



Water Resilience: What is it & do we have it..?

Nick Paling - WRT

bouncebackability

resilience:

“an ability to recover from or adjust easily to misfortune or change.”

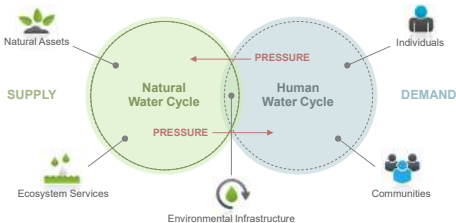
People, communities & nature are all incredibly resilient...
...but only to a point. Everything has its limit.

As stress reduces resilience, vulnerability increases.



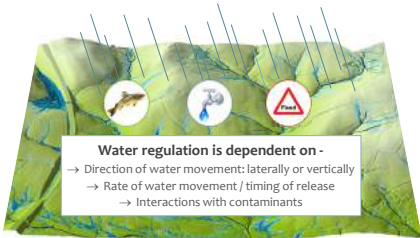
What is water resilience...?

Understanding resilience requires taking a whole-system approach...



The Natural Water Cycle

A fundamental processes we depend on ... when the landscape is healthy & functioning...



The Natural Water Cycle

A fundamental processes we depend on ... when the landscape is healthy & functioning...



Soil type & condition/practices

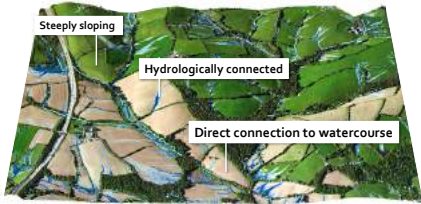




The Natural Water Cycle

A fundamental processes we depend on ... when the landscape is healthy & functioning...

Location, topography & hydrological connectivity



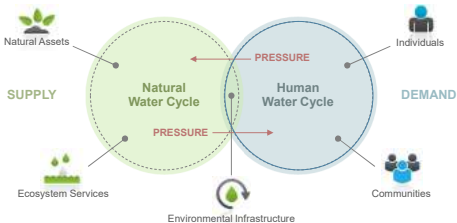
Steeply sloping

Hydrologically connected

Direct connection to watercourse

What is water resilience...?

Understanding resilience requires taking a whole-system approach...





64% DART



THE
BIOREGIONAL
LEARNING
CENTRE



DRINKING WATER



FLOOD PROTECTION

WASTE DISPOSAL





IRRIGATION



HEALTH &
WELLBEING

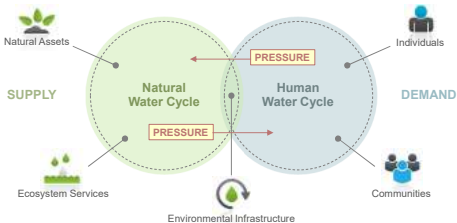




WILDLIFE

What is water resilience...?

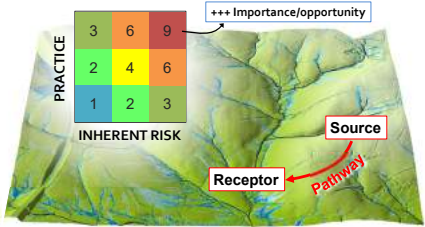
Understanding resilience requires taking a whole-system approach...





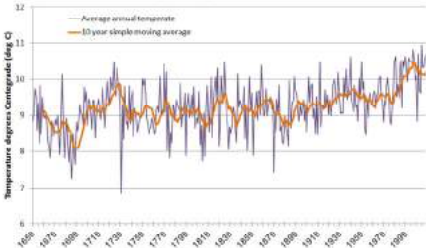
Anthropogenic Pressure - ▲ stress ▼ resilience

Human behaviour (such as land management or water use) impacts the water cycle...





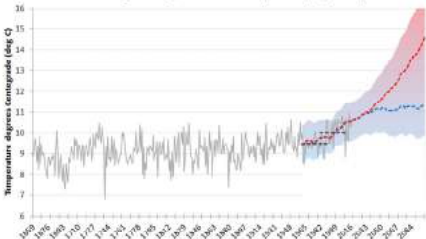
Central England Temperature record 1659-2018



Source: Met Office Hadley Centre, Parker D.F., T.R. Legg, and C.K. Folland 1999. A new daily Central England Temperature Series, 1772-1991. *Int. J. Clim.*, Vol 12, pp.317-342 (<http://www.metoffice.gov.uk/hadobs/hadcrut/index.html>). Chart created by Chris Cookes (www.chriscookes.net) March 2013.

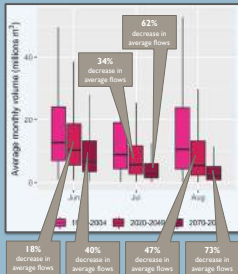
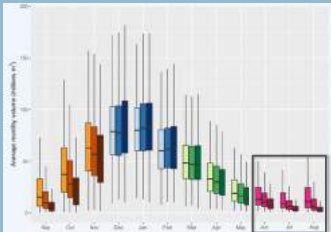


Central England Temperature 1659-2100 (UKCP18 projections)



Source: Met Office Hadley Centre - Parker, D.E., T.P. Legg, and C.K. Folland, 1992. A new daily Central England Temperature Series, 1772-1981. *Int. J. Clim.*, Vol. 12, pp 317-342 (<http://www.met.rdg.ac.uk/~atmos/hadobs/index.html>). With UKCP18 (<http://www.met.rdg.ac.uk/research/collaborator/ukcp18proj/index.html>) and a 30 year long term average. [Low \(RCP2.6\)](#) & [High \(RCP8.5\)](#) emissions scenarios. Chart created by Chris Beale (www.chrisbeale.net) March 2016

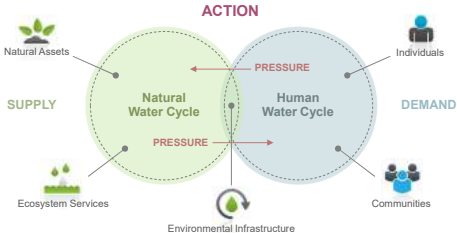
River Exe at Thorverton



...based on the High Emissions Scenario (RCP8.5)

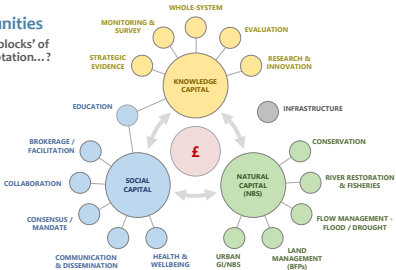
What is water resilience...?

Understanding resilience requires taking a whole-system approach...



Building Water Resilient Communities

What are the 'building blocks' of water resilience & adaptation... ?



Riverkeepers

Coaching people from across the watershed to succeed

Stewardship

The Riverkeepers program provides stewardship training to watershed residents, businesses, and organizations. This training is designed to help individuals and organizations understand their role in protecting the river and the watershed. The program includes a variety of activities, including field trips, workshops, and presentations. The program is designed to be flexible and can be tailored to meet the needs of different audiences.

Training, Support & Legacy

The Riverkeepers program provides training, support, and legacy for watershed residents, businesses, and organizations. This training is designed to help individuals and organizations understand their role in protecting the river and the watershed. The program includes a variety of activities, including field trips, workshops, and presentations. The program is designed to be flexible and can be tailored to meet the needs of different audiences.

Environmental Restoration

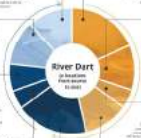
The Riverkeepers program provides environmental restoration training to watershed residents, businesses, and organizations. This training is designed to help individuals and organizations understand their role in restoring the river and the watershed. The program includes a variety of activities, including field trips, workshops, and presentations. The program is designed to be flexible and can be tailored to meet the needs of different audiences.

Iconic Species Protection

The Riverkeepers program provides iconic species protection training to watershed residents, businesses, and organizations. This training is designed to help individuals and organizations understand their role in protecting iconic species in the river and the watershed. The program includes a variety of activities, including field trips, workshops, and presentations. The program is designed to be flexible and can be tailored to meet the needs of different audiences.

Citizen Science

The Riverkeepers program provides citizen science training to watershed residents, businesses, and organizations. This training is designed to help individuals and organizations understand their role in collecting and analyzing data to monitor the health of the river and the watershed. The program includes a variety of activities, including field trips, workshops, and presentations. The program is designed to be flexible and can be tailored to meet the needs of different audiences.



Watershed Charter

The Riverkeepers program provides watershed charter training to watershed residents, businesses, and organizations. This training is designed to help individuals and organizations understand their role in developing and implementing a watershed charter. The program includes a variety of activities, including field trips, workshops, and presentations. The program is designed to be flexible and can be tailored to meet the needs of different audiences.

Relationship with Police

The Riverkeepers program provides relationship with police training to watershed residents, businesses, and organizations. This training is designed to help individuals and organizations understand their role in building a positive relationship with the police. The program includes a variety of activities, including field trips, workshops, and presentations. The program is designed to be flexible and can be tailored to meet the needs of different audiences.

Alignment with Balanced Efforts

The Riverkeepers program provides alignment with balanced efforts training to watershed residents, businesses, and organizations. This training is designed to help individuals and organizations understand their role in ensuring that their efforts are aligned with the overall goals of the watershed. The program includes a variety of activities, including field trips, workshops, and presentations. The program is designed to be flexible and can be tailored to meet the needs of different audiences.

The Arts as Catalyst

The Riverkeepers program provides the arts as catalyst training to watershed residents, businesses, and organizations. This training is designed to help individuals and organizations understand their role in using the arts to inspire and engage the community. The program includes a variety of activities, including field trips, workshops, and presentations. The program is designed to be flexible and can be tailored to meet the needs of different audiences.

July 2017

Bring your wellies!

Meet us on the Dartington estate
for a morning of fun and learning

BOOK NOW



Love the River Dart?

Begin your journey to
become a Citizen Scientist
on the Dart

Saturday morning
10am-12:30pm
16th March or 13th April

Location: The Green, Dartington

Join the community of Citizen Scientists using a range of tools to monitor the health of the river. You'll get to see the river up close and learn about the challenges it faces.



Book your place: www.dartington.org/thecharter



Partnership with



Partnership with



Dartington



SPONGE 2020
LOCAL ACTION PROJECT

Using nature-based solutions to reduce surface water flooding & deliver multiple benefits

“...Developing a comprehensive, practice based Toolbox and Guidance Pack for effective participatory climate adaptation through community based co-creation pilots...”



instatroy 
2 River, Marsh, Tower
SPONGE 2020
Local Action Project

WESTCOUNTRY WOMEN WORKING WITH WATER (5W)

We are working with a group of engineers to inspire school children in Taunton to understand a little more about water management in their town. We will then use the everything the students have learnt to get their help designing SuDS to be built in both the schools. 5W is a project funded by The Royal Academy of Engineers under their Ingenious program. We are working with two primary schools in Taunton to co-create raingardens...and inspire young people, especially girls, about engineering and the problems engineering can help to solve.



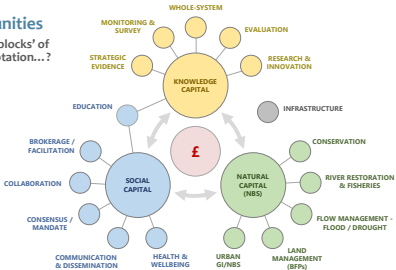
TRADITIONAL DRAINAGE vs SuDS

These interactive boards were used to demonstrate the difference between traditional water management systems and sustainable drainage systems. In the board to the left, water goes down a gutter, onto some hard paving, down a drain and into the 'river' below. The water ran through the system very quickly, eventually flooding the Lego house below! On the right, the water went into a bucket (acting as a water butt), through some permeable paving, into a grassy swale and then into a raingarden. The water moved more slowly, plus the board looks a lot more green and interesting!



Building Water Resilient Communities

What are the 'building blocks' of water resilience & adaptation... ?



Co-creating a community NBS & GI Plan for Millbrook



- Millbrook River Catchment, Cornwall
- 2016-2018
- Community engagement
- Evidence review
- Interactive flood modelling
+ a 'Serious Game'



Co-creating a community NBS & GI Plan for Millbrook



Co-creation and trialling the Millbrook Serious Game -

- ⇒ Developed by Centre for Water Systems at Exeter University
- ⇒ Interactive, educational 'game' that illustrates movement of water through catchment and village over time
- ⇒ Ability to change land use and investment to drainage infrastructure within different parts of the catchment
- ⇒ Trialled by local stakeholders



Paper published in December 2018

<http://www.mdpi.com/2073-4441/10/12/1885/pdf>



CASE STUDY

Studying Water Resources Management

Interreg 
2 Seas Mers Zeeën
PROWATER
Water Resource Management


**South West
Water**



 **Upstream Thinking**

DRINKING WATER PROVISION PROCESS



Chemicals
Assets Sludge
Energy



0.0043p



RISK: treatment **failure** leaves pollutants in final water

SOURCE: Some pollutants are natural – some can be **reduced**

10mg

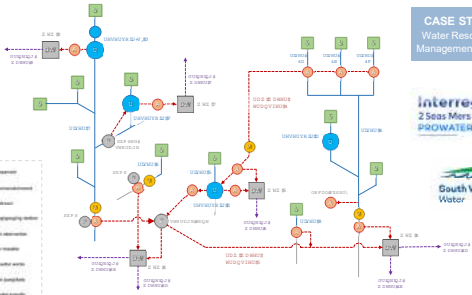


Soil
Algae
Pesticides
Colour

COSTS: some costs are fixed
– some are **variable**

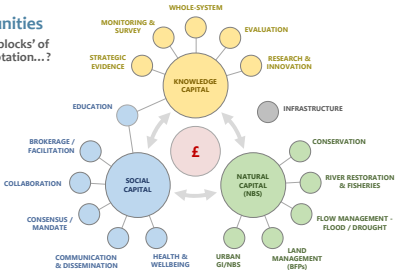
CASE STUDY

Water Resources Management 'Loop'



Building Water Resilient Communities

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