

A scenic landscape photograph of a river flowing through a forested valley. The river is in the foreground, surrounded by rocks and lush green vegetation. In the background, there are rolling hills and mountains under a clear sky.

Woodlands and NFM

David Hetherington

Arup Associate
Global Water Research
Manager

Woodland Creation Conference

Thursday 21st June 2018 - Harrogate

Running Order

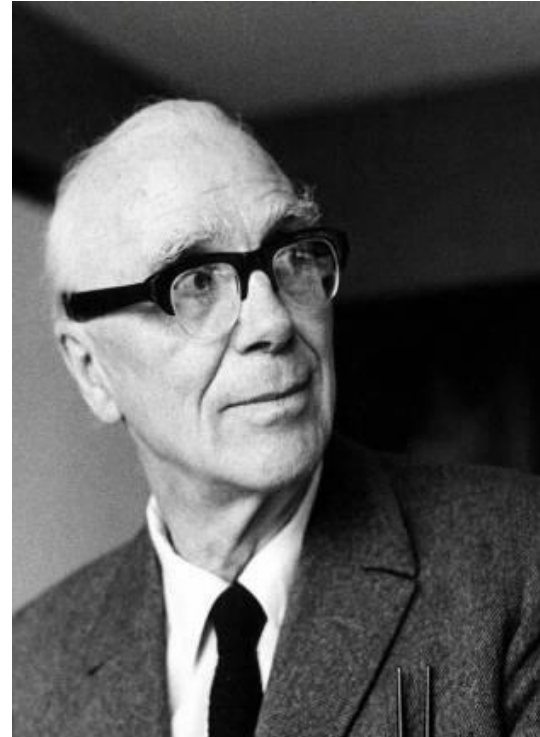
1. Arup
2. Natural Catchments, Woodland and Rivers
3. Artificial Processes
4. Catchment and Woodland Process Restoration
5. Woodland and NFM
6. Conclusions

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About Arup

'Arup is an independent firm of designers, planners, engineers, consultants and technical specialists, working across every aspect of today's built environment'.

- **Sir Ove was born in Newcastle in 1895 (Raised in Jesmond)**
- **Founded Ove Arup in 1946**
- **Local offices in York, Leeds, Newcastle and Stockton.**
- **Now operates around the globe to Ove's values (appx 14000 staff)**
- **Independent, staff owned and held in trust.**



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Famous Geordies

**Admiral Lord Collingwood. Alan Hull. Alan Plater. Alex Glasgow. Ant
And Dec. Alan Shearer. Basil Bunting. Bob Stokoe. Bobby Charlton.
Bryan Ferry. Brian Johnson. Brendan Foster. Bruce Welch. Cardinal
Basil Hume. Capability Brown. Charles Sheridan Swan. Catherine
Cookson. Chas Chandler. Cheryl Tweedy. Donald Brothers. Denise
Welch. Dame Flora Robson. Donna Air. David Scott Cowper. Eric
Burdon. Emily Davies. Eric Idle. Geordie Ridley. George Hunter.
Grace Darling. George Stephenson. Hank Marvin. Harry Clasper.
Heather Mills. Hilton Valentine. Ian Le Frenais. Jack Charlton. Jayne
Middlemiss. Jimmy Nail. Jackie Milburn. John Martin. John Wilson
Carmichael. Jill Halfpenny. Kevin Whately. Lawrie McMenemy.
Michael Chaplin. Mike Neville. Miriam Stoppard. Myles Birket
Foster. Neil Tennant. Ove Arup. Paddy McAloon. Paul Gascoigne.
Peter Beardsley. Richard Grainger. Ridley Scott. Robert Stephenson.
Robson Green. Ross Noble. Rowan Atkinson. Simon King. Sid
Chaplin. Sting. Steve Cram. Sir John Hall. Thomas Bewick. Tim
Healy. Timothy Hackworth. Tom Hadaway. Tom Graveney. Venerable
Bede. William Armstrong. William Hedley... and Ma.**

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Famous Geordies

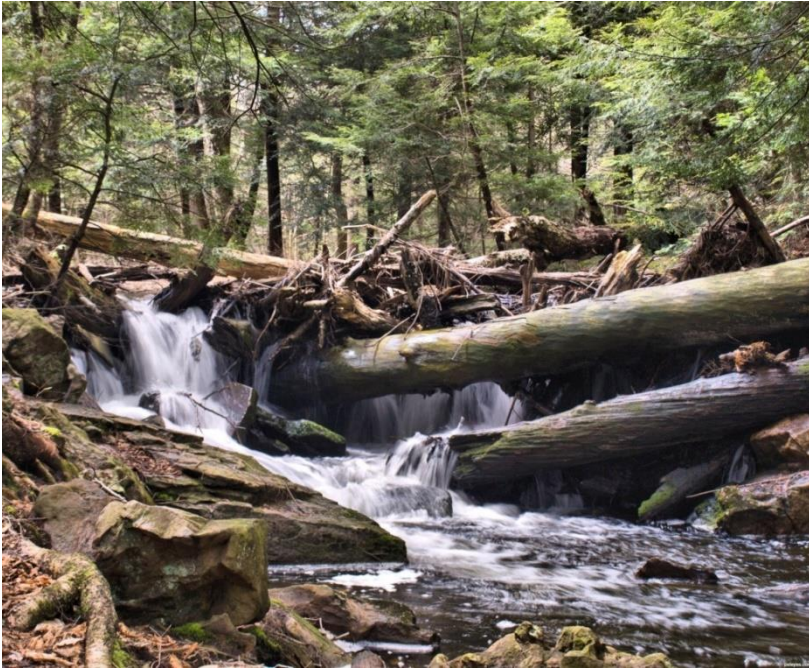
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Why are we no longer resilient?



Wilderness forest rivers – forest typologies

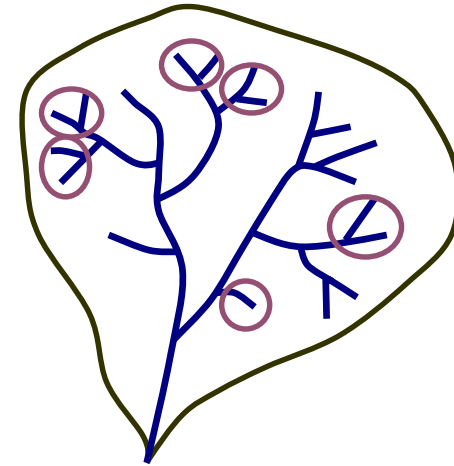


Images from Luca
Mao



FACULTAD DE AGRONOMÍA E INGENIERÍA FORESTAL
PONTIFICIA UNIVERSIDAD CATÓLICA DE CHILE

Trees and Rivers – 1st Order



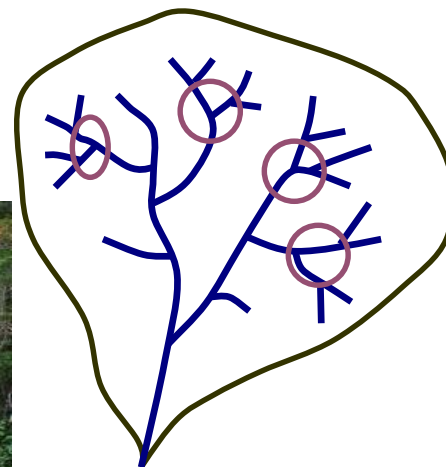
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Trees and Rivers – 2nd Order

Orthogonal log step

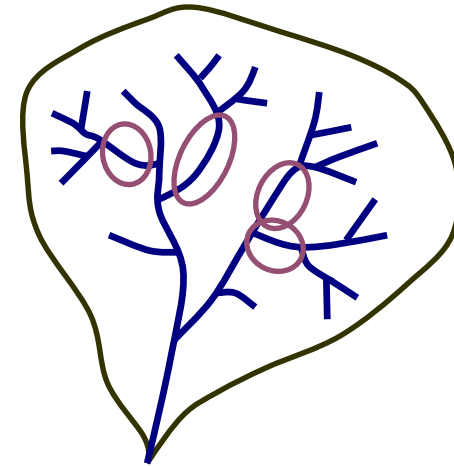


Valley jam

Images from Luca
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Trees and Rivers – 3rd Order

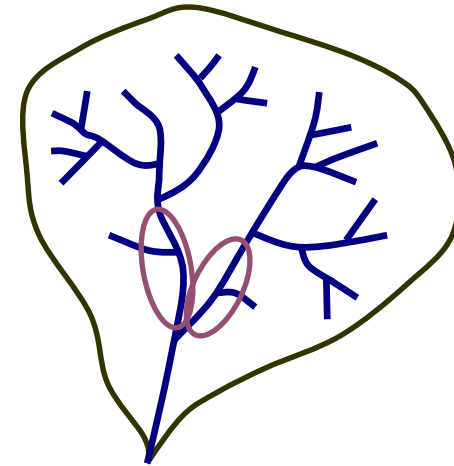


Flow deflection



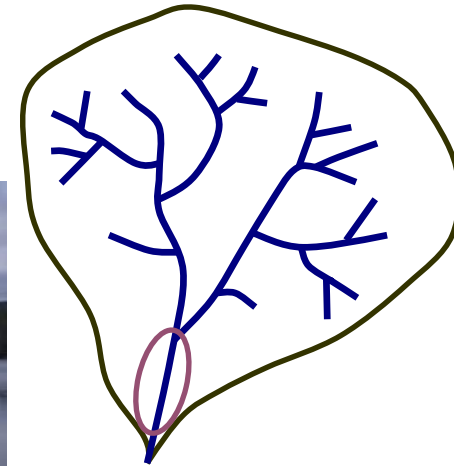
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Trees and Rivers – 4th Order



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Trees and Rivers –5th Order



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Artificial Catchment Processes (no trees!)



Images from
Paul Quinn

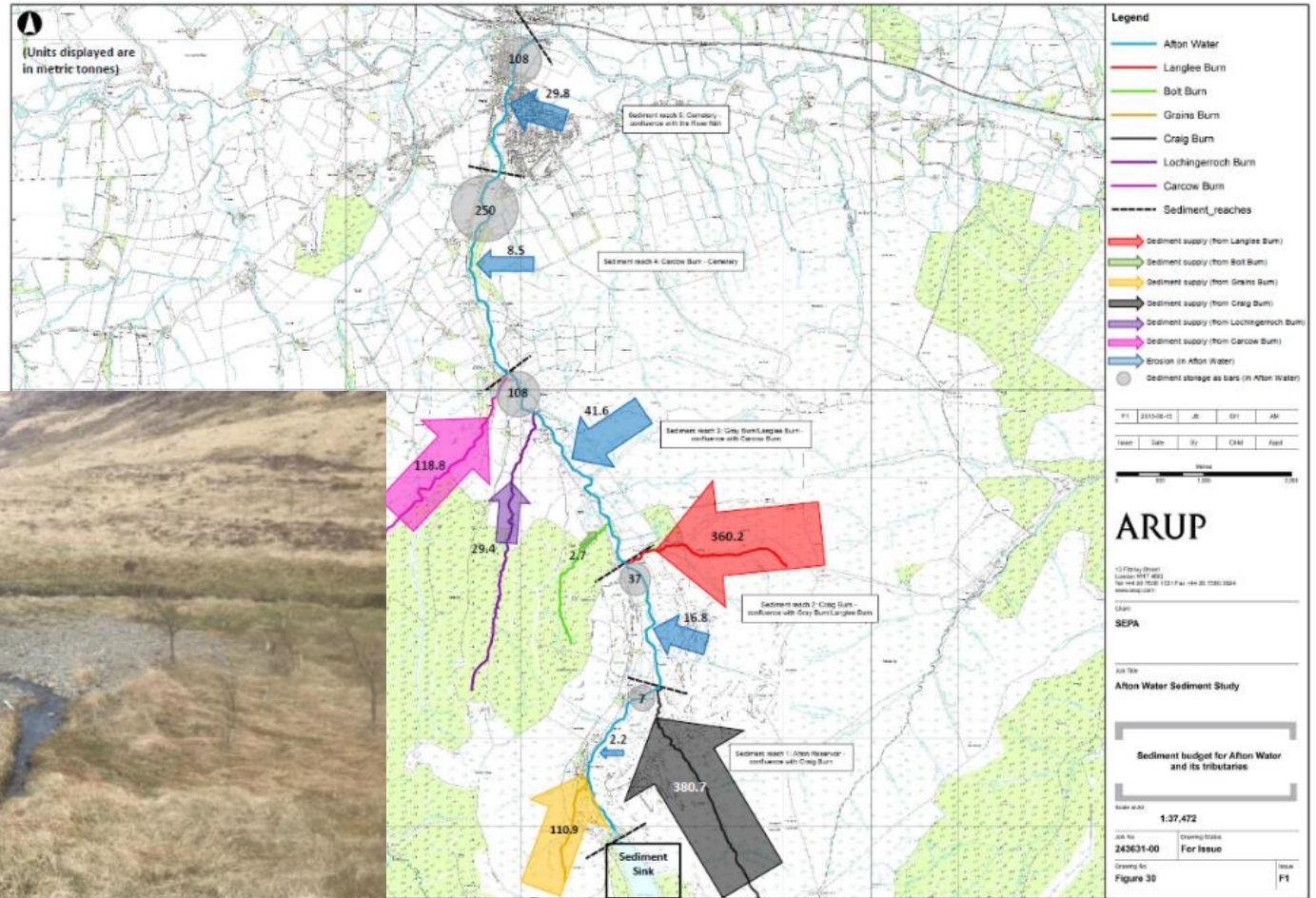


Newcastle
University

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Artificial Processes in Treeless Catchments

Afton Water Sediment Management



Fine sediment sources – Lugg catchment

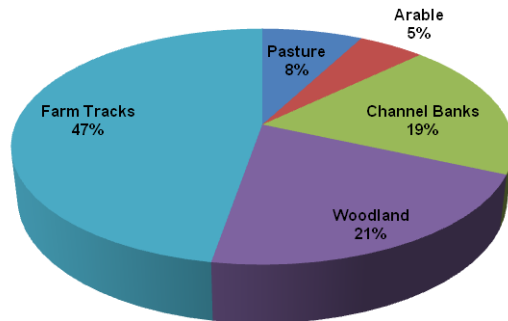


Fine sediment sources – Lugg catchment

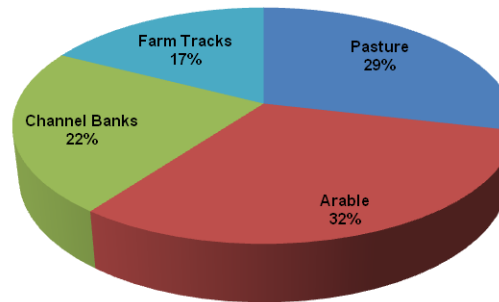


Sediment sources for 'hot spot' tributaries

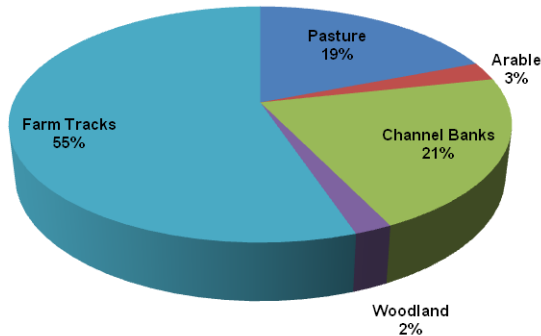
Cheaton Brook



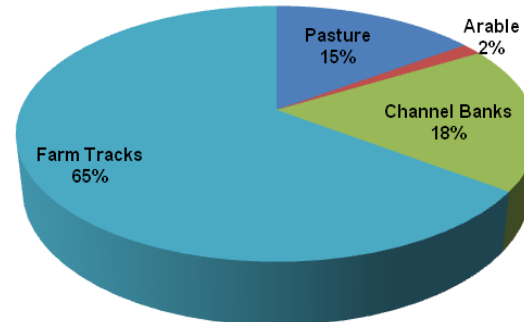
Ridgemoor Brook



Curl Brook



Moor Brook



Images from
Jason Stopps

‘Natural Flood Management’?

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‘Natural Flood Management’?

*Natural **Erosion** Management* *Natural **Drought** Management*
*Natural **Carbon** Management* *Natural **Habitat** Management*
*Natural **Fisheries** Management* *Natural **Forestry** Management*
*Natural **Gravel** Management* *Natural **Groundwater** Management*
*Natural **Fines** Management* *Natural **Water Quality** Management*
*Natural **Soil** Management*
*Natural **Climate Change** Management*

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Nature Based Solutions

Upper Basin



Mid Basin



**Lower Basin
(including Cities)**

a) Land use change / Agricultural management

b) River Restoration

c) Wetlands (Artificial and restored)

d) Blue Green Corridors

e) Natural Flood Management

f) Water Sensitive Urban Design

g) Coastal

h) 'Soft' Flood Schemes

i) Green Infrastructure

j) SuDS

k) Water Framework Directive (overarching legislation)

l) Ecosystem Services & Natural Capital

Funding

Government Agency (Inc Grant in Aid)
(a,b,c,e,g,h,k,l)

Local Authority
(b,c,d,e,f,g,h,I,k,l)

Water Company
(b,c,d,e,f,I,j,k,l)

Social / Crowd (b,c,d,e,f,I,l)

Payment for ecosystem services (a,b,c,d,e,f,g,i,k,l)

Private & Developer Levy
(a,b,c,d,e,f,I,j,l)

Lenders for income generating projects
(a,b,c,d,e,f,g,I,j,l)

Growth Deal & Enterprise Zones (b,c,d,f,I,j,l)

PF2 (b,c,b,e,f,g,h,I)

Rivers Trusts (a,b,c,e,I,k,l)

Fisheries (b,c,e,k,l)

Defra (a,e,g,h,I,l)

A restoration targets and scales

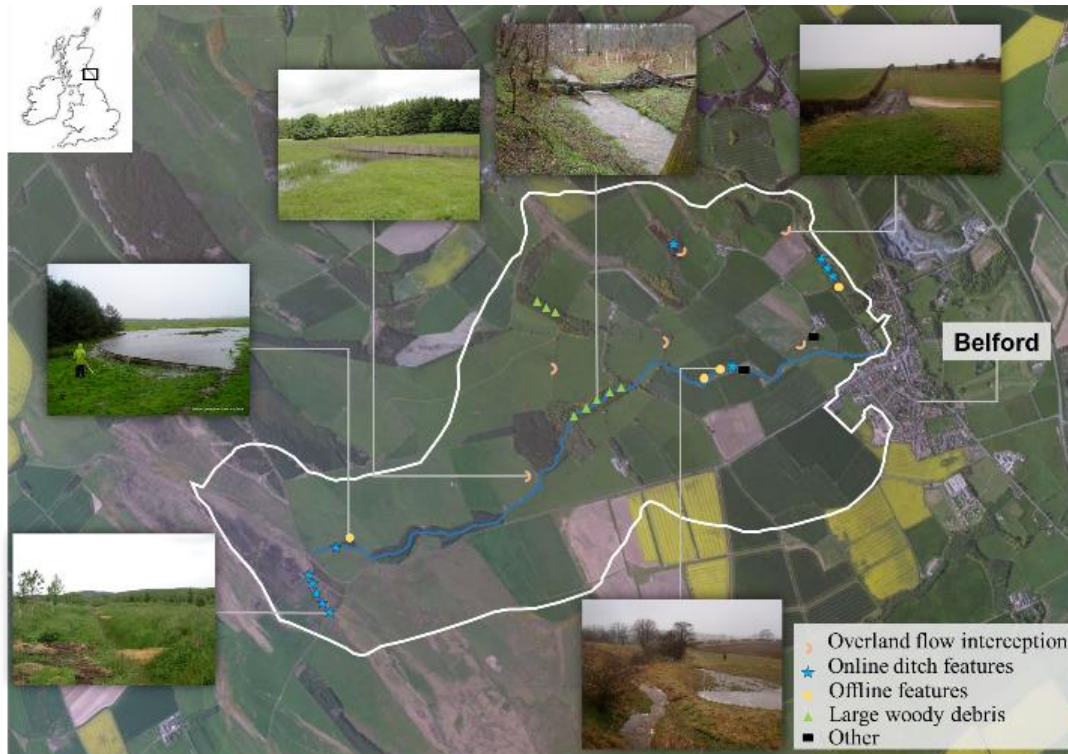
| Degree of Restoration | Scale | Target / Difficulty |
|--|--------------|---------------------|
| Complete Catchment Rewilding (physical, ecological and chemical restoration to a pre-artificial state) | Catchment | 7 |
| Catchment Process improvements (physical, chemical and ecological improvements that replicate / emulate pre-artificial conditions) | | 6 |
| Catchment hydrological process restoration (using land use change and NFM) alongside river restoration and natural recovery. | | 5 |
| Reach scale process restoration (with flood plain restoration) | Reach | 4 |
| Reach scale habitat improvement (in channel improvements) | | 3 |
| Localised habitat improvement (gravel addition, riparian planting, fencing etc) | | 2 |
| Artificial structure removal | Local / unit | 1 |



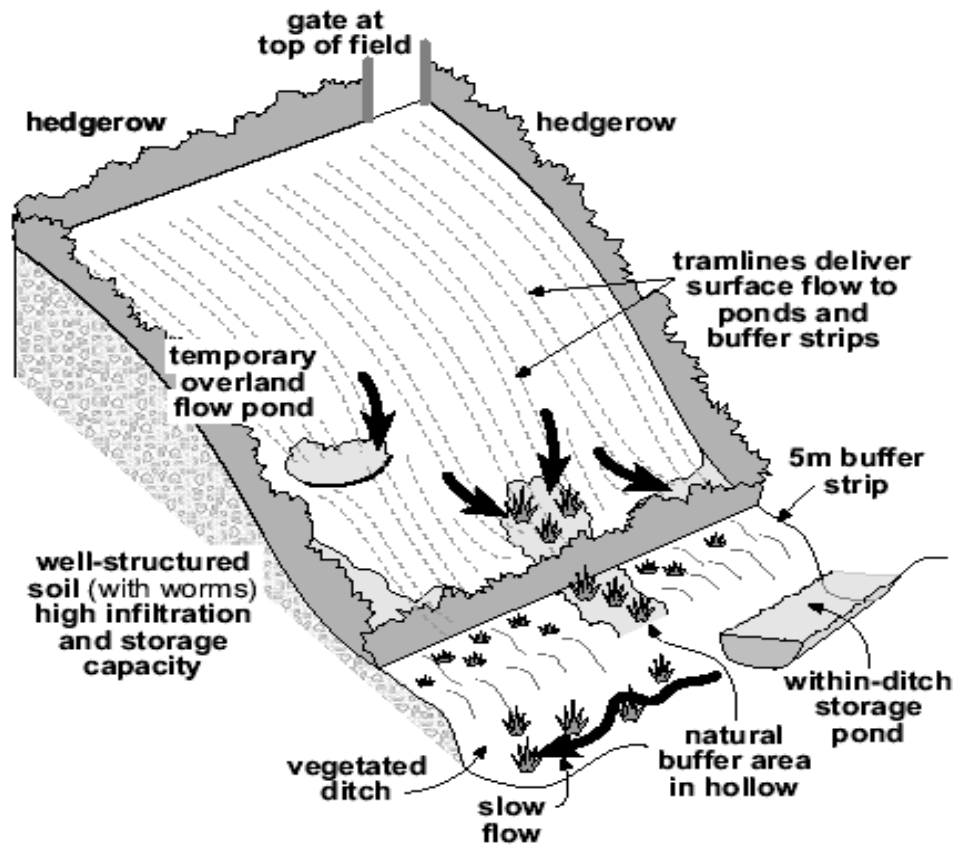
Design Targets and Climate Change

| Scales of Process Restoration and associated Climate Change resilience benefits | Scale | Target / Difficulty |
|---|-----------------------|---------------------|
| Complete Basin Rewilding (physical, ecological and chemical restoration to a pre-artificial state). Maximum 'natural' capacity to adapt to a changing climate and maximum resilience. Long term sustainability. | Basin / region | 7 |
| Basin Process improvements (physical, chemical and ecological improvements that replicate / emulate pre-artificial conditions). Significant climate change adaptation and mitigation benefits felt at the catchment scale. Long term sustainability. | | 6 |
| Basin hydrological process restoration (using land use change and NFM) alongside river restoration and natural recovery. Meaningful climate change adaptation and mitigation benefits felt at the catchment scale. Medium term sustainability. | | 5 |
| Reach scale process restoration or city region GI implementation (with flood plain restoration). Meso-scale / regional climate change adaptation and mitigation benefits related to widespread habitat and process improvement. Benefits potentially felt directly in nearby urban areas. Long term sustainability. | Reach / City | 4 |
| Reach scale habitat improvement or 'Area wide' GI implementation. Meso-scale / regional climate change mitigation benefits related to widespread habitat improvement. Medium term sustainability. | | 3 |
| Localised habitat improvement or sequence of GI features (gravel addition, riparian planting, fencing etc). Local adaptation and resilience benefits related to improved biodiversity, flood risk management and process continuity. | | 2 |
| Artificial structure removal of single GI feature implementation. Very local adaptation and resilience benefits related to improved flood risk management and process continuity. | Local / unit | 1 |

Natural Flood Management - Belford



Agricultural NFM



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Natural Engineering - Pathways



Images from
Paul Quinn



University of
Exeter



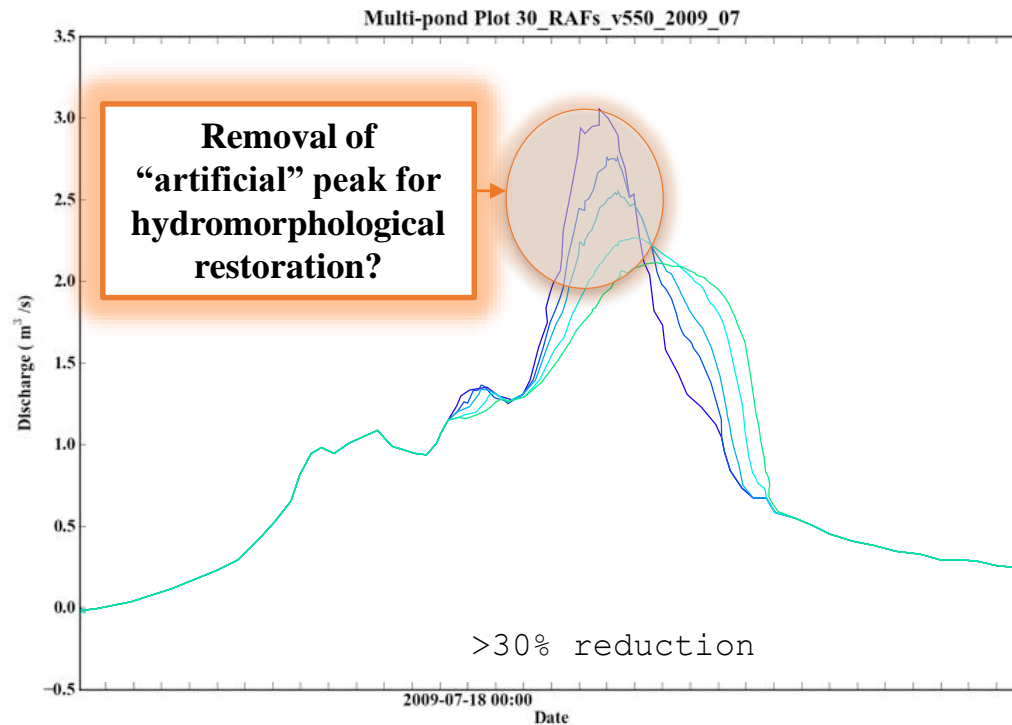
Environment
Agency

Natural Engineering – Forested Floodplains



Images from
Paul Quinn

Addition of 5 NFM features per hydrograph iteration:

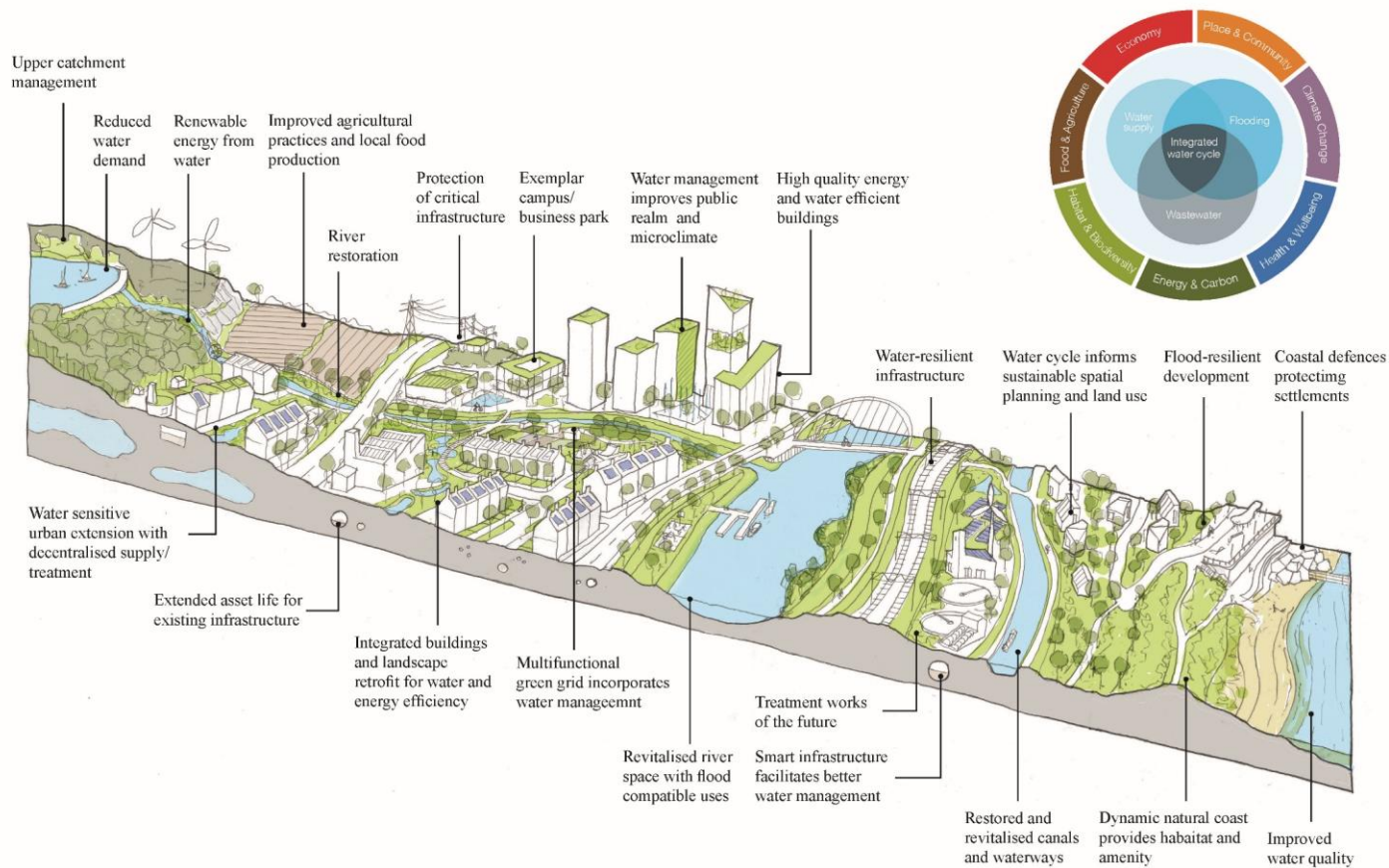


Natural Engineering – Forested Streams



Images from
Paul Quinn

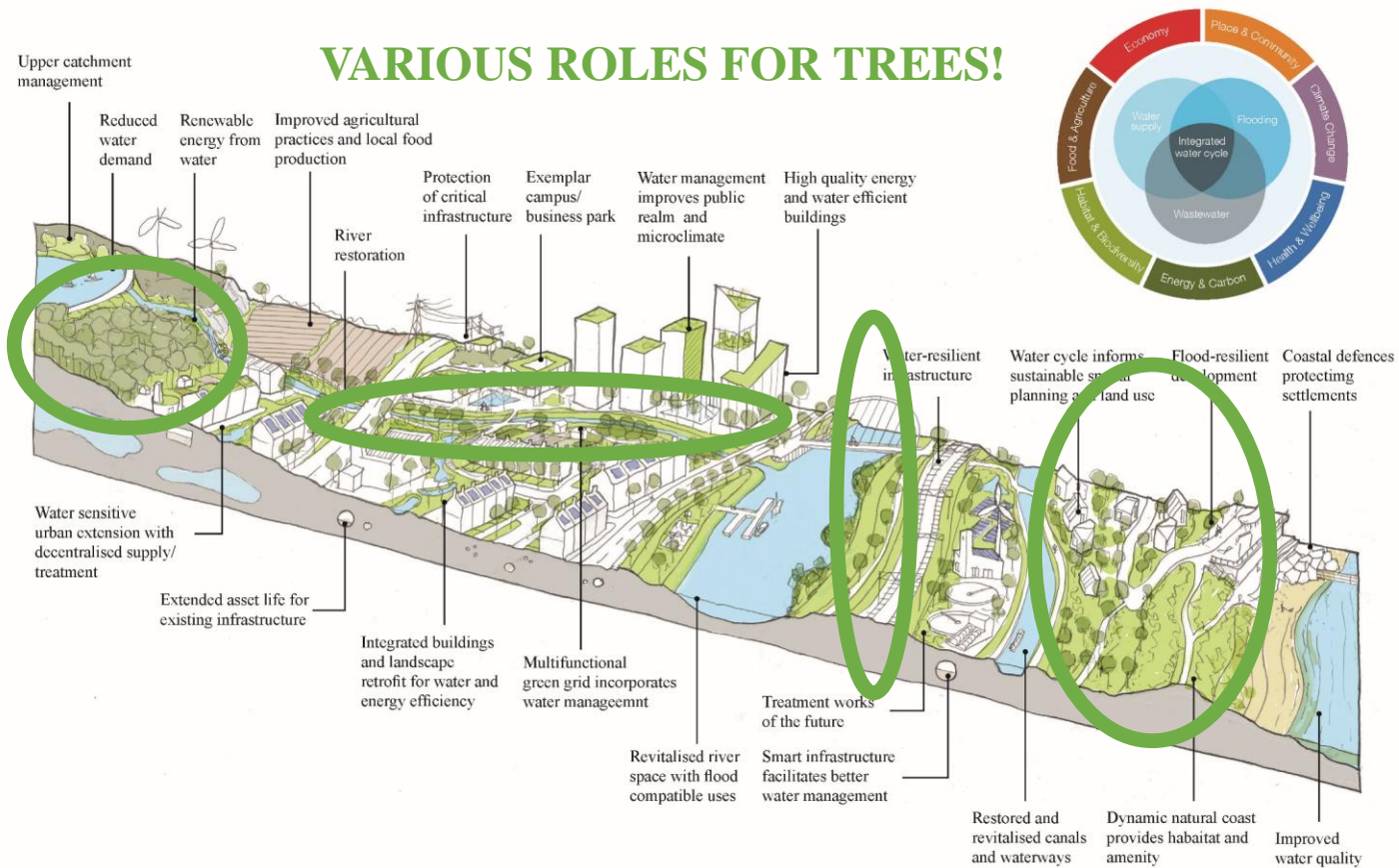




Reducing risk, increasing resilience
and making better places

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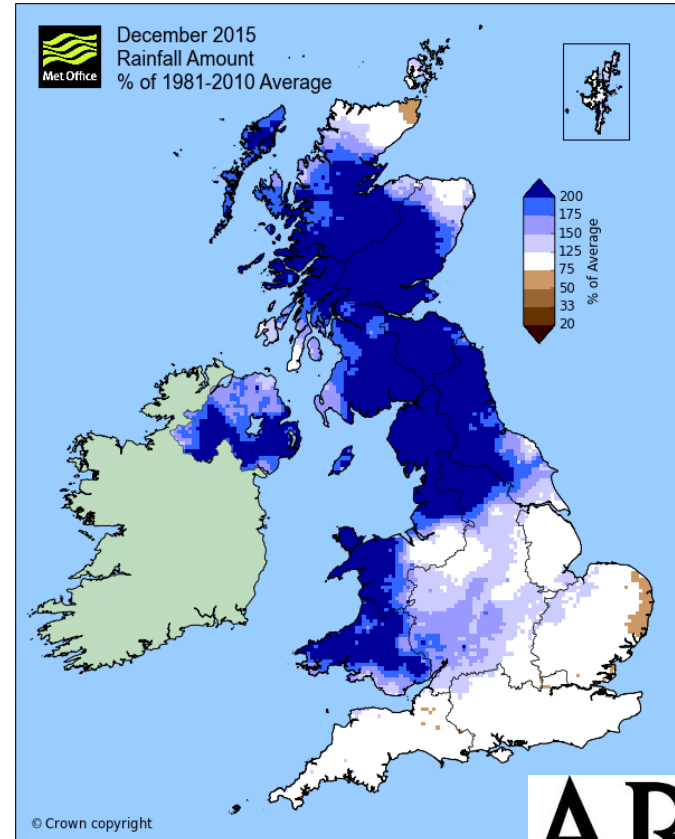
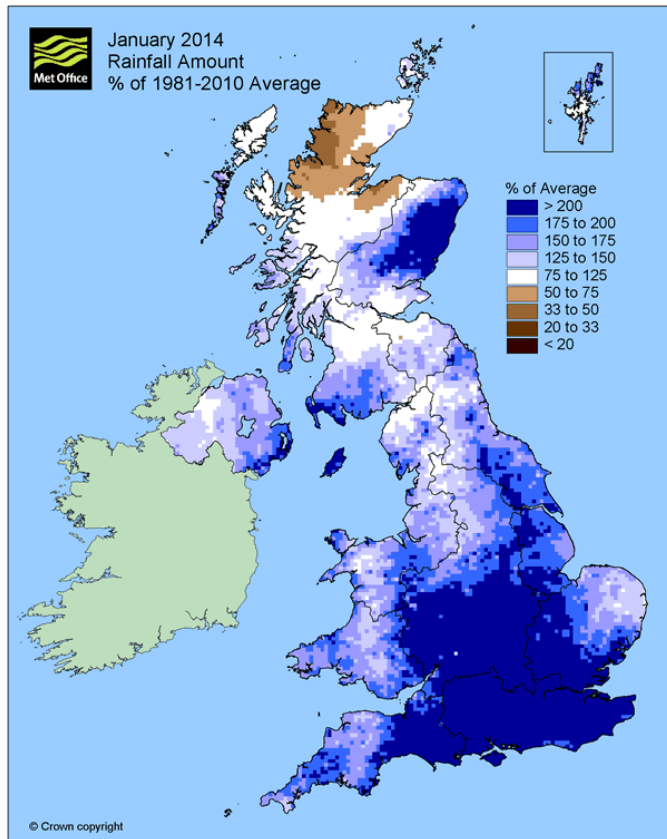
VARIOUS ROLES FOR TREES!



Reducing risk, increasing resilience
and making better places

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UK weather anomaly maps (% of average)



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Conclusions

- Forestry provides huge opportunities for NFM (targeting reference);
- NFM provides huge benefits for forestry (resilience);
- Planting and growth takes time that we might not have;
- Think catchment and holistic process benefits (use conflicting needs to innovate in design);
- What is our design target / reference condition? (needs careful thought and design)
- A common objective:
 - To restore damaged processes to a sustainable state for the benefit of people and the environment.
- Ultimately, process restoration leads to economic resilience.
- This is not optional.... It is crucial.

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Water^{Up} – Humanitarian process restoration



Community driven decentralised water management is one of the most effective and robust ways to decrease global water woes, whilst delivering environmental, social and economic resilience.

‘There is no urban resilience without rural resilience...’ (Rajendra Singh)



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Water^{Up} – Partners and Precedent

Science & Environment

'Water man of India' Rajendra Singh bags top prize

By Roger Harrabin
BBC environment analyst

21 March 2015

f t b e Share



Rajendra Singh, is known as "the Water Man of India"

An award known as "the Nobel Prize for water" has been given to an Indian

A screenshot of the website for The Goldman Environmental Prize. The header includes the logo and navigation links: The Prize, Prize Recipients, News, Press Room, and Who We Are. The main content area features a profile for Michal Kravcik, a 1999 Goldman Prize Recipient from Europe. It lists his focus areas as Slovakia and Rivers & Dams, and includes a share button. To the right is a portrait of Michal Kravcik. Below the profile, a text block states: "Michal Kravcik galvanized support to halt a dam planned during the Communist era by proposing effective democratic alternatives, including smaller dams, decentralized water management, and restored farmlands."

'One of the 50 people who can save the planet' - The Guardian 2008



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Water^{Up} - Delivery

1) Learning

(from investigations into existing water management projects in India)

2) Restoring

(maintaining existing interventions and new build)

3) Documentation

(of features, maintenance and communities)

4) Education

(developing universal films, visual tools and digital technology)

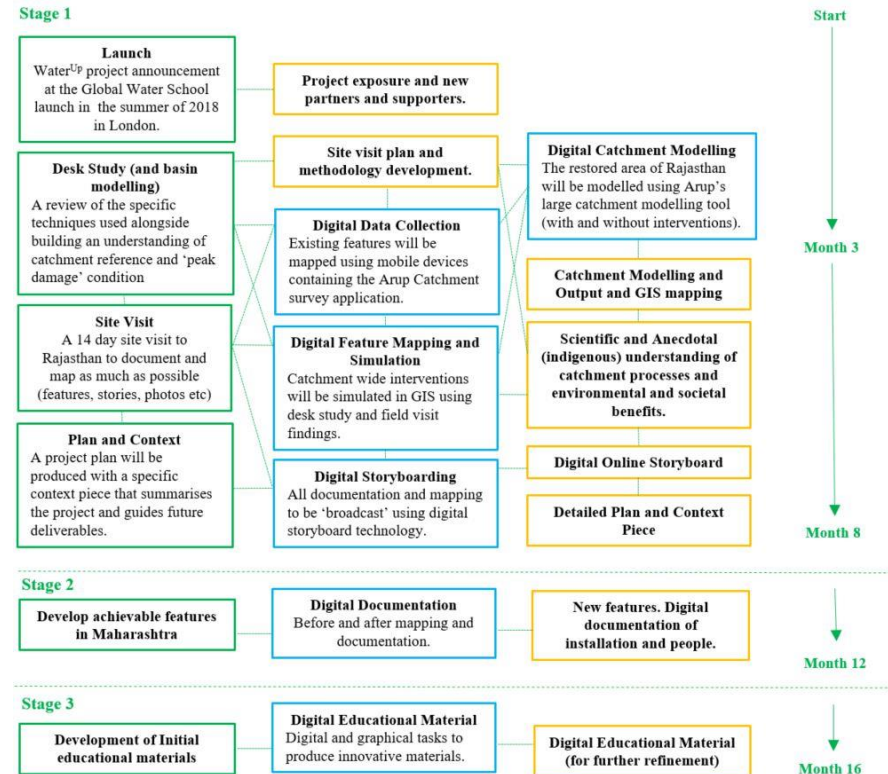
5) Testing

(of the universal tools in a different geography/culture in Colombia)

6) Dissemination

(of refined education tools through our global networks)

Site reconnaissance planned for August 2018...!



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Healthy Catchments, Future Resilience.



david.hetherington@arup.com

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