UNCERTAIN DIFFUSE PHOSPHORUS PATHWAYS IN CATCHMENTS

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BACKGROUND

Why should we understand pathways?

For mitigation strategies

- When/where nutrients are released and transferred to the stream
- Processes along the pathways
- Time lag
- Measures for policy making

Pathways

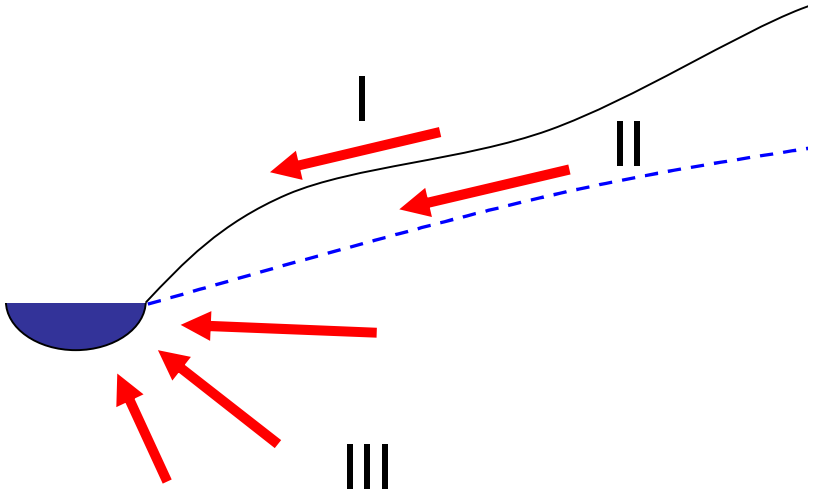
I. Overland flow (Surface runoff)

II. Interflow:

- subsoil
- perched water
- drains

III. Baseflow (Groundwater):

- weathered bedrock
- interconnected fissures
- isolated fissures



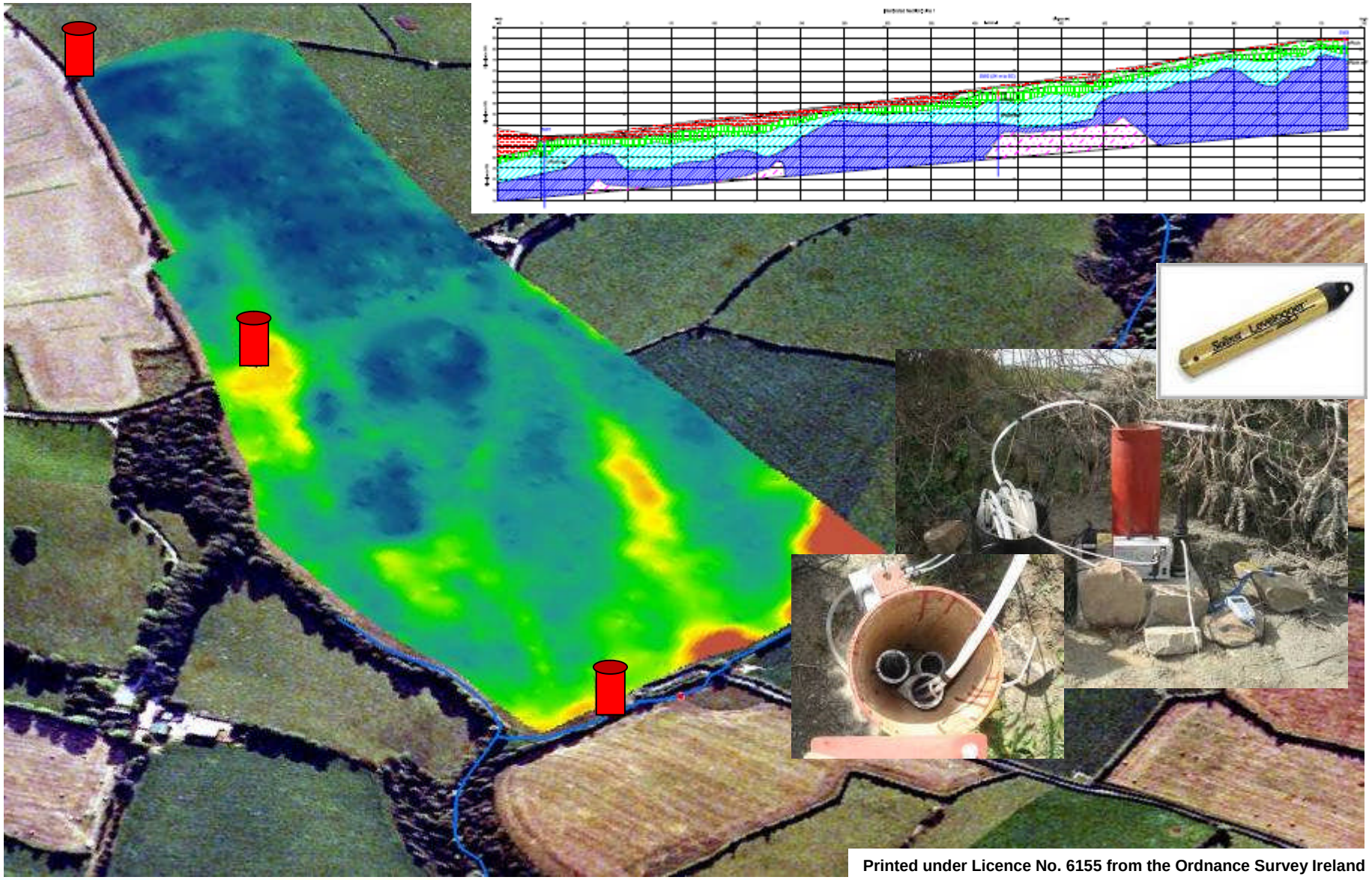
UNCERTAINTIES

I. Experimental design
   - Spatiotemporal variation in recharge, land management/sources, soil, geology and topography

II. Methods
   - Focused approach
   - Integrated approach
   - Observations and conceptual understanding

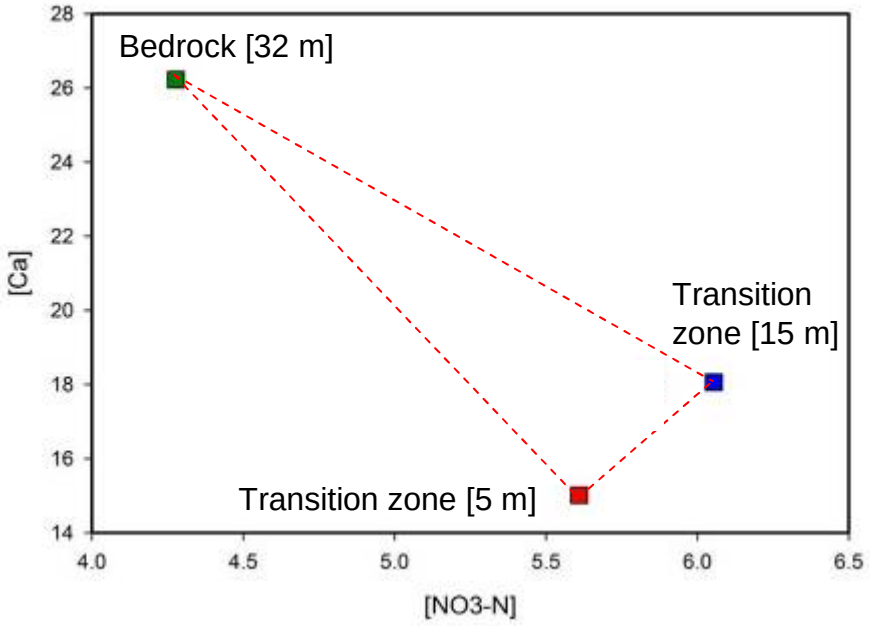
III. Interpretation
   - In-stream processes
   - Point sources

IV. Mitigation
   - Right measure?

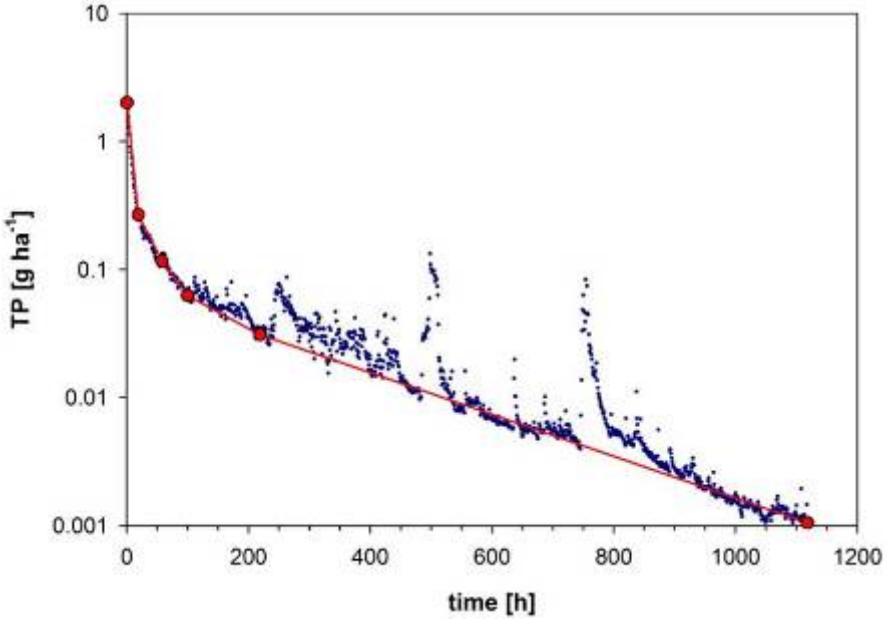


ANALYSIS
Estimation of pathways

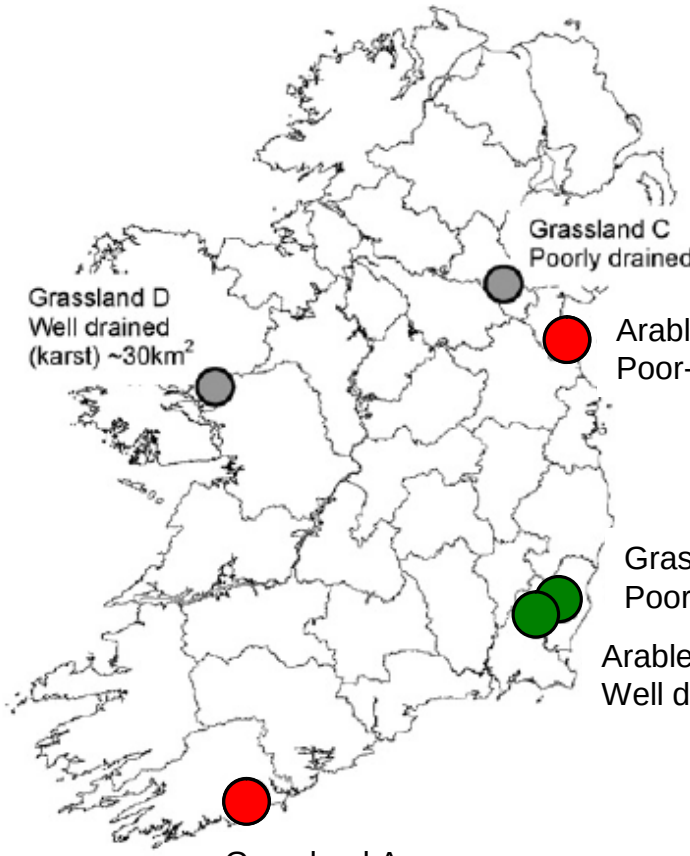
End Member Mixing Analysis

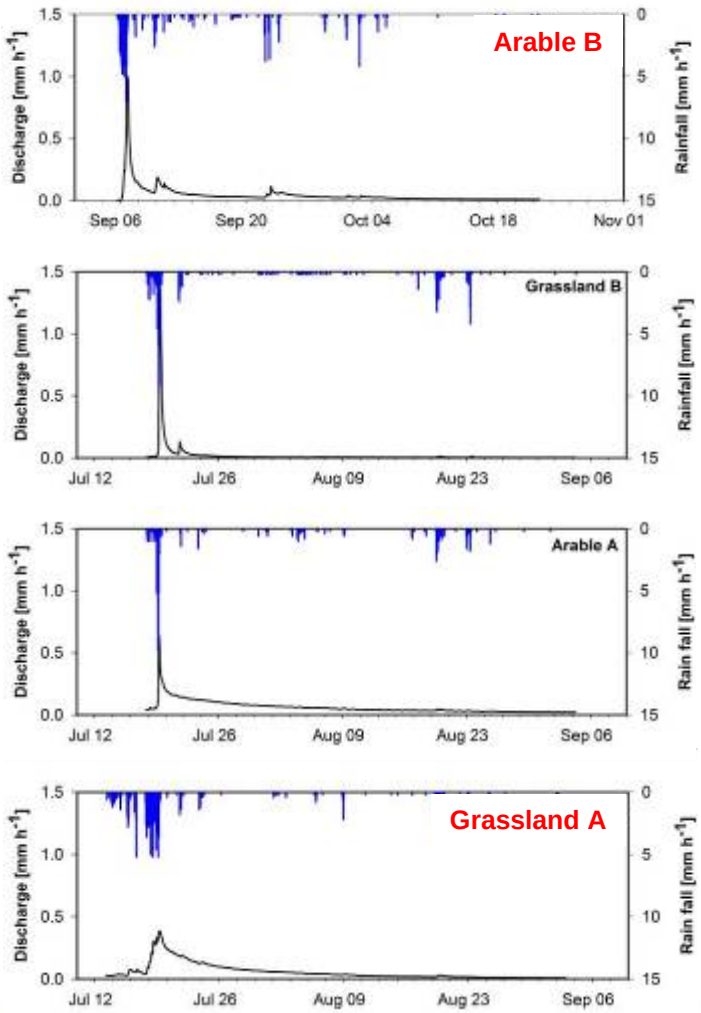


Loadograph Recession Analysis

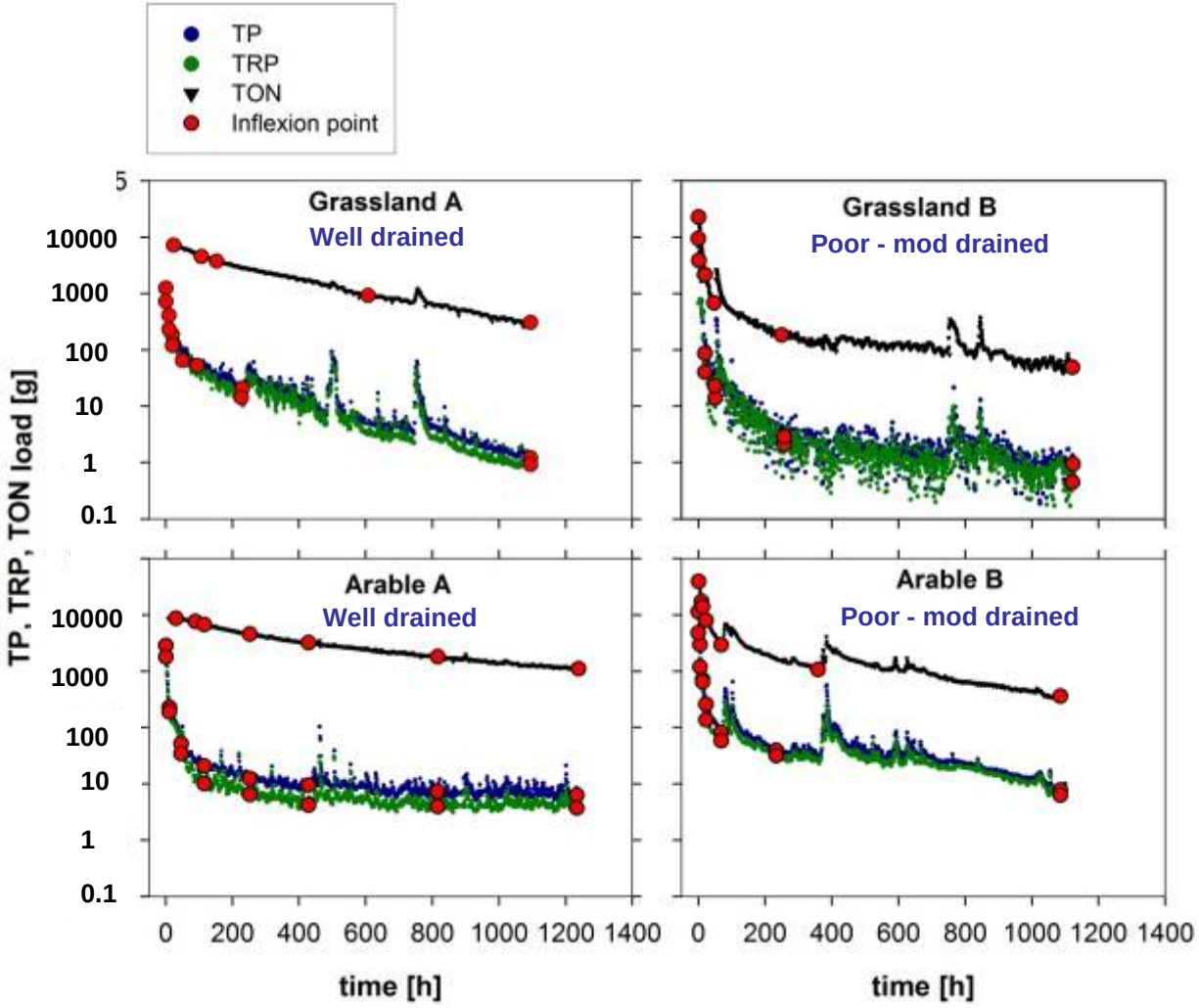


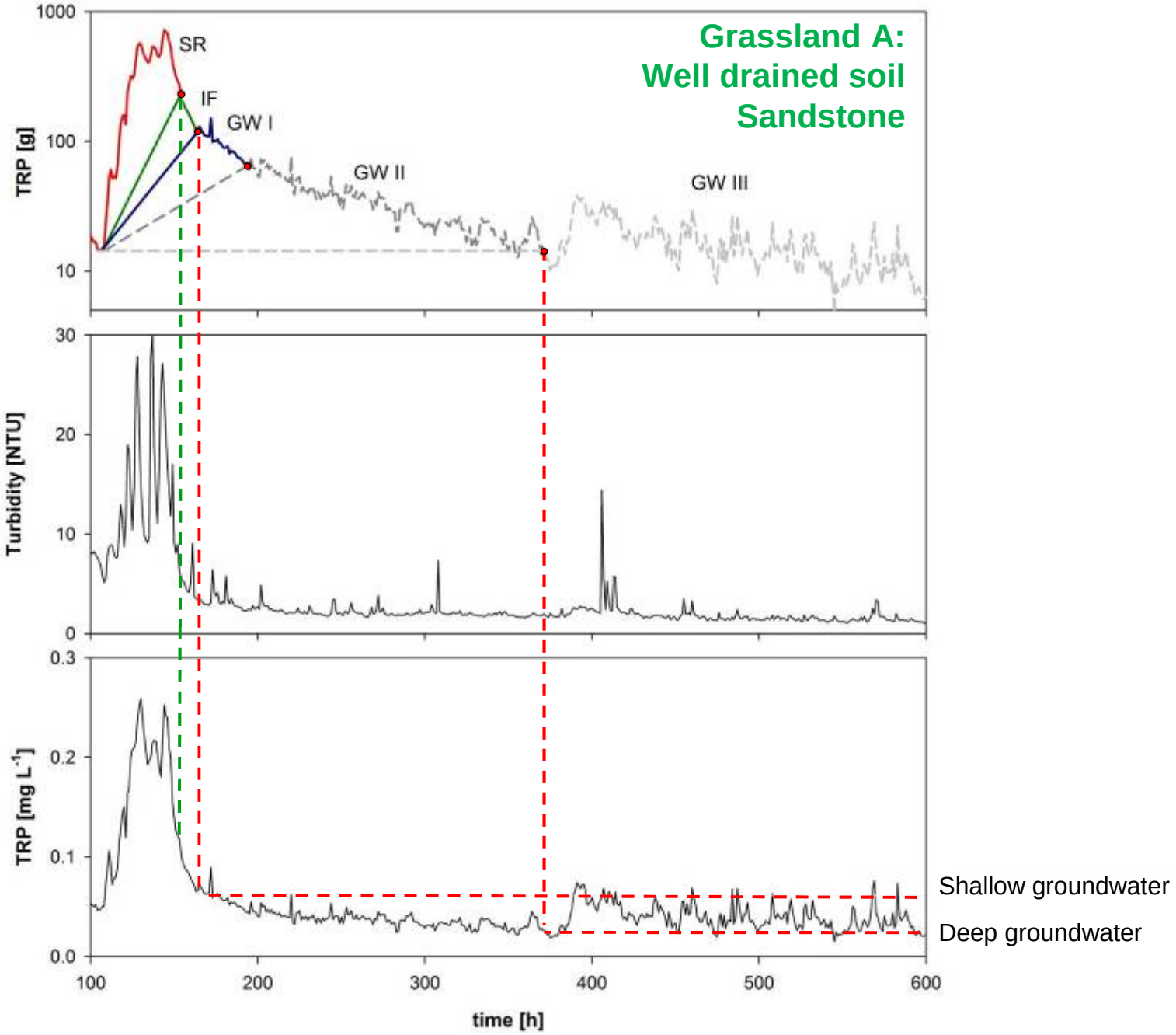
AGRICULTURAL CATCHMENTS

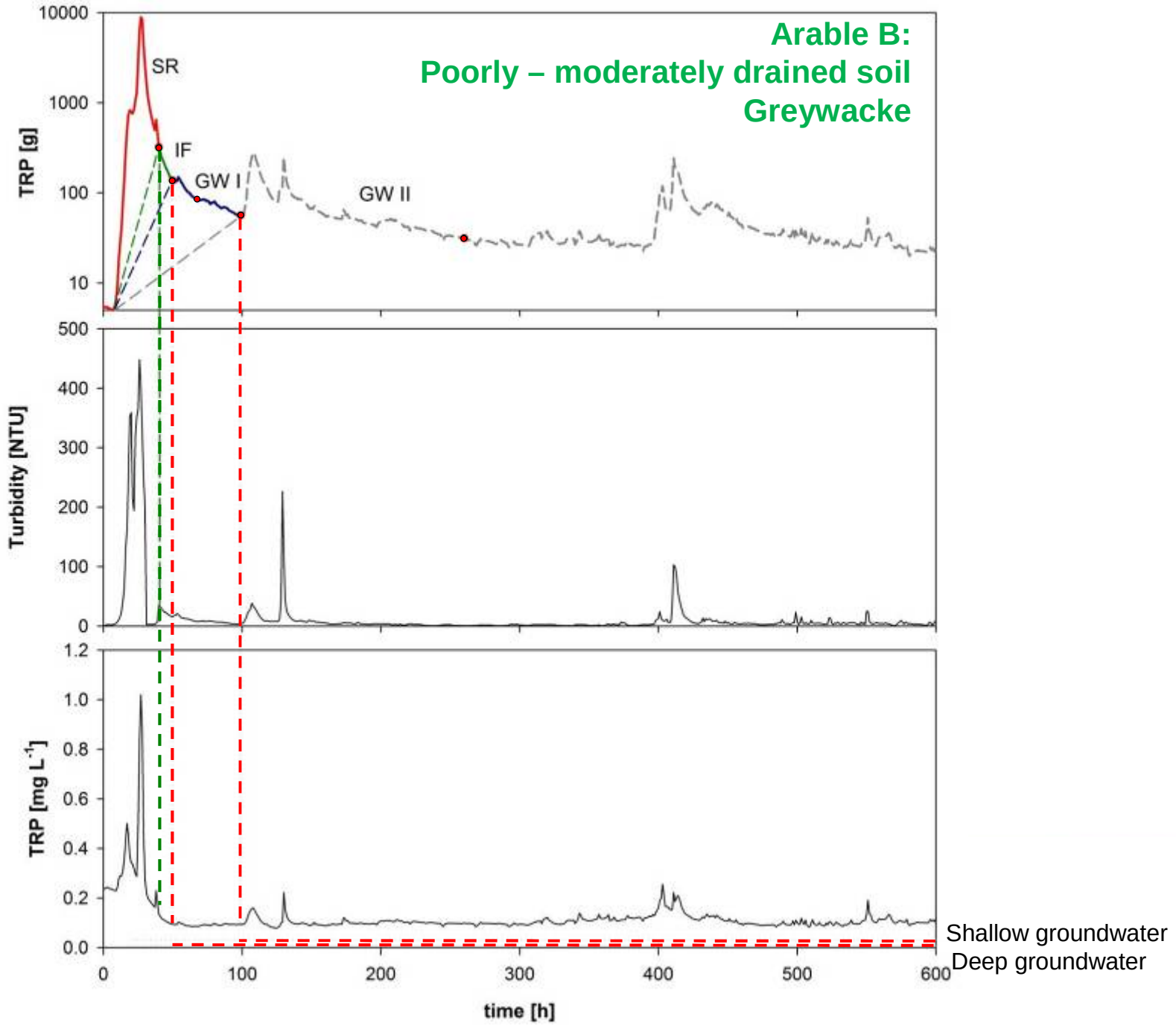




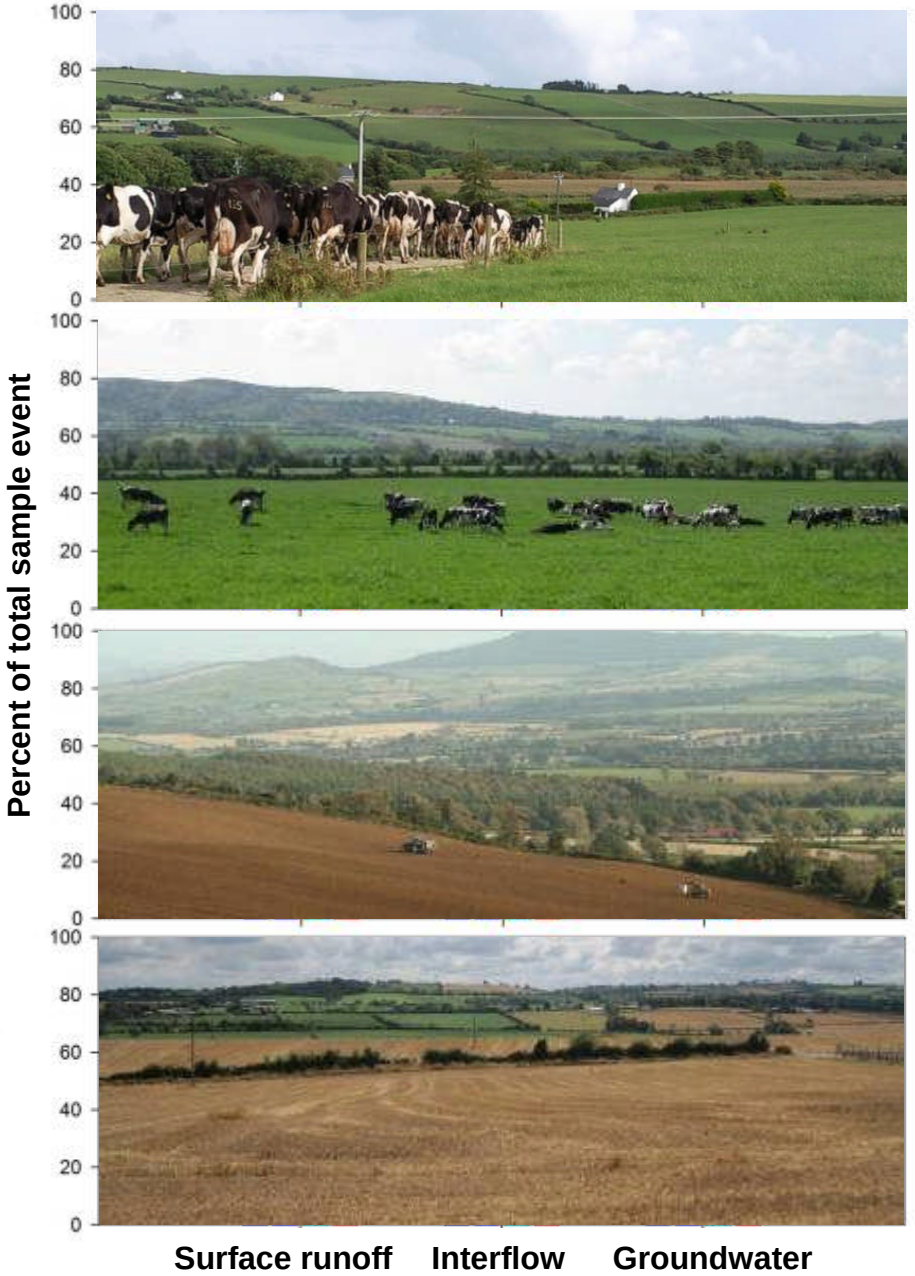
RESULTS


TP
TRP
TON
Inflexion point
Grassland A
Well drained
Grassland B
Poor - mod drained
Arable A
Well drained
Arable B
Poor - mod drained
TP, TRP, TON load [g]
10000
1000
100
10
1
0.1
0
200
400
600
800
1000
1200
1400
time [h]


Grassland A:
Well drained soil
Sandstone
SR
IF
GW I
GW II
GW III
TRP [g]
1000
100
10
Turbidity [NTU]
30
20
10
0
TRP [mg L-1]
0.3
0.2
0.1
0.0
100
200
300
400
500
600
time [h]
Shallow groundwater
Deep groundwater


Arable B:
Poorly – moderately drained soil
Greywacke
SR
IF
GW I
GW II
TRP [g]
Turbidity [NTU]
TRP [mg L-1]
time [h]
Shallow groundwater
Deep groundwater

Interpretation of pathways



Grassland A
•Well drained soil
•Sandstone and mudstone

Grassland B
•Poor-moderately drained soil
•Rhyolitic volcanic and slate

Arable A
•Well drained soil
•Slate and siltstone

Arable B
•Poor-moderately drained soil
•Calcareous greywacke and mudstone

IMPLICATIONS AND CONCLUSIONS

1. Estimating pathways requires holistic insight in processes and spatiotemporal variation
2. We introduced a method (“LRA”) to identify and quantify N and P pathways
3. Subsurface pathways need to be considered for mitigation strategies for diffuse P transfer
4. Long recession may be significant for ecological status of receiving rivers
5. Buffer strips may not be effective in reducing annual diffuse P loss – if bypassed
6. Point source mixing occurs – overestimates belowground pathway delivery

ACKNOWLEDGEMENTS

- Catchment farmers
- ACP Expert Steering Group
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