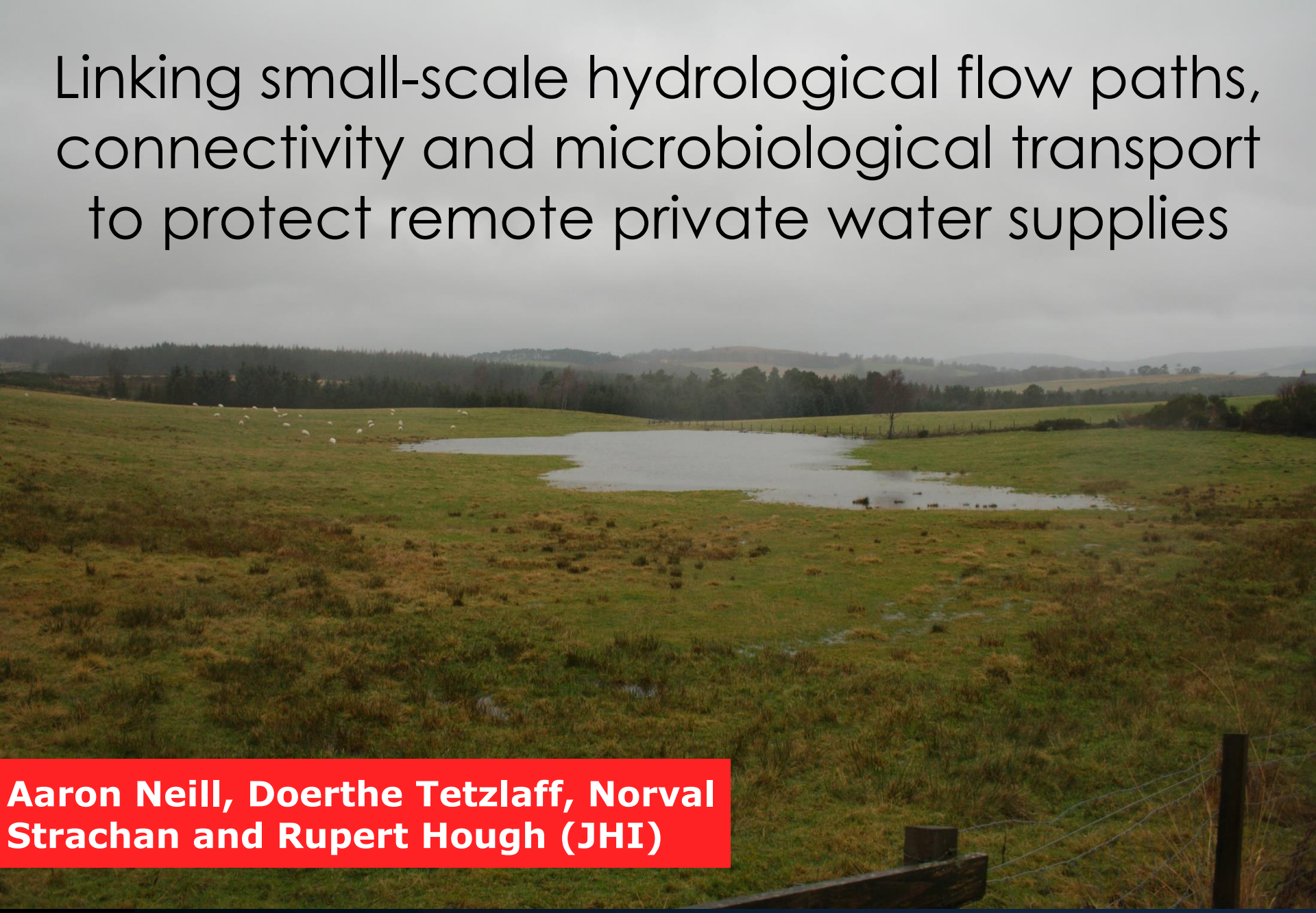
Linking small-scale hydrological flow paths, connectivity and microbiological transport to protect remote private water supplies



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Private Water Supplies

PARAMETER	NO. TYPE A SAMPLES	TYPE A % SAMPLES FAILED
All Parameters	44,812	6.03
Coliform Bacteria	2,266	24.23
E. coli	2,264	13.38
Colour	2,126	17.97
Turbidity	2,217	1.85
Hydrogen ion (pH)	2,228	16.79
Aluminium	816	2.08
Iron	1,012	13.44
Manganese	891	7.30
Lead (10)	1,001	9.89

PARAMETER	NO. TYPE B SAMPLES	TYPE B % SAMPLES FAILED
All Parameters	13,971	12.14
Coliform Bacteria	1,127	43.12
E. coli	1,128	21.63
Colour	220	16.82
Turbidity	961	5.20
Hydrogen ion (pH)	1,034	26.79
Aluminium	122	12.30
Iron	626	14.06
Manganese	603	12.27
Lead (10)	894	8.39

188,000

People in Scotland rely on private water supplies (PWS)

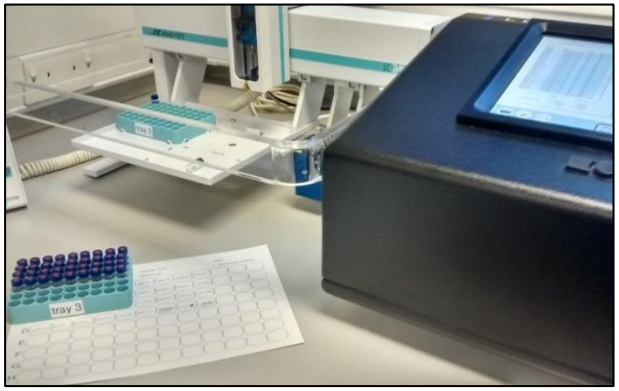
Drinking Water Quality in Scotland, 2014

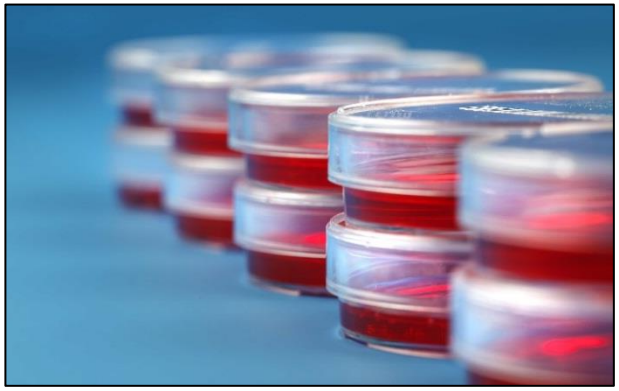
Aim

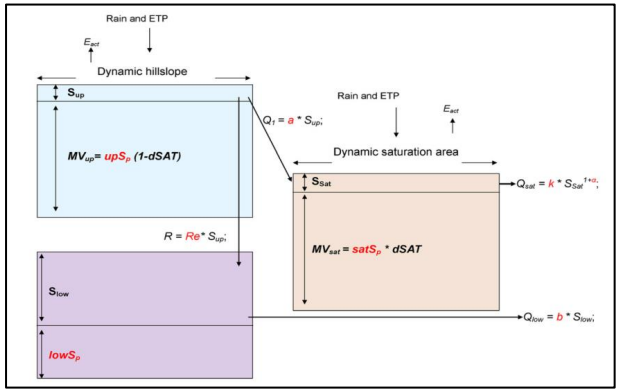
Combine geochemical tracer methods, microbiological pollutant monitoring and numerical modelling at the plot to hillslope scale" to:

1. Investigate how different hydrological source areas become connected to PWS under varying hydrological conditions, and how changes in connectivity affect the potential mobilisation and transport of faecal pollutants from different reservoirs.

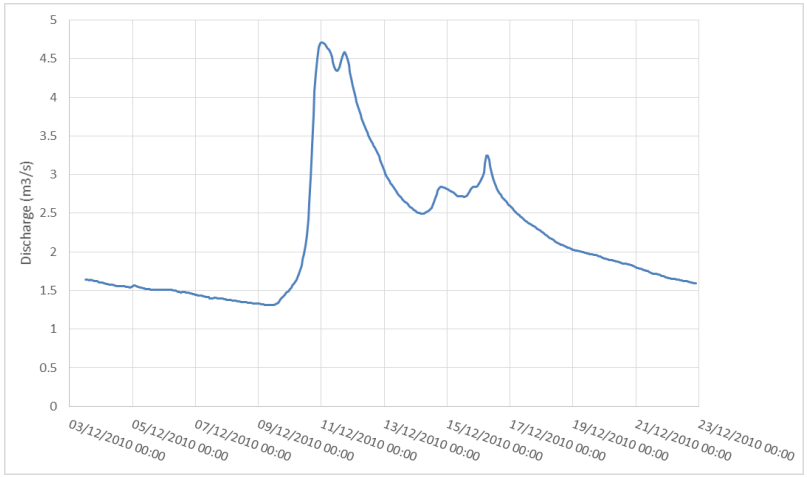
2. Investigate how faecal pollutant transfer dynamics may be changed under different climatic and mitigation scenarios

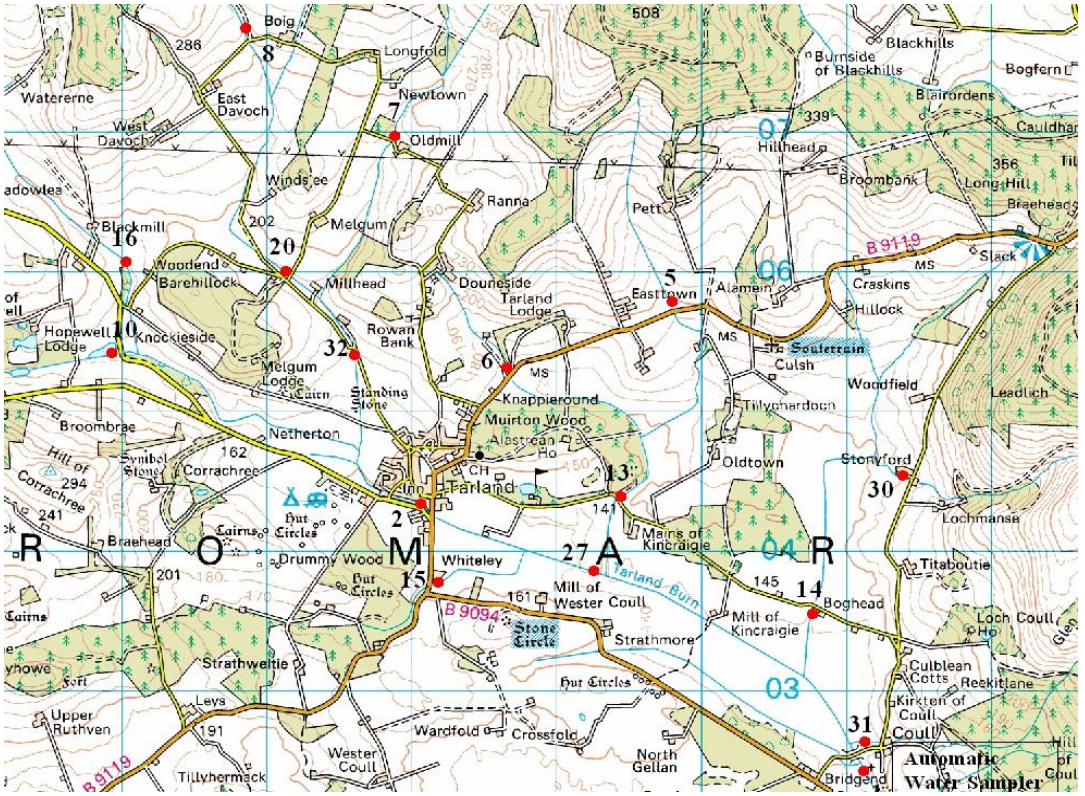






WP1: Long-term spatial and temporal patterns of faecal contamination "hot spots"





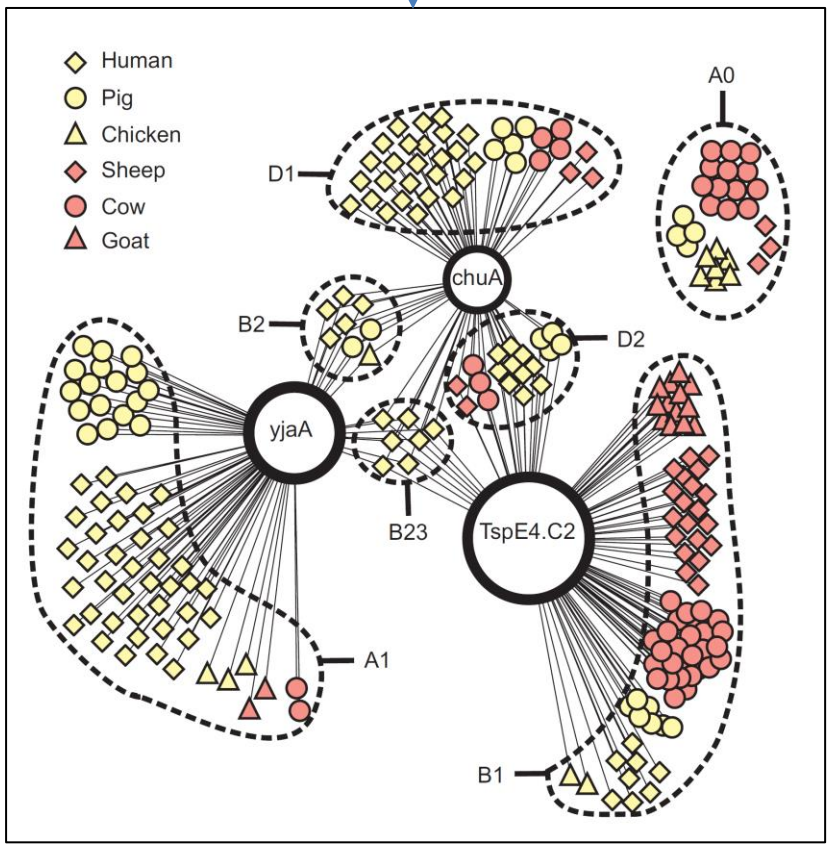
Research Questions:

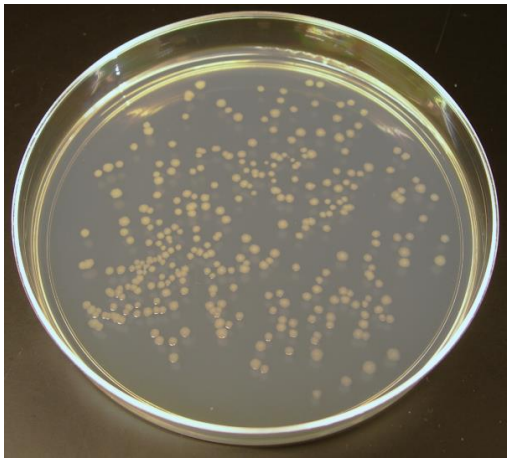
What is the long-term spatial distribution of "hot-spots" of faecal contamination risk and what are the dominant landscape controls on this distribution?

What is the short-term variability in "hot-spot" spatial distribution, and what are the dominant controls?

WP2: Combining empirical and modelling approaches to investigate faecal pollutant transfer dynamics

1. Under different hydrological conditions, from where are faecal pollutants present in PWS sourced?

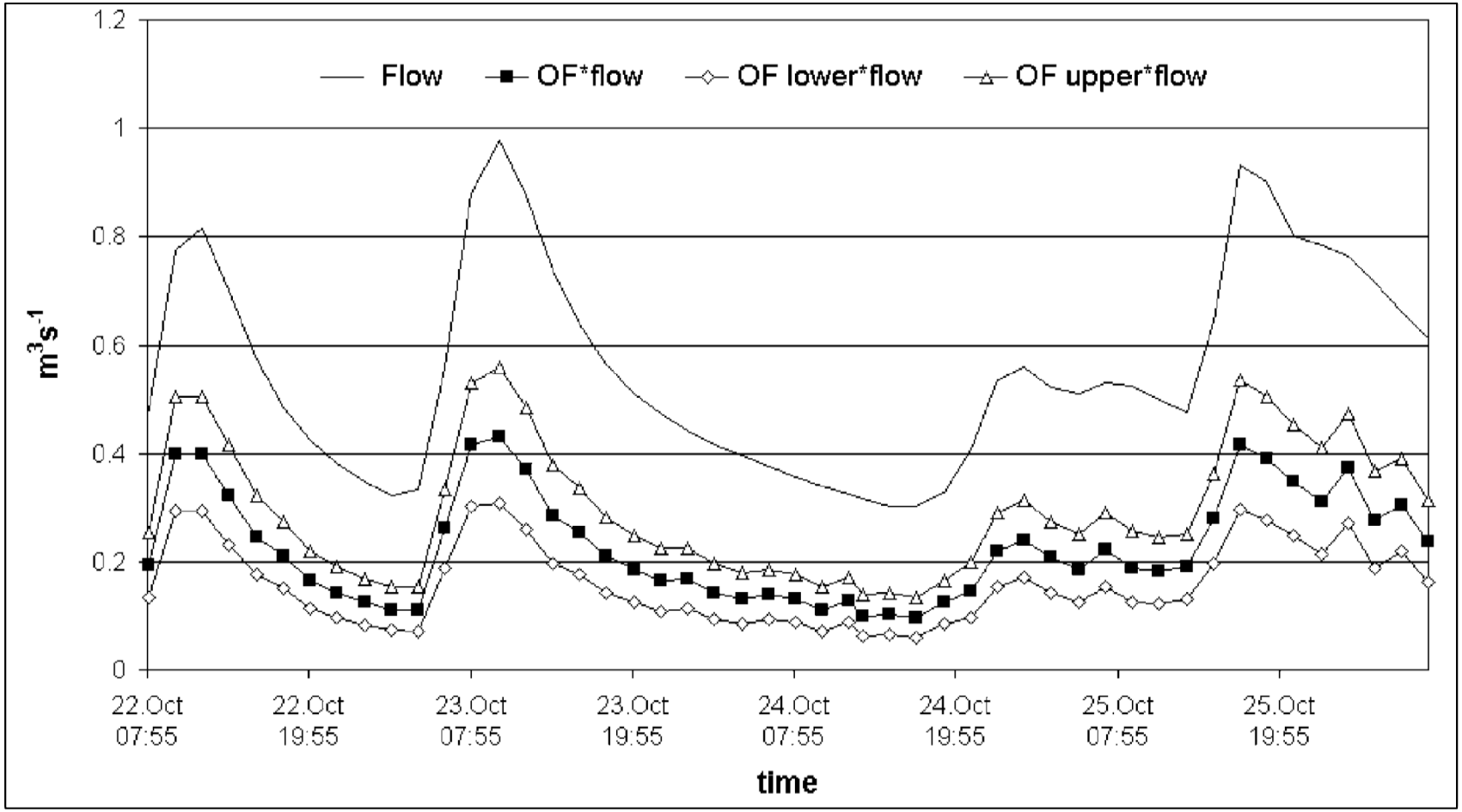




Carlos *et al*. (2010)

WP2: Combining empirical and modelling approaches to investigate faecal pollutant transfer dynamics

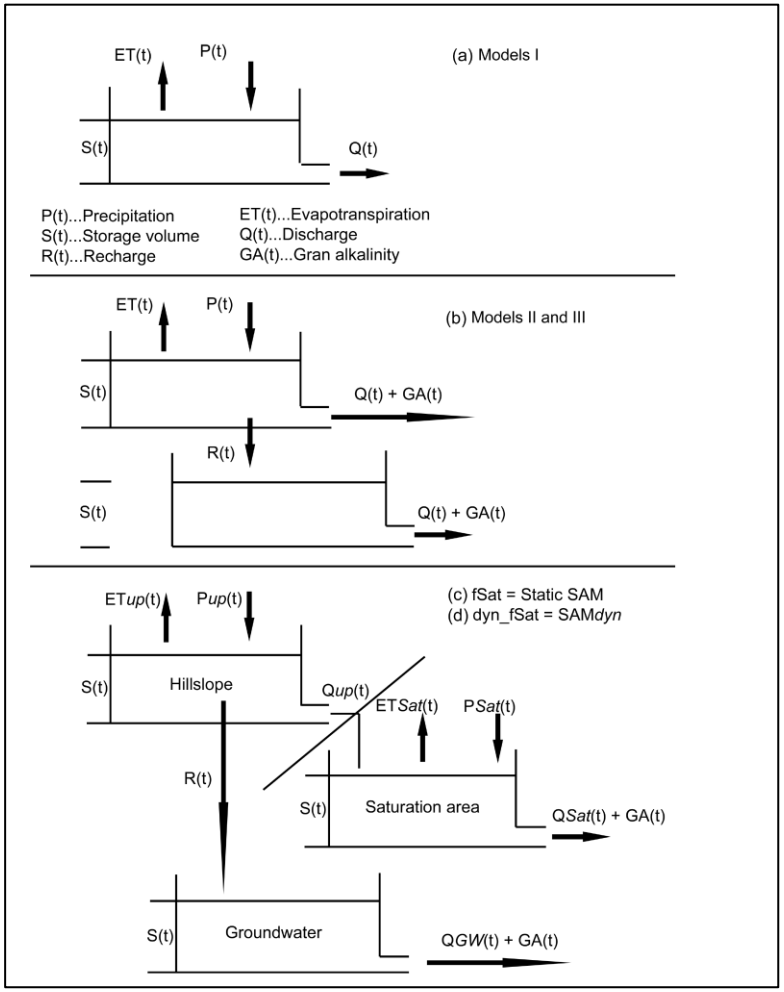
2. What are the hydrological flow pathways responsible for connecting the sources of pollutant to the PWS?



Soulsby *et al*. (2003)

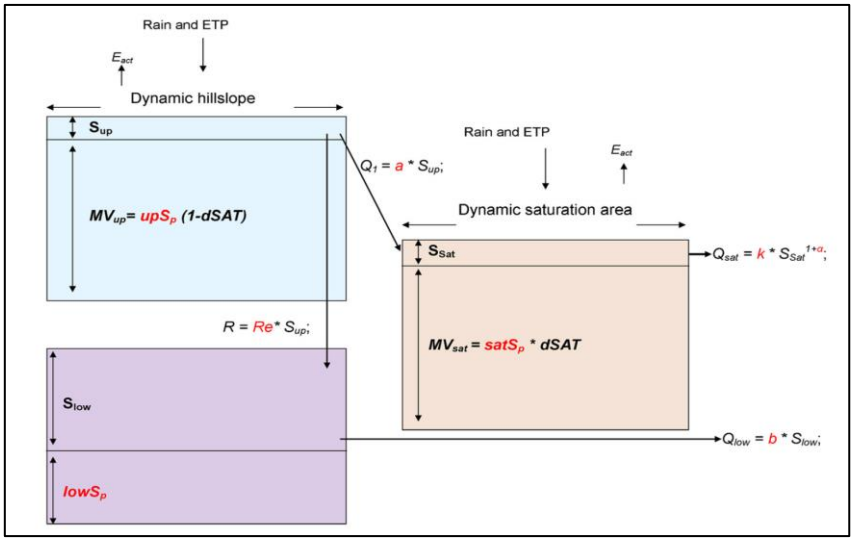
WP2: Combining empirical and modelling approaches to investigate faecal pollutant transfer dynamics

3. Development of numerical model based on empirically-derived faecal pollutant transfer dynamics



Birkel *et al*. (2010)

WP3: Scenario-based modelling of faecal contamination risk



Scenarios:

- Climatic
- Mitigation affecting:
  - Hydrological connectivity
  - Livestock access to connected areas
- Farm management practices

Thank You

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Scotland's centre of expertise for waters

The James Hutton Institute