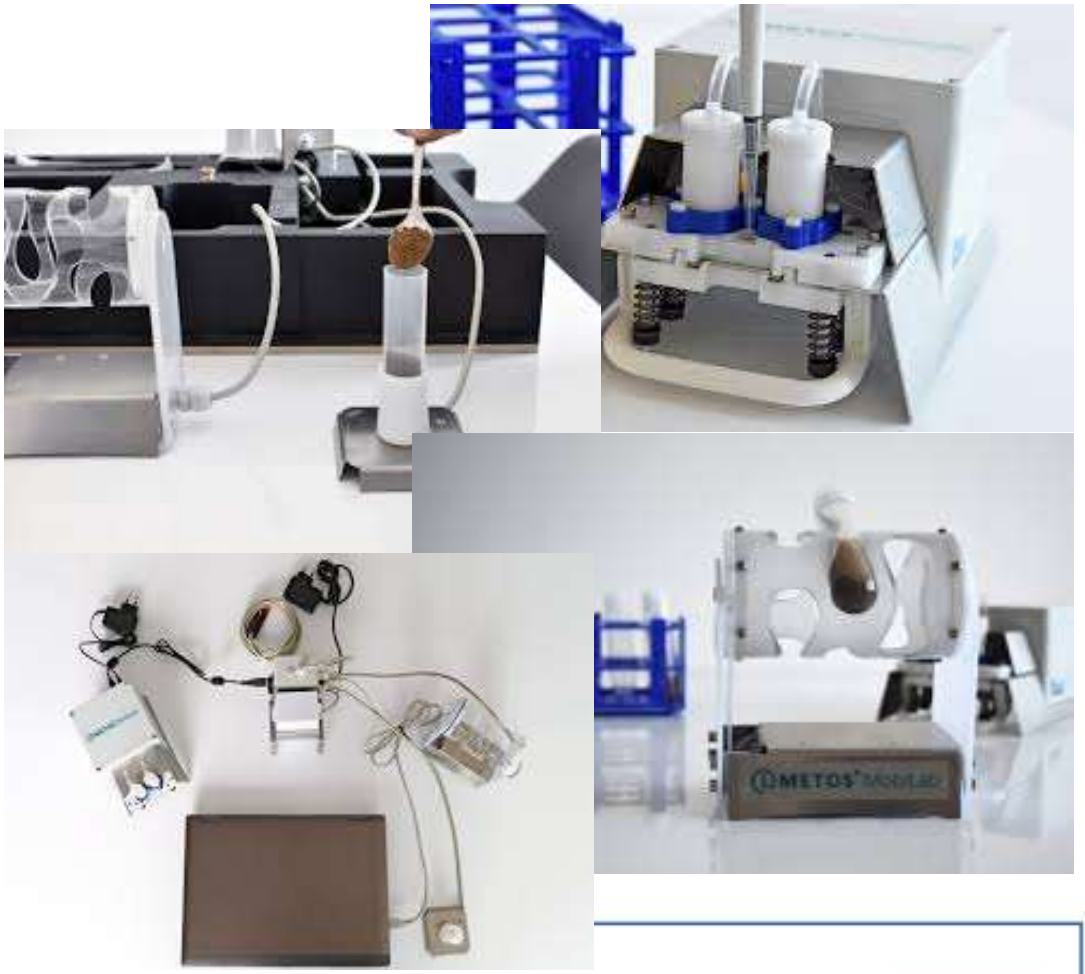
Mobi-Lab

- Mobile lab developed through EU Horizon 2020 Project
- Sample Nitrogen levels within:
  - Plant tissue
  - Water
  - Soil
- Soil samples: 300/600/900mm
- 10 infield samples per field
- Hedgerow sample taken as uncultivated comparator
- Samples taken 3 times yearly
  - Pre-winter/Post Harvest (Oct/Nov)
  - Post Winter (Feb)
  - Pre-Harvest (April – June)



This project has received funding from the European Union's Horizon 2020 research and innovation programme under the grant agreement No. 765262.

Project Output Summary

- Compare the uncultivated control site soil parameters to the infield cultivated sites.
- Compare primary site soil parameters with the infield comparator sites
- Analyse possible barriers to nutrient availability in the soil and uptake by the plant
- Identify nitrogen within the soil profile; estimated losses below 900mm depth and potential savings through appropriate fertiliser application
- Assess wider benefits of effective infiltration rates and water retention.

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Primary Stakeholder Involvement

- 3 Demonstration Farms
- Frontier Agriculture
- Tyne Rivers Trust
- Wear Catchment Partnership
  - Durham County Council drainage team: reduction in highway flooding can be mitigated by improving water infiltration, reducing agricultural run-off.
- Wider Catchment Based Approach
  - Agricultural land management is the single biggest factor influencing water quality, flood risk management and carbon storage

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Messages to the Wider Farming Audience

- Promote farmer-led integrated land, surface and groundwater management.
- Gathering and analysing local data captured under local climatic and soil conditions
- More specifically:
  - Water infiltration and retention.
  - Soil health indicators
  - Management of the Nitrogen Cycle
  - Distribution and availability of Nitrate in the soil profile.
  - Uptake of Nitrate by the plant
  - Barriers to Nitrate uptake and potential corrective action.
  - Estimated loss of Nitrate to groundwater

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Any Questions?

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