

Make it rain: a field rainfall simulator experiment on Culm grassland soils



Devon
Wildlife Trust
Environment
Agency

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Outline

Introduction

- Natural flood management
- Culm grassland and NFM

Rainfall simulator design and use

Results

Research implications

Natural Flood Management



Grasslands and NFM?



Culm grassland

Unimproved grassland: 'species rich in native grasses not normally treated with fertiliser and are associated with low intensity agriculture'.

(Blakesley and Buckley, 2016)

Culm grassland: Wet, unimproved grassland (Purple-moor grass and rush pasture) situated in North Devon and Cornwall on an area of heavy clay overlying the Upper Carboniferous culm measures.

(Natural England, 2013)



PhD Aim: To provide an understanding of potential unimproved grassland natural flood management properties.

Objective: Understand impact of soil and vegetation upon rainfall response.



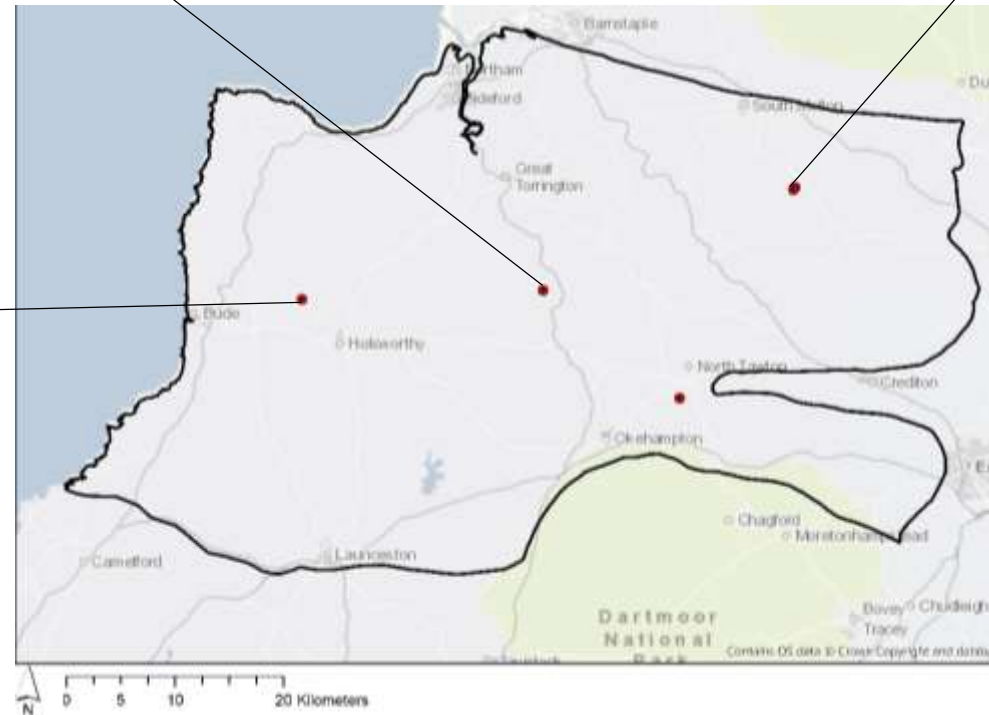
Ash Moor Nature Reserve



Meshaw Moor



Dunsdon Nature Reserve



- Plots
- Habitat
- Improved grassland
 - Purple moor-grass
 - Rush pasture

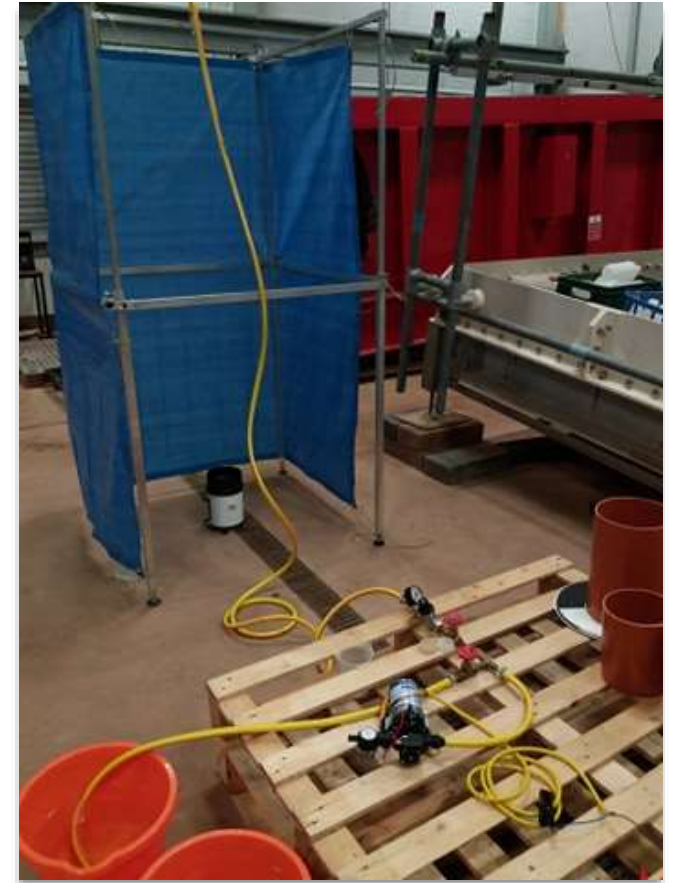


Designing and building the rainfall simulator

Designed, tested and calibrated over 6 months

Specifications:

- Closely mimic natural rainfall
- Had to cope with a challenging environment
- Repeated deployment
- Simulate 40mm/hr rainfall (2011 storm +10mm/hr)
- Cost effective (<£1000)



In the field

- January-February 2019 (wet soils).
- Deployed over *Molinia Caerulea*, rush pasture and improved grassland (key grassland categories in the Culm).
- 40mm/hr rainfall over 1m².
- **20 total simulations, 200 hours in the field, 30 field volunteers, 1 ton of water.**





Molinia Caerulea

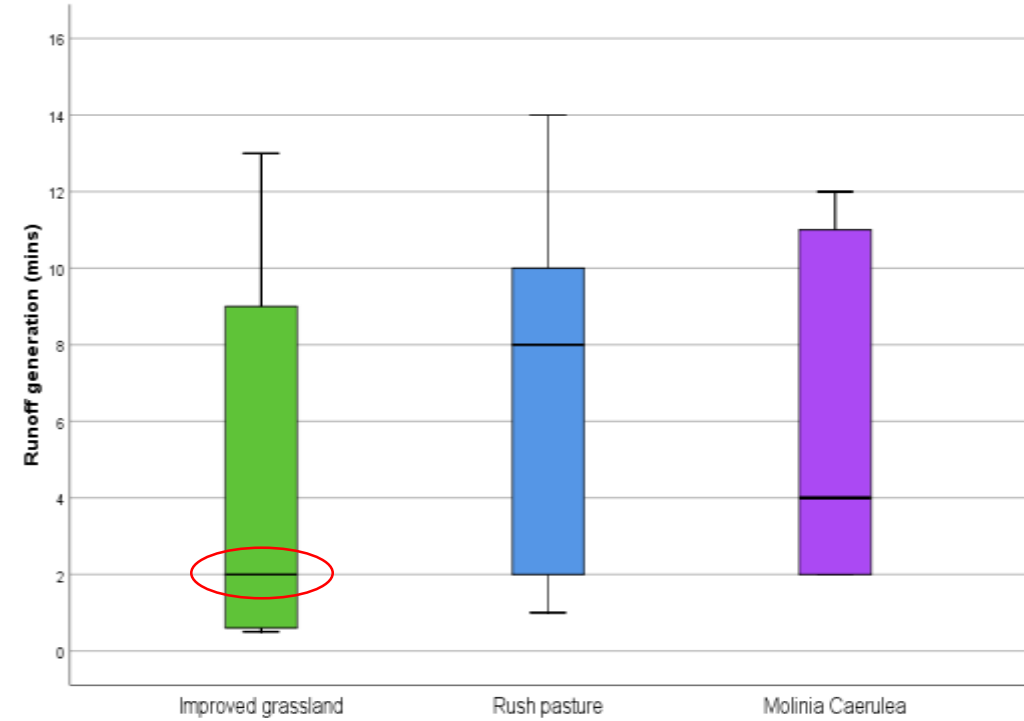
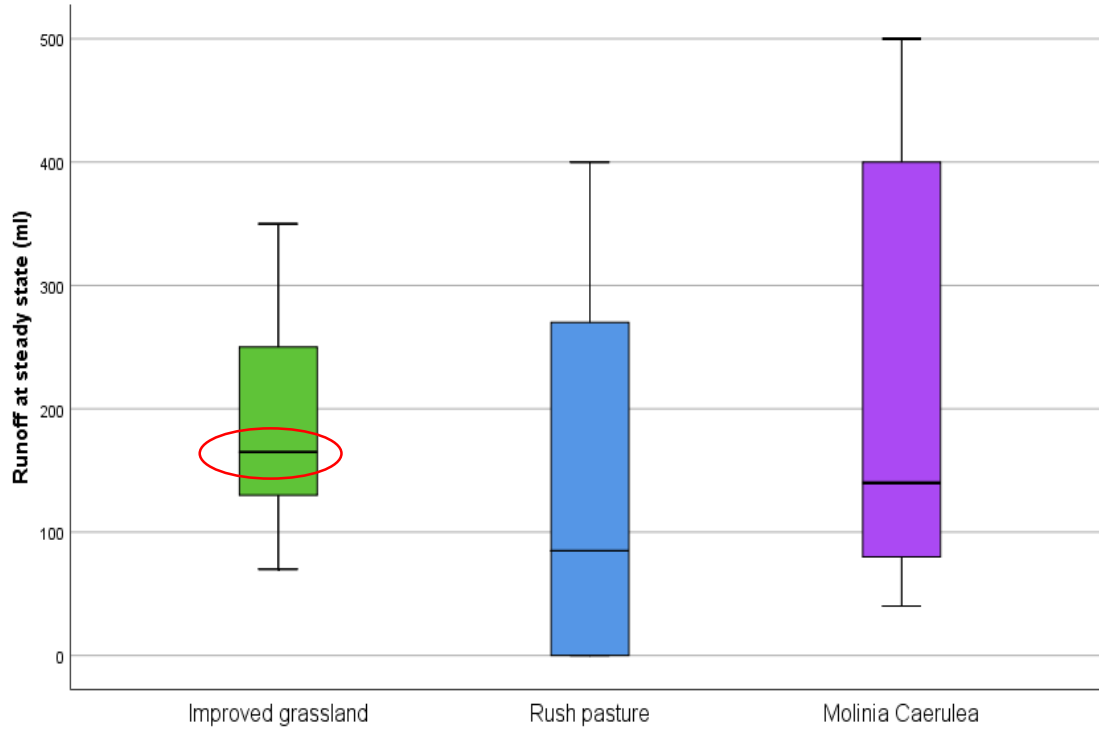


Improved grassland



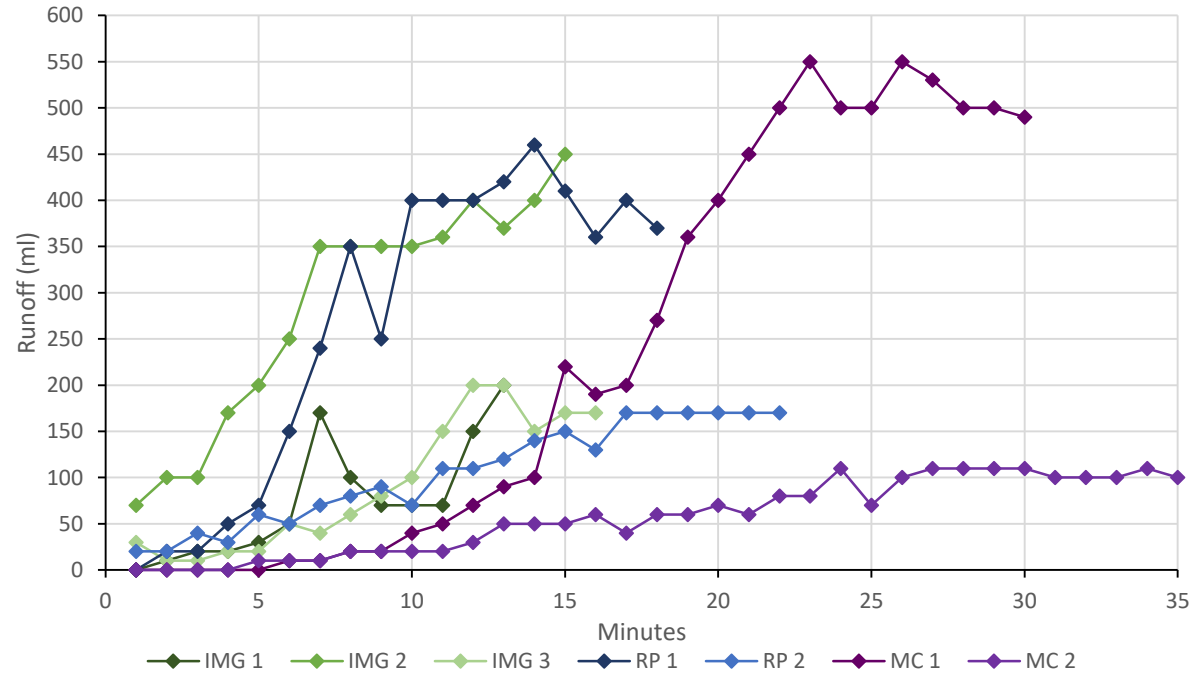
Rush pasture

Results

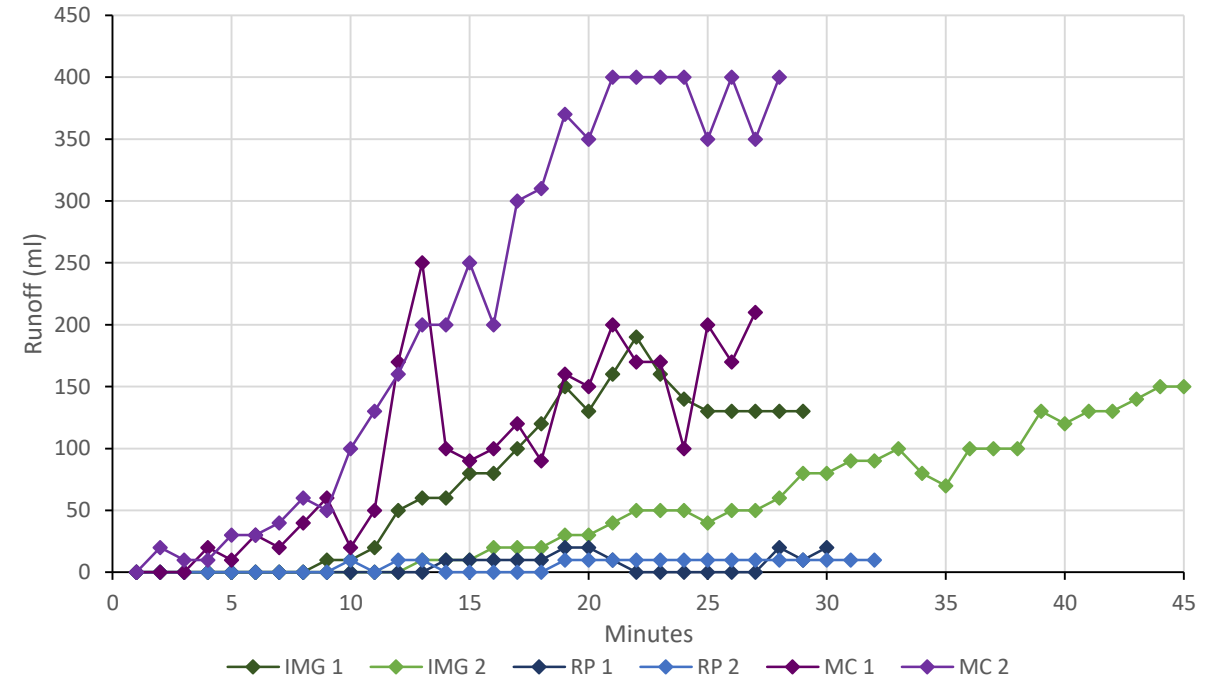


Results

Ash Moor



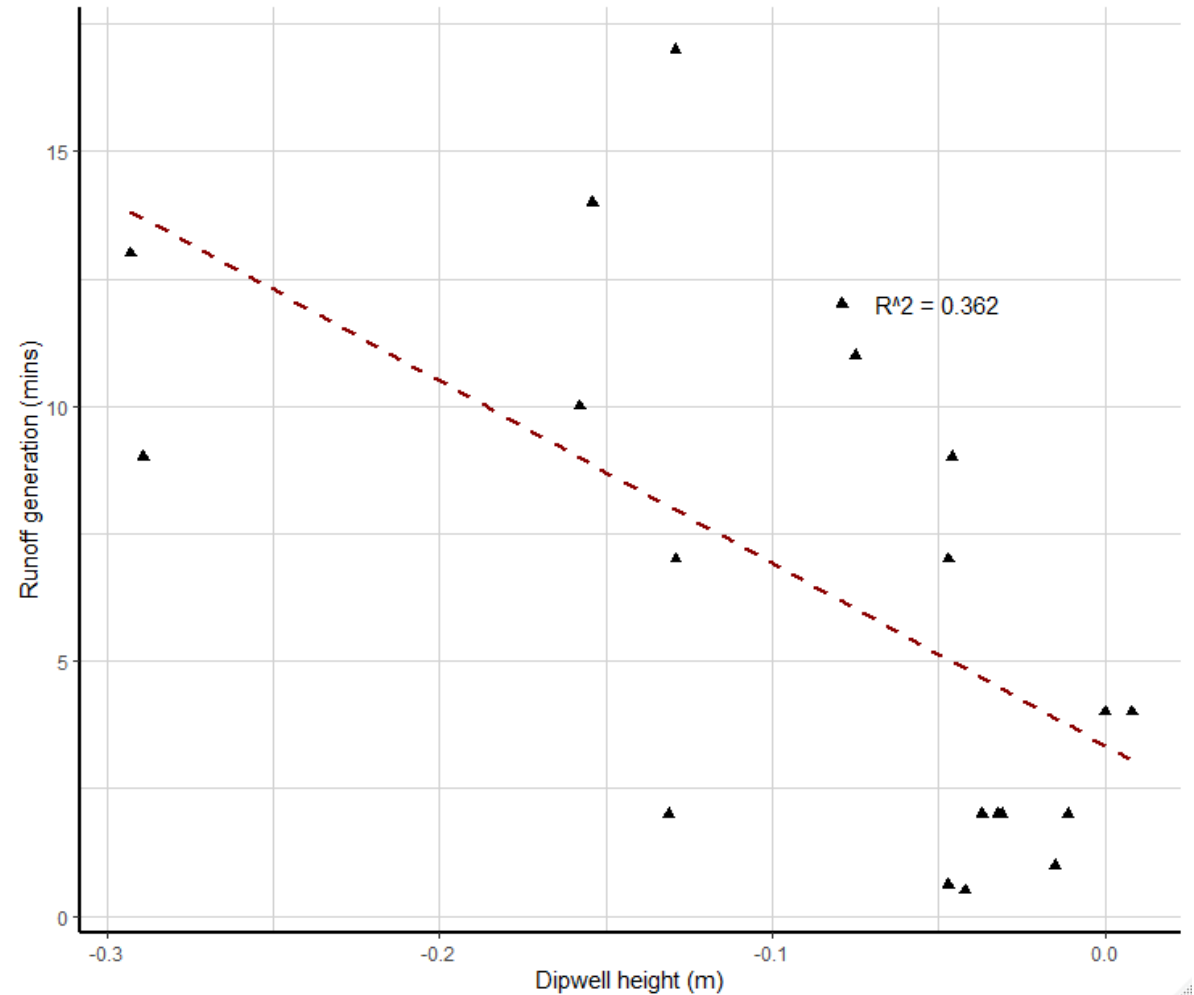
Dunsdon



Explaining patterns

Initial soil moisture

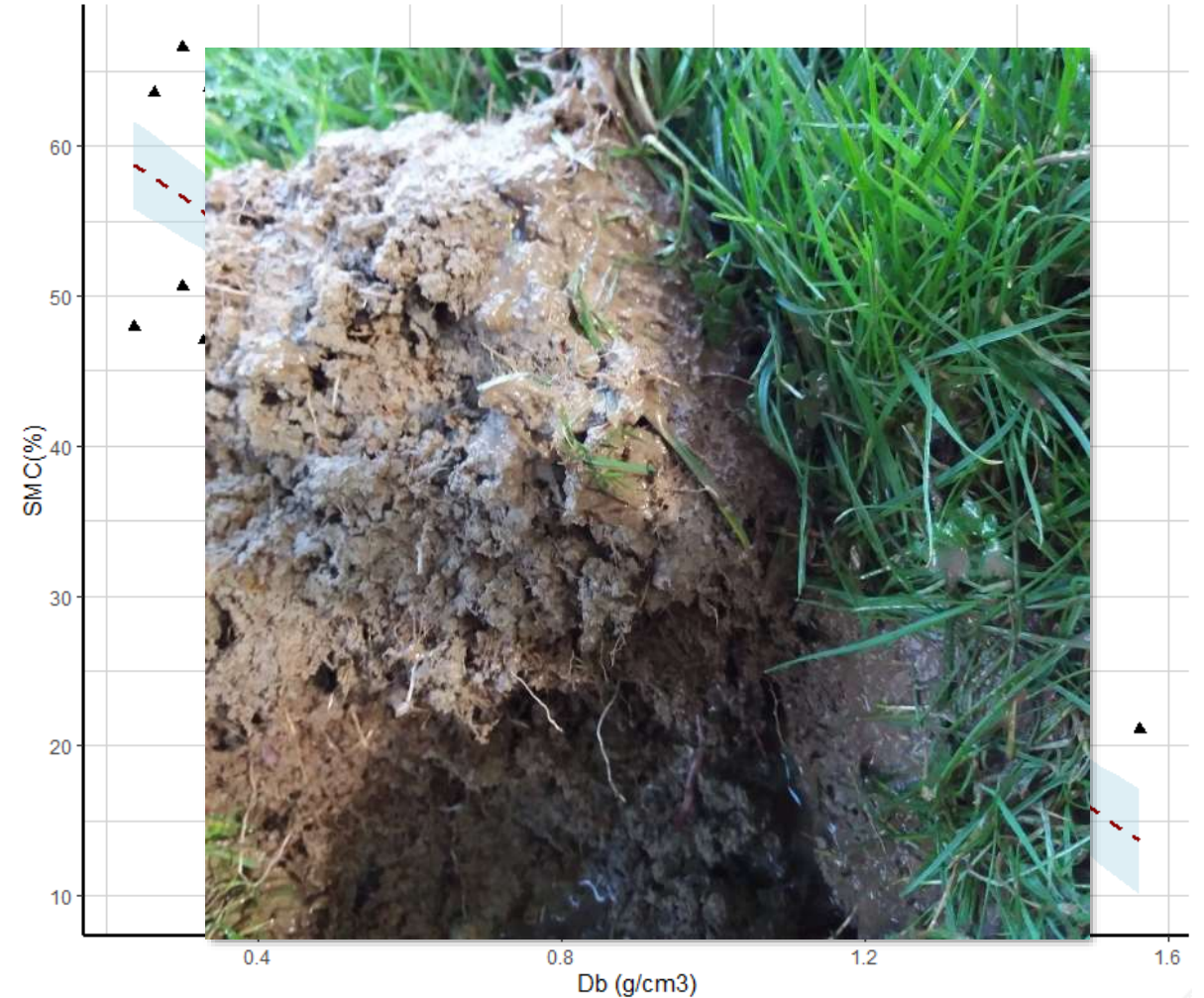
- Statistical relevant link between water table height and when runoff was generated
- *However*, no relationship between water table and runoff volume



Explaining patterns

Soil

- More compacted fields had a higher amount of runoff
- Dark organic layer in Culm grassland
- Impact of land management (present and historic)



Explaining patterns

Vegetation

- Vegetation density may explain field variability and runoff volume
- Denser vegetation means greater surface roughness and rainfall interception/uptake
- Importance of root system



Research implications

Values of runoff and point of saturation can be used in flood models

- Previously limited data
- PhD modelling in progress using these values

Land management implications:

- Soil compaction and initial moisture control runoff generation and point of saturation...
- ...but vegetation may control volume?
- Unimproved grassland restoration for flood management

Rainfall simulator method:

- Cheap and effective method, but hard work

Land management is key

Thank you

