Filter socks to control runoff, sediment and nutrient losses from arable lands under extreme rainfall events; 1st year Annual Review

Alexandra Cooke, PhD Researcher, SEEA

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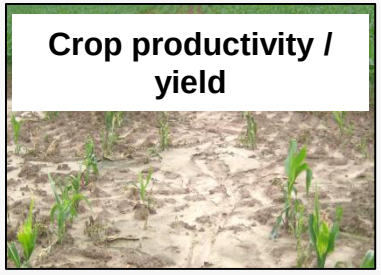
Background – Soil Erosion

Climate **Soil Type** **Relief** **Management Practice**

Soil Erosion

2.2 million tonnes of topsoil lost annually (Graves et al, 2011)

On site impacts



Off site impacts

Background – Water Framework Directive (WFD)

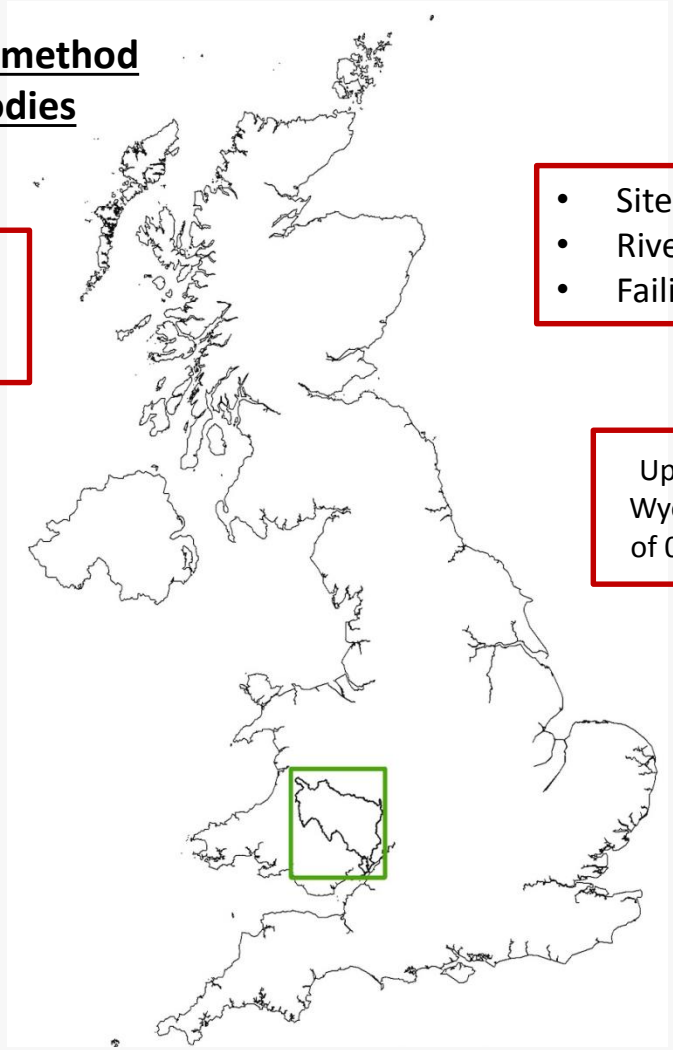
European Union WFD provides a method to ensure water quality in waterbodies

UK
- 30% failing
- 27% 'good ecological status'

Agriculture - 70% of sediments, 60% of nitrates and 25% of phosphates

Climate change

Impacts



River Wye catchment

- Site of Special Scientific Interest (SSSI)
- River Lugg part of the River Wye SAC
- Failing WFD for sediment and phosphate

Upper River Wye P target of 0.03 mg l^{-1}

River Lugg and lower River Wye P target of 0.05 mg l^{-1}

70-85% sediment in River Wye and Lugg from eroded soils Target of <10 mg l^{-1}

Impacts

Maize – High erosion risk crop

Increase of maize in River Wye catchment

The Project – Filter Socks (FS)

1. Concentrated flow or sheet flow
2. Slows runoff velocity
3. Obstructions to flow, turbulence and friction increase
4. Sediment deposition

To mitigate runoff, sediment and nutrient losses under current and extreme rainfall events

River Lugg and River Clun catchments

Phase 1

Phase 2

Phase 3

Project Hypothesis and Objectives

Traditional filter socks can be combined with innovative P-sorbing fill media for use on arable land to reduce runoff volume and runoff rate, as well as losses of sediment, soluble-P and sediment-bound-P under a range of rainfall events

1. Critically evaluate the effectiveness of innovative P-sorbing filter sock fill media to facilitate sediment, sediment-bound and dissolved-P removal from surface water runoff.

2. Develop end-user guidelines to facilitate the adoption of filter socks as a practical BMP for the control of runoff, sediment and P-losses from agricultural land.

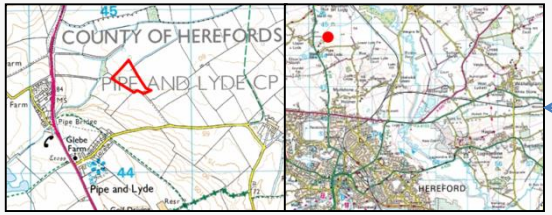
3. Carry out a cost-benefit analysis of the application of filter socks for the reduction of runoff, soil and P losses from agricultural land.

4. Investigate modelling approaches to identify optimum field placement (spacing) of filter socks to optimize runoff, sediment and P capture.

The Project – Phase 1 progress

Phase 1

River Lugg catchment



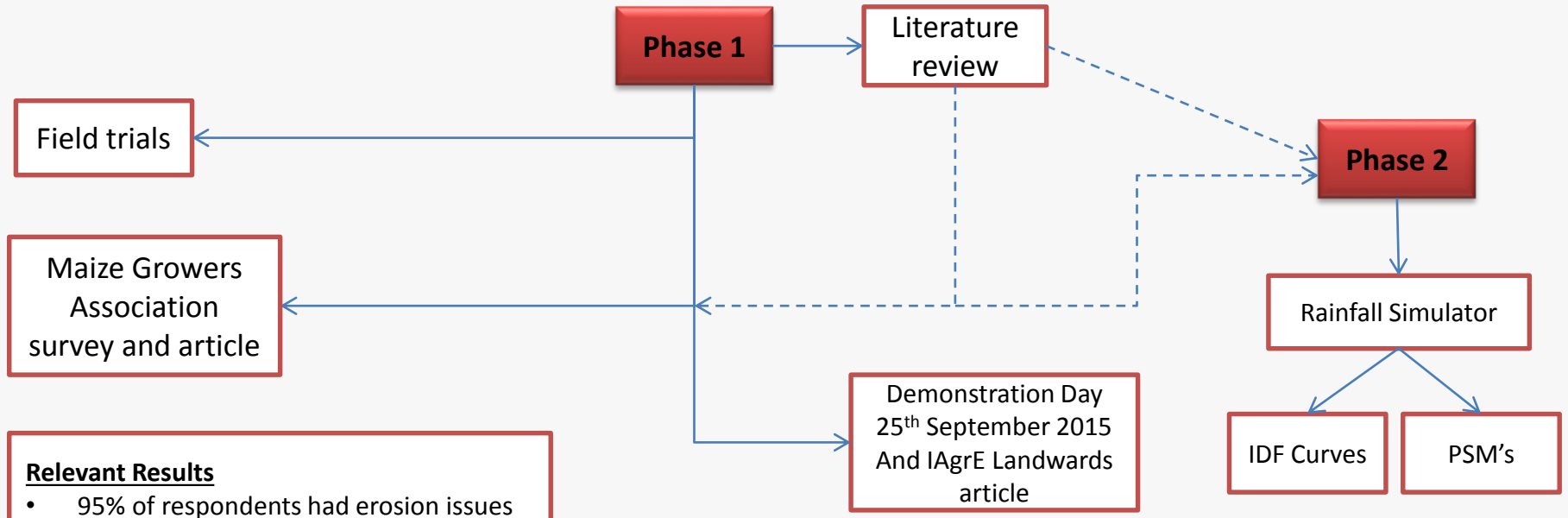
Field trials

20 randomly distributed erosion plots
- 4 x Control (no FS)
- 4 x Compost FS
- 4 x Bark FS
- 4 x Compost + Nutriloxx FS
- 4 x Bark + Nutriloxx FS

Fieldwork Challenges

1. Length of time to trial set-up – equipment and support issues
2. Extensive weed cover over plots - sampling
3. Lack of rainfall over summer months - sampling
4. Later than typical maize harvest – delaying overwinter trials
5. Communication issues with farmer

The Project – Phase 1 progress



Relevant Results

- 95% of respondents had erosion issues
- Combined erosion mitigation – cover cropping, changes to ploughing regime, and end-of-pipe solutions
- Costs of filter socks main consideration
- Preferred fill media – woodchip; compost with nutrient sorbing bacteria; compost with a seedbank; silica sand.

Next Steps

Phase 1

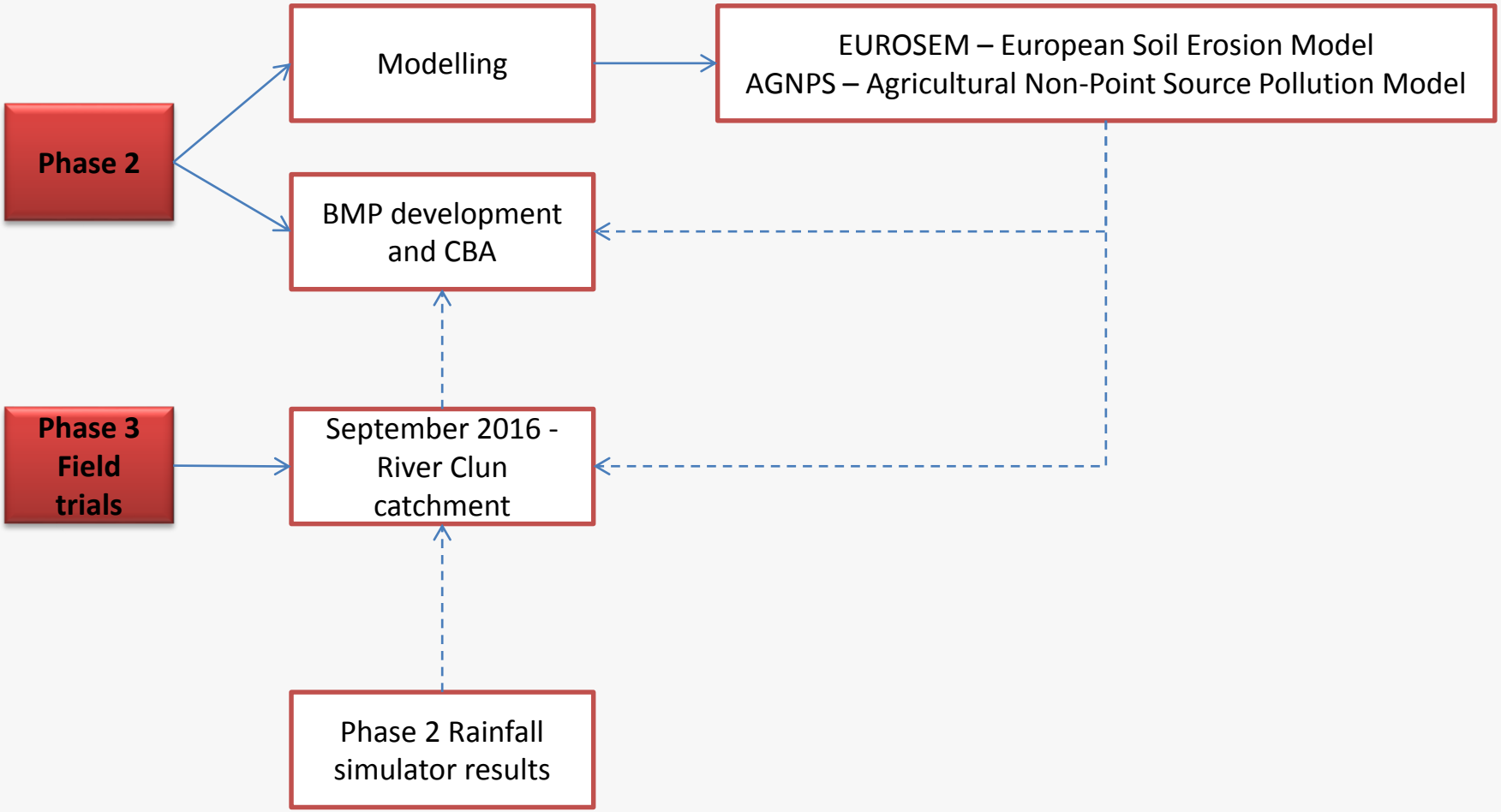
- Field trials → Continued sampling until end of Phase 1 trials in April 2016
- Laboratory analysis →
  - Soil: pH, PSD, OM, Olsen-P, TOP;
  - Compost and bark: Olsen-P, TOP;
  - Nutriloxx: PSD, pH, elemental analysis using SEM;
  - Treatment Performance: Runoff sediment load and concentration, TOP, Olsen-P, hydrographs
- Statistics
- Analysis of deposition sequence
- Maize canopy analysis

Next Steps

Phase 2 Rainfall simulator

- Phosphorus sorbing materials (PSMs) → Literature review
- Soil types → Typical Lugg catchment soils → **LandIs data**
  1. Bromyard / Barton series – medium silty
  2. Escrick / Eardiston series – sandy loam / sandy silt loam
- Rainfall events → IDF Curves for the Lugg catchment → Flood Estimation Handbook and Rational Method
- Slope gradients → Typical Lugg slope gradients → **LandIs data**
  1. 2 degrees
  2. 5 degrees
  3. 10 degrees
  4. 15 degrees
  5. 20 degrees

Next steps


Phase 2
Modelling
EUROSEM – European Soil Erosion Model
AGNPS – Agricultural Non-Point Source Pollution Model
BMP development and CBA
Phase 3 Field trials
September 2016 - River Clun catchment
Phase 2 Rainfall simulator results

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Thank you for listening!

Phosphorus sorbing materials (PSMs)

PSMs as indicated by the literature	
Crushed Concrete	Bituminous refuse ash
Humate product	Wollastonite
Drinking water treatment residual	Polonite
Mg fertiliser by-product	Filtra P
Mg salts	Kaolinite
Organic soil	Aluminium sulphate
Gypsum	Limestone
Iron Ochre	Dolomite
Silica Sand	Laterite
Compost with bacteria	Marl
Emergent vegetation species and macrophytes	Blast furnace slag