



Land-use, Sediment and Flood Risk

delivered by:

Colin Thorne, Nottingham University

on behalf of:

FRMRC Sediment Research Team



How much does Land-use affect sediment yield?



Catchment Sediment Yields: natural vs intensive pasture



Melin-y-grug



Pen-y-cwm



Pontbren Experimental Catchments

Coarse sediment yield
12x greater

Fine sediment yield
5x greater

Most excess sediment generated from *within* channel network



Increased Sedimentation in Engineered vs Natural Channels

River Wharfe: sedimentation in engineered channels can lead to significant increases in flood risk. Review of Foresight on Future Flooding commissioned by Sir Michael Pitt (Evans et al., 2008) stated that:

“approximately a year and a half of aggradation produced an increase in the flooded area equivalent to nearly half a century of the impact of climate change on catchment runoff.”

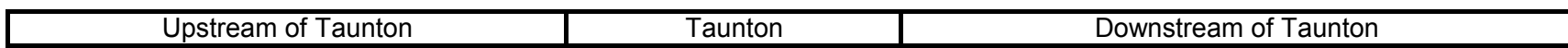
E.K Raven et al. 2010. Understanding sediment transfer and morphological change for managing upland gravel-bed rivers. Progress in Physical Geography 34(1) 23-45.





Land use and Sediment Dynamics in the River Tone

Sediment Yield (Best Fit with limits)



Halse Water



Bishops Hull GS

Upper River Tone

Elevated sediment yields

Localised coarse sedimentation

Complex fines deposition – especially at structures



Options for Modelling, Predicting and Managing Sediment-Related Flood Risk



Upstream of Taunton Taunton Downstream of Taunton

CAESAR – Cellular Automaton Evolutionary Slope and River model

90 T/k
8,000 (estim.)

75 T/k
15,000 (SS No)

CAESAR: Cellular Automaton Evolutionary Slope And River model, version 5.1 (pb.aml)

Project: Hawkcombe 30-10-06 Best SIAM
 Plan: Plan 16-01-06
 Geometry: Most Accurate data - broken back
 Steady Flow: Correct flow
 Unsteady Flow:
 Hyb Design: bedform

River	Station	Elevation
1 Hawkcombe	0	200.89
2 Hawkcombe	11.17	200.85
3 Hawkcombe	14.15	200.53
4 Hawkcombe	14.76	199.47
5 Hawkcombe	22.53	199.42
6 Hawkcombe	23.2	200.82
7 Hawkcombe	27.13	201.54
8 Hawkcombe	29.82	202.2
9 Hawkcombe	10	
10 Hawkcombe	11	
11 Hawkcombe	1	
12 Hawkcombe	1	
13 Hawkcombe	1	
14 Hawkcombe	1	
15 Hawkcombe	1	
16 Hawkcombe	1	
17 Hawkcombe	1	

Downstream Reach Lengths
 LOB Channel ROB
 10 10 10

Channel Bank Settings
 Left Bank Right Bank
 11.17 23.2

Channel Conditions
 Contraction Expansion
 0.1 0.3

WP 5.2

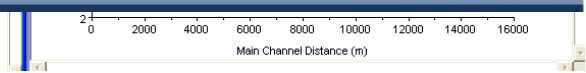


Assessment Method



Some schematic data outside default extents (see View/Set Schematic Plot Extents...)

TEC-RAS/SIAM





How does sediment management affect Nature?



Value of Nature

Ecosystem Services

Supporting



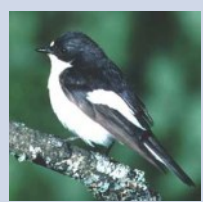
Provisioning



Regulating



Cultural



Ecosystem services, including flood regulation, often involve stocks and flows of material or individuals across landscapes: water, soil, carbon, organisms

The areal extent and spatial configuration of landscape features (trees, ponds, wetlands) affect these flows and hence the provision of services

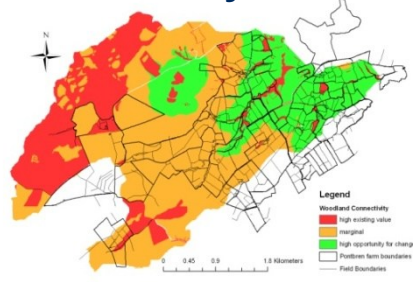
Change in land use or sediment management and impacts on landscape features affect multiple ecosystem services



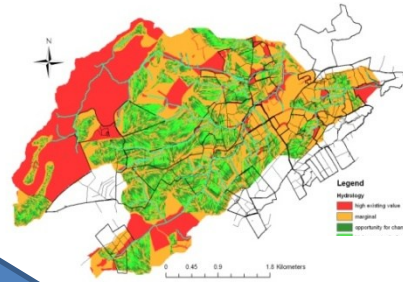
POLYSCAPE

Multi-functional Land-use Management areas are beneficial to all services

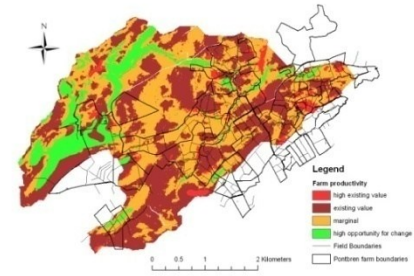
Habitat Connectivity



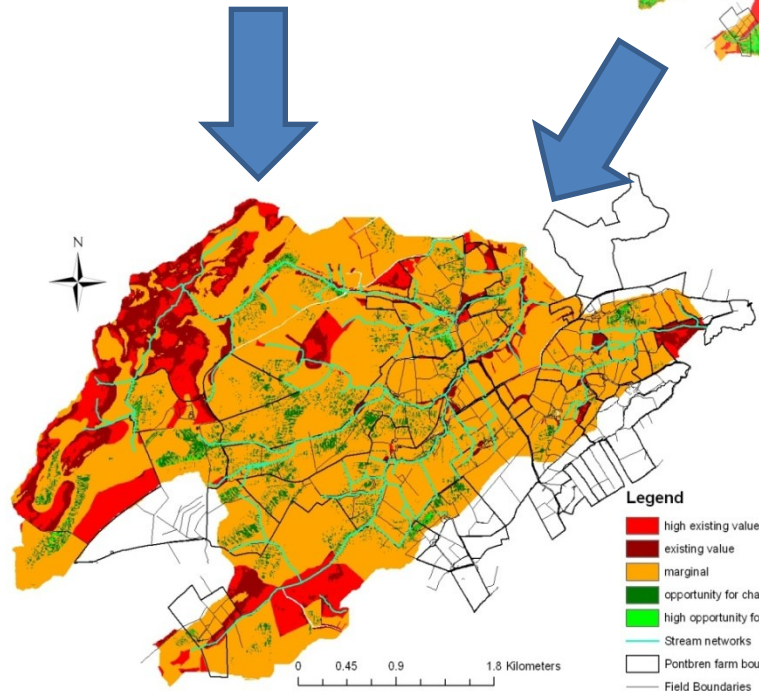
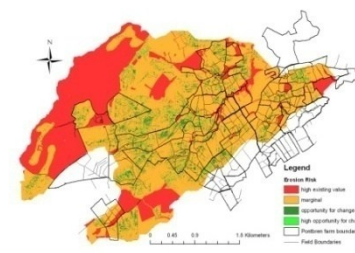
Hydrology



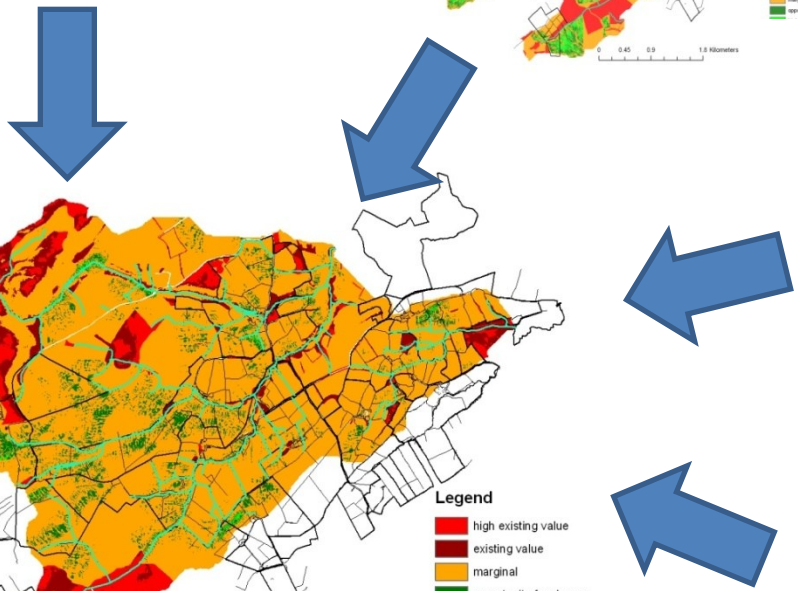
Farm productivity



Sediment



Trade off Layer





1. Sediment-related flood risks and damages are significant.
2. Land use management can substantially increase or decrease sediment-related flood risks.
3. Unless we act, future sediment impacts are likely to increase due to climate change.
4. Sediment management for flood risk reduction must be aligned with environmental legislation.