

Flood Risk: What role for natural flood management measures?

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Legislation



DIRECTIVES

DIRECTIVE 2007/60/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL
of 23 October 2007
on the assessment and management of flood risks

delivering benefits through evidence



Working with natural processes to reduce flood risk

R&D framework: science report

Report – SC130004/R2

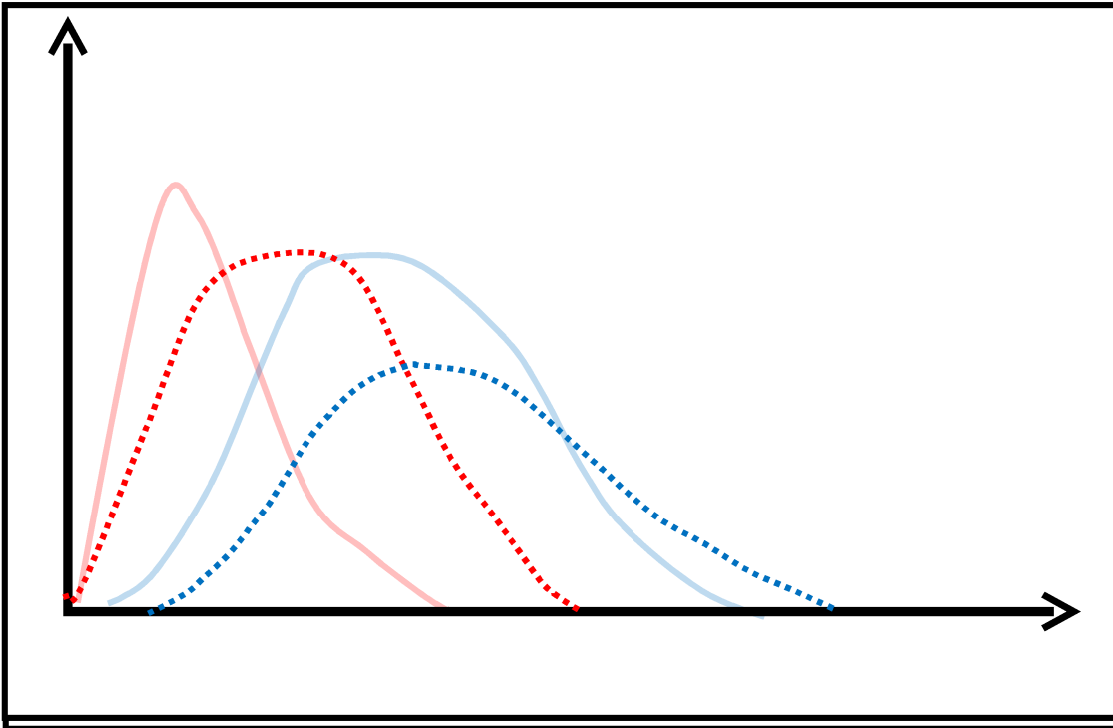
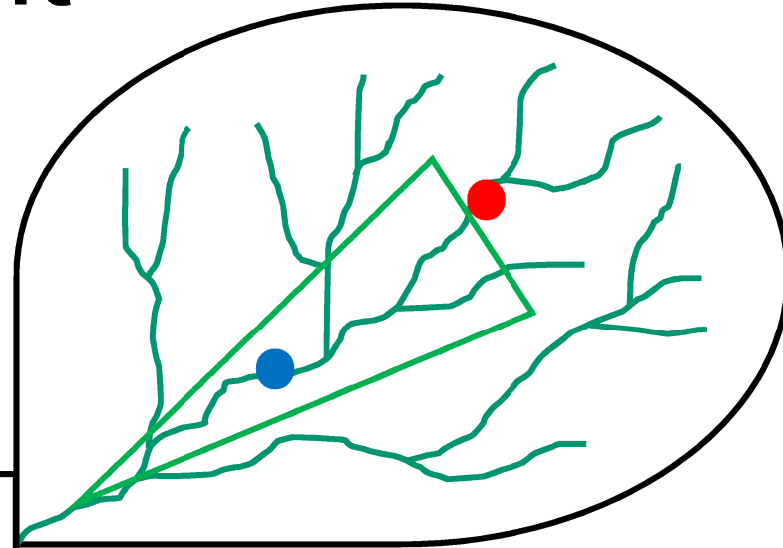


Flood Risk Management (Scotland) Act 2009
2009 asp 6

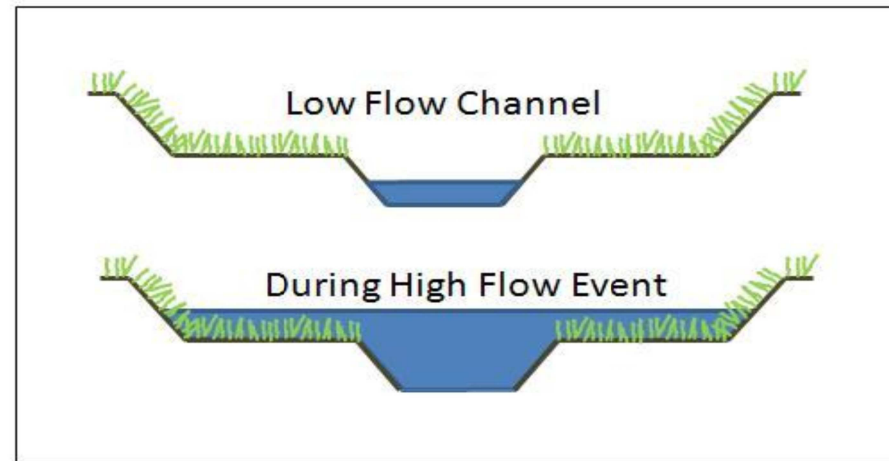
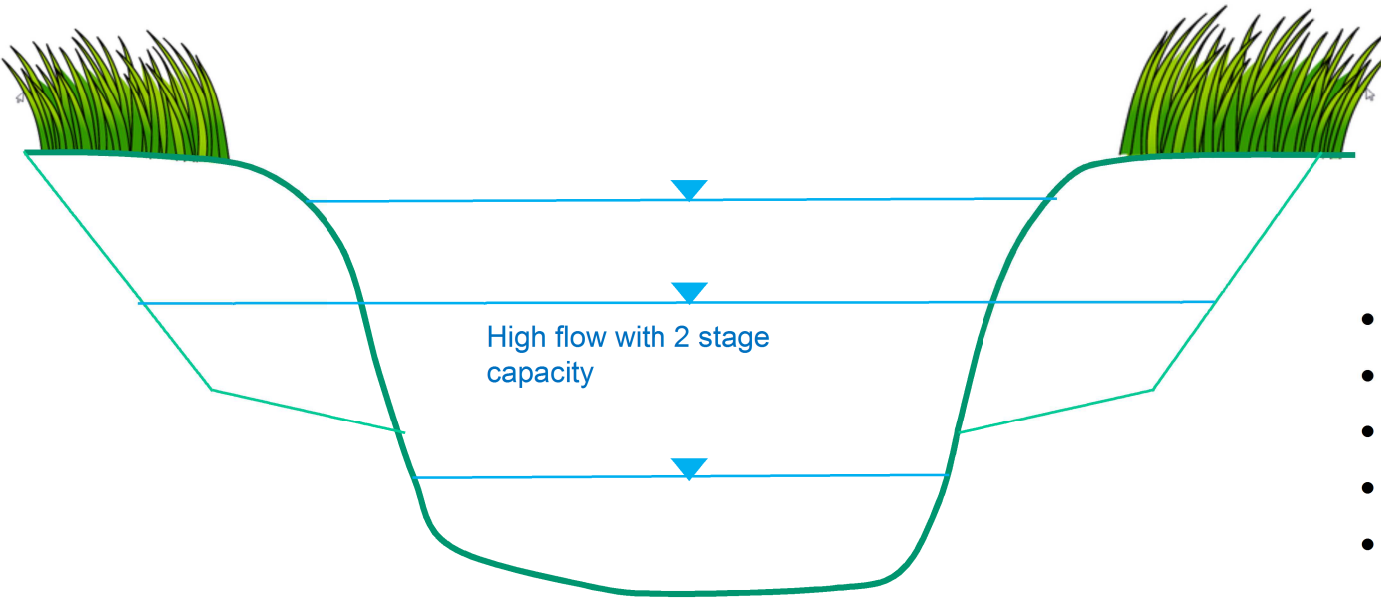


Research Gaps	
Gap 5	New studies to improve evidence base
Gap 7	Experimental studies of WWNP

Natural Flood Management



Two-Stage Channels

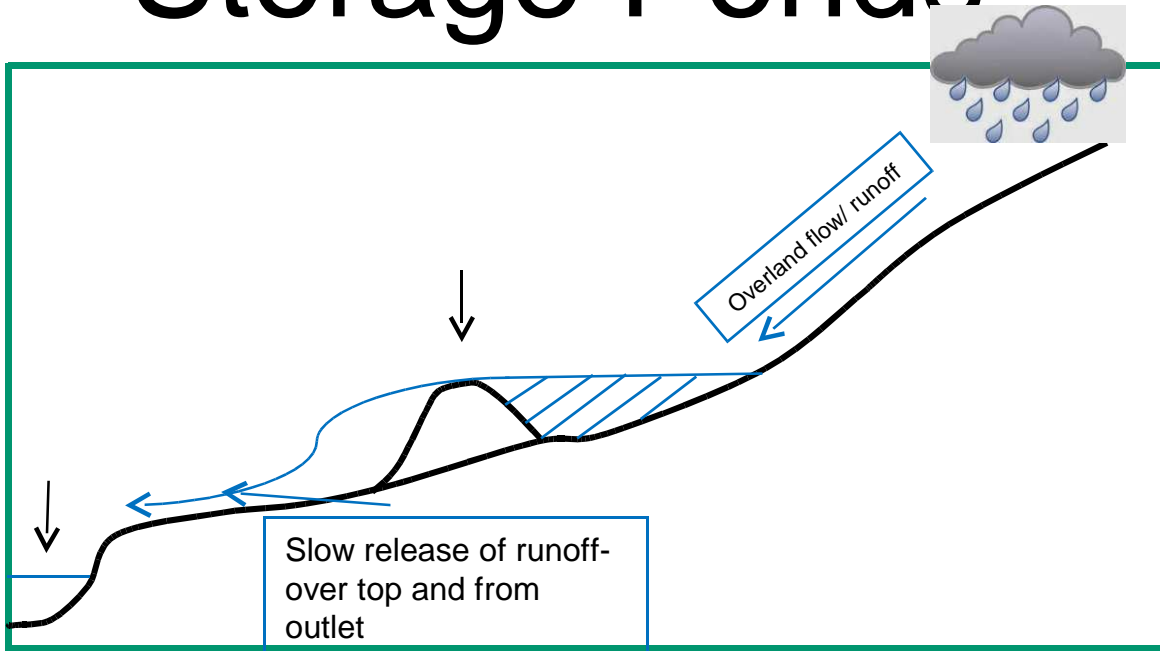


Riparian Buffer Strips/ Fencing Off

- How it works
- Advantages
- Disadvantages
- Multiple benefits
- Where might it be



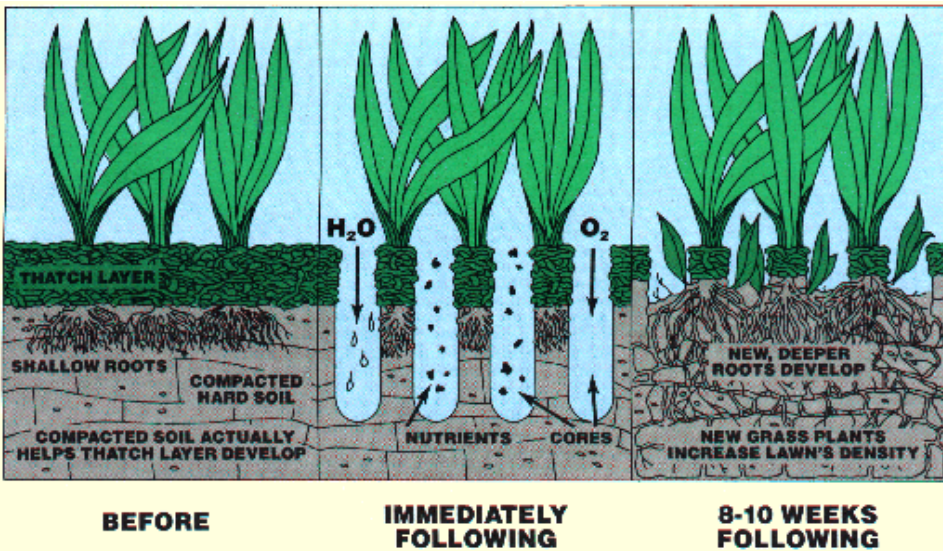
Storage Ponds



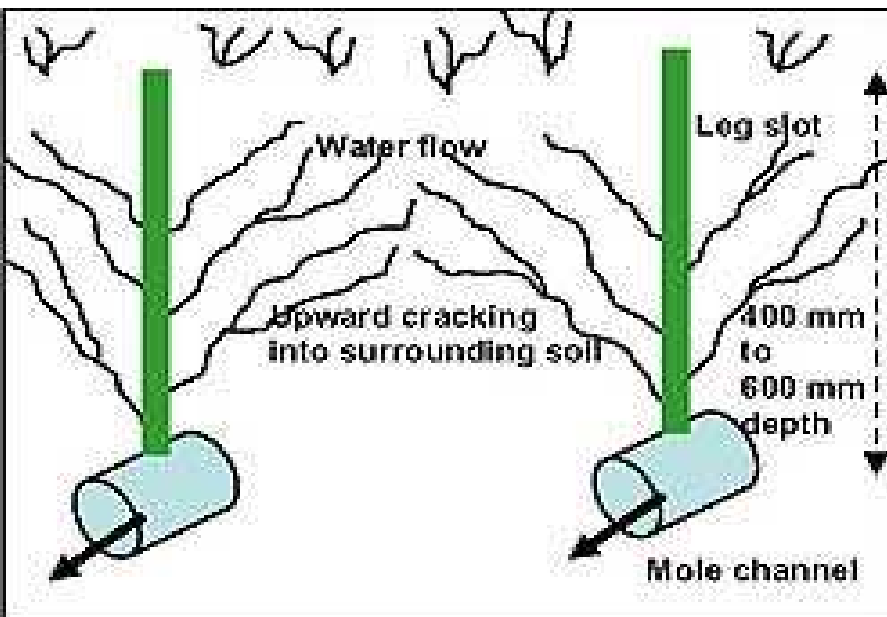
- How it works
- Advantages
- Disadvantages
- Multiple benefits
- Where might it be



Soil Aeration / Mole Ploughing



- How it works
- Advantages
- Disadvantages
- Multiple benefits
- Where might it be used?



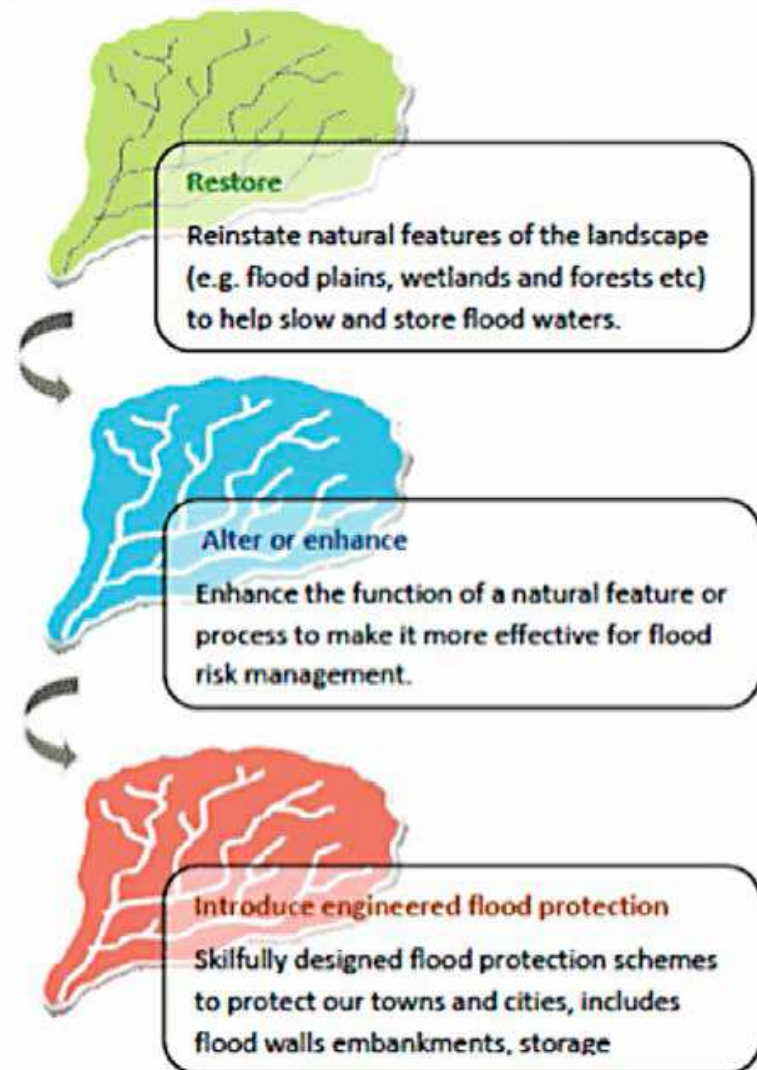
Tree Planting/ Upland Planting



- How it works
- Advantages
- Disadvantages
- Multiple benefits
- Where might it be



Justifying Investment



- Natural Flood Management (NFM)
- Multiple benefit/ Ecosystem approach
- We need more evidence and integration of disciplines

Evaluation methods

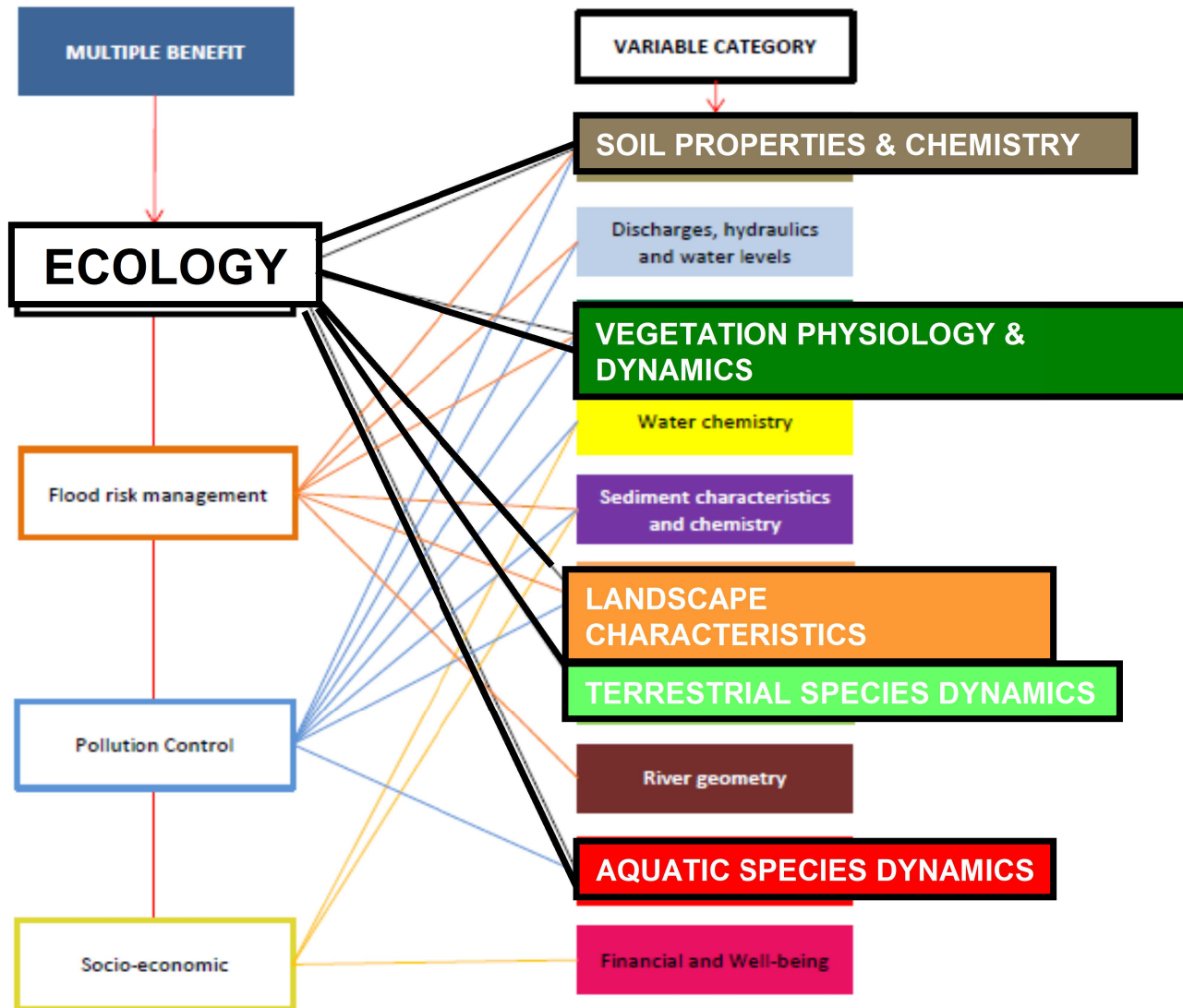


BENEFIT CATEGORY	SPECIFIC RAF BENEFITS	VARIABLES		LITERATURE
Hydraulics/ Hydrology	<ul style="list-style-type: none"> Water storage Groundwater recharge Disconnection, interception and 	<ul style="list-style-type: none"> Vol. of water storage capacity Time to peak Peak/ stage/ bank full discharge 	<ul style="list-style-type: none"> Soil infiltration rate & compaction Channel geometry Overbank area wetted by flood Rate of sediment build up behind RAF Land use Soil moisture/ groundwater level Temp. (water) Evaporation rate (diurnal and seasonal) Hydrological pathways (seasonal) Drainage & irrigation connectivity 	(Frontier Economics Ltd et al. 2013, N Barber, J and P. F Quinn 2012, Nicholson et al. 2012, Owen et al. 2012, Wilkinson et al. 2010b, Wilkinson et al. 2010a)
	<ul style="list-style-type: none"> attenuating peak flows. Flood risk reduction properties 	<ul style="list-style-type: none"> Soil type & structure Geology Residence time (in RAF) Vol. rainfall/ time 		
Ecology/ Habitat/ Biodiversity	<ul style="list-style-type: none"> Habitat cre Landscape heterogeneity Biodiversity 	<ul style="list-style-type: none"> structure, presence and population 	<ul style="list-style-type: none"> Signings of migratory birds Population of migratory birds 	(N Barber, J and P. F Quinn 2012, Morris et al. 2008, Jonczyk et al. 2008)
Pollution Control	<ul style="list-style-type: none"> Nutrient cycling- N, P, C, S & pathogens (denitrification & carbon sequestration) 	<ul style="list-style-type: none"> Soil type/structure/ profile/ distribution/ nutrient retention capacity 	<ul style="list-style-type: none"> Crop species & cultivation practices Organic matter 	(Frontier Economics Ltd et al. 2013, N. J
Sediment Trapping	<ul style="list-style-type: none"> Filtration of diffuse pollution, heavy metals & contaminants (fertilisers/ pesticides/ herbicides/ pathogens) Mitigates periodic nutrient release incidents Improved water quality (likely) 	<ul style="list-style-type: none"> Soil moisture & chemistry (N, NO₃-N, PO₄-P, pH, N, P, Ca, Mg, Si, S and Ca) Land use & stock density nutrient sources- proximity and connectivity Hydrological pathways 	<ul style="list-style-type: none"> Fertiliser/ pesticides/ herbicide application- type, volumes, concentrations, spatial extent, timing of application Temp. (water and soil) Macroinvertebrate indicator species 	Acreman 2004, Jonczyk et al. 2008, Nicholson et al. 2012)
Socio-Economic	<ul style="list-style-type: none"> Aesthetic appeal Re-use of sediment Reduce costs of the impact of flooding on local communities. 	<ul style="list-style-type: none"> Equivalent cost of fertiliser for sediment re-use Cost of flood impacts (when they occur) 	<ul style="list-style-type: none"> Number of properties at flood risk Cost of flood insurance Equivalent savings on water treatment due to improved water quality 	No relevant literature

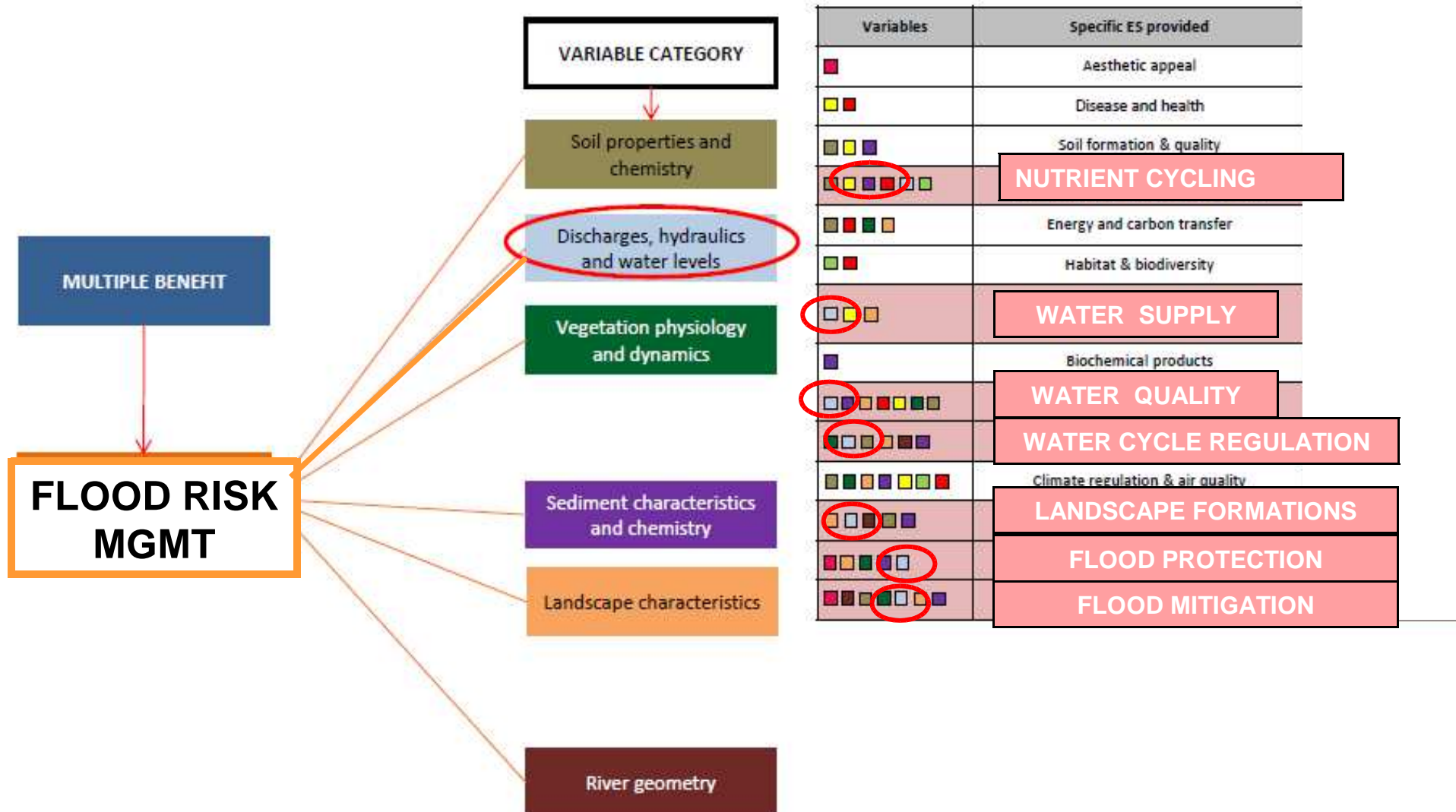
Extensive literature review- variables

Collation of variables into categories

Creation of the navigation diagram



How Does it work?



Initial tool evaluation



Simplifies and **identifies** complex relationships and linkages

Assists in **evaluating** the most realistic **approach** to adopt for a monitoring strategy

Inform appraisal of NFM measures

Multi-functional- applied by various backgrounds (social, economic and environmental)

Identifies **overlaps** where data can have multiple purposes

A useful tool for flood engineers with other discipline interests

Requires a mechanism to account for **spatial and temporal** scales

Needs to incorporate each NFM measures' **ability to reduce flood risk** (scoring system?)

Open to **bias** and requires **subjectivity** and **expertise**

A work in progress....and will require further use to cover all NFM measures

delivering benefits through evidence



Working with natural processes to
reduce flood risk

R&D framework: science report

Report – SC130004/R2

Flood and Coastal Erosion Risk Management Research and Development Programme

delivering benefits through evidence



Aquatic and riparian plant management:
controls for vegetation in watercourses

Technical guide

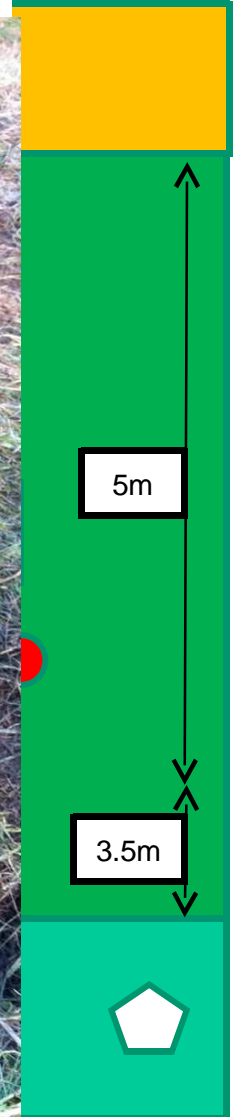
Project: SC120008/R2

Flood and Coastal Erosion Risk Management Research and Development Programme

Research Gaps	
Gap 5	New studies to improve evidence base
Gap 7	Experimental studies of WWNP

Lack of research on riparian buffers
that directly look at hydrology and the
implications for flooding

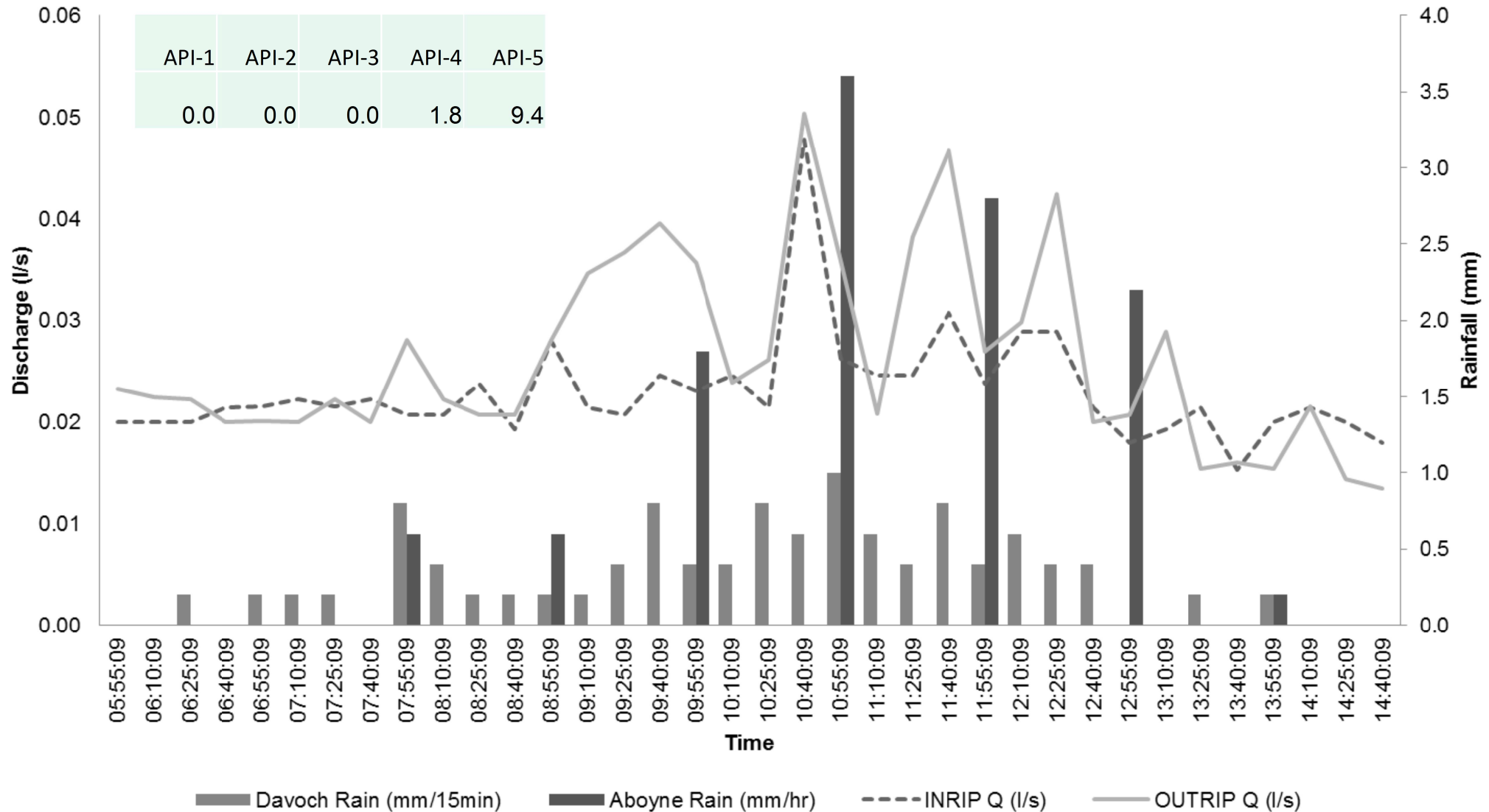
Experiment design



PRELIMINARY RESULTS- RUNOFF outrip > inrip



5 September Event: Rainfall & Runoff



CONCLUSIONS

- Buffer reduces runoff more often than not.
- There are “transitional events”: showing a threshold of effectiveness?
- Why is INRIP higher sometimes?
- Relationships/ behaviour between soil and runoff needs further analysis

Thank You