頭前溪流域環境治理公私協力論壇

公民參與流域治理
- 英國及歐盟計畫經驗分享

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2021/09/24

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6. The UpStream project

Personal Introduction

個人簡介

Background

1999-2005

National Taiwan University
BSc in Civil Engineering
MSc in Computer Aided Engineering

2005-2008

ROC Army
Second Lieutenant
National Taiwan University
RA in two-phase flow simulation

2008-2012

Imperial College London
PhD in Civil & Environmental Engineering

2012-2020

Imperial College London
Postdoc in radar signal processing
Postdoc in urban pluvial flood forecasting

Katholieke Universiteit Leuven
Postdoc in urban hydrometeorology

Rain++
Co-founder/hydrometeorologist

2020-NOW

National Taiwan University
Assistant Professor in Computer Aided Engineering

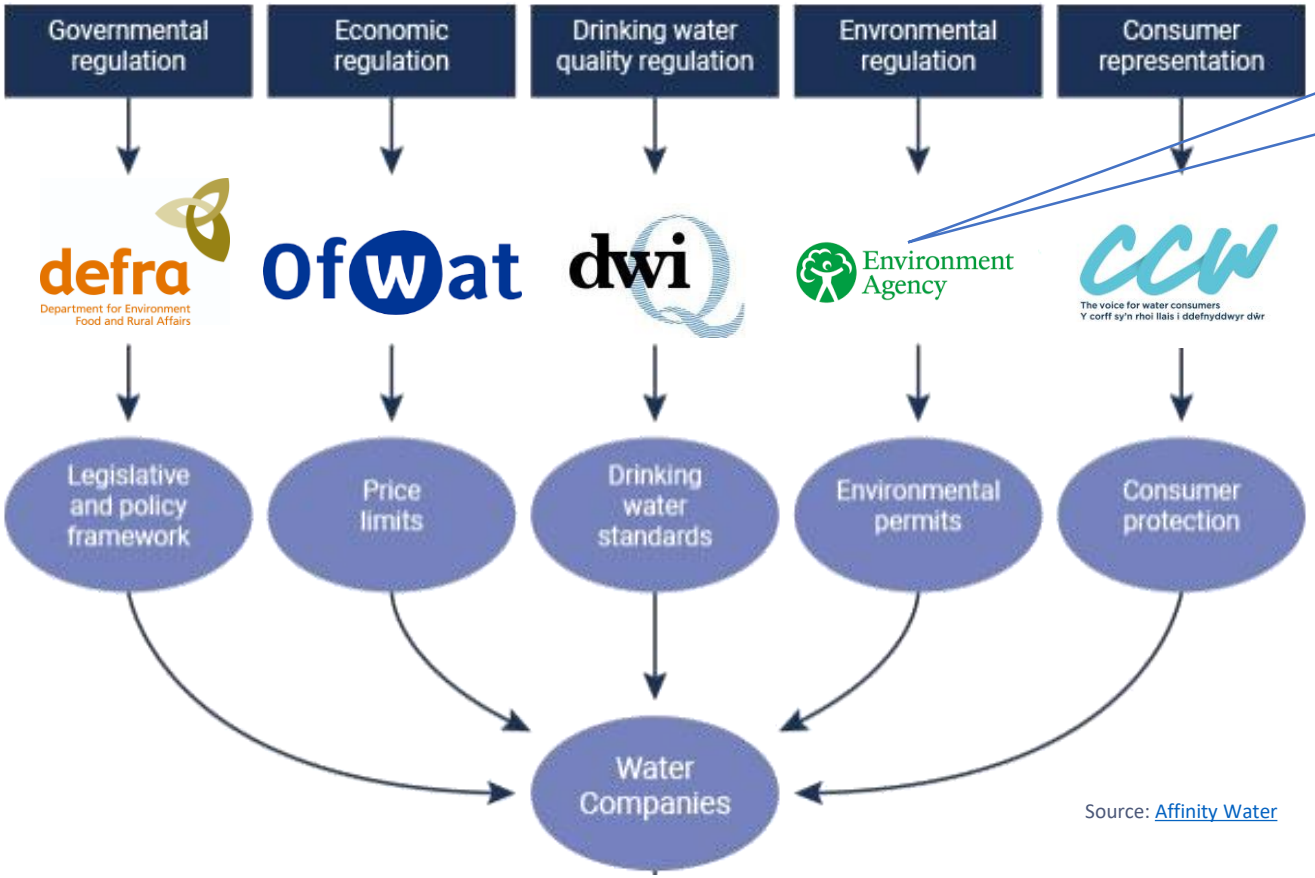
Research Interests:

- Climate change and its impact on local rainfall extremes
- Short-term rainfall and flood forecasting
- Citizen Observatories
- Computational hydro-meteorology

UK Water Management Structure & Policy and the Role of Citizens in It

英國水資源管理架構、政策，及公民參與

UK Water Management Structure



Source: Affinity Water

Enforces WQ legislation

Formerly, the EU would set overarching environmental policies, later implemented locally by Defra / UK gov.

Water companies were privatised in 1989 -> Private capital injection

Two types of companies:

- Water supply and sewerage services
- Water supply-only

They are a monopoly, therefore strong regulation required

Development of European (& UK) Water Policy

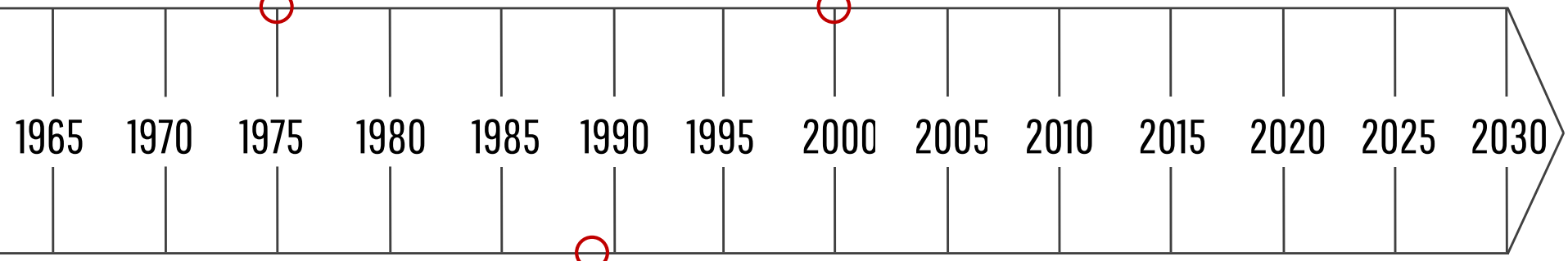
Focus on WQ

1975 – 1980: Drinking water

- Dangerous Substances Directive

2000 – Now: All water (integrated)

- Water Framework Directive
- Goal: good status in all water bodies



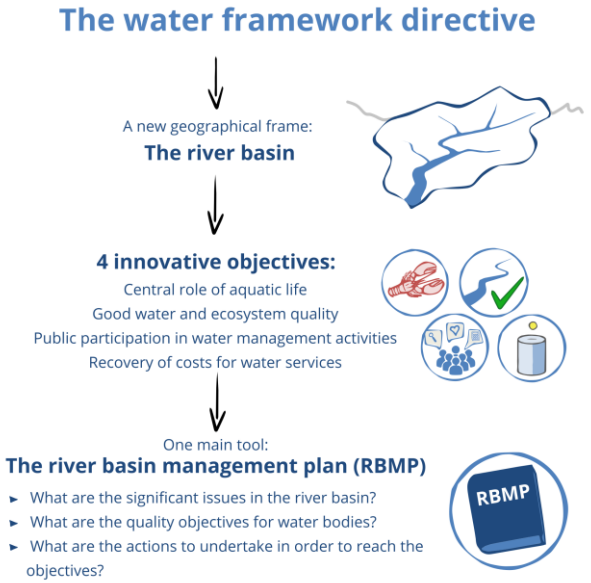
1988 – 1996: Regulation of individual aspects

- Urban Waste Water Treatment Directive
- Nitrates Directive
- New Drinking Water Directive
- Industrial Emissions Directive

European (& UK) Water Policy – Current State

Largely shaped by WFDs

- Integrated approach (quantity + quality)
  - From separate to integrated systems
  - E.g. the impact of drought to water quality
- Consistent approaches to water management
- River basin-based water management
  - Break administrative borders
  - Natural catchment border
  - With a common goal
- **<u>Public participation at its core</u>**



UK independent legislation going forward; however, overarching EU directives have fundamentally shaped UK water management and are enshrined in local law

UK Water Management Policy

Other relevant laws and planning instruments (with a focus on water management; not an exhaustive list!):

- **Environmental Permitting Regulations (2010):**
  - Gave further effect to the WFD by defining water discharge offences and associated penalties
  - Penalties include unlimited fines and up to 5 years imprisonment
- **Flood and Water Management Act 2010**
  - Provisions about water management, including management of flooding and erosion risks
  - Clarification of water management roles, in response to localised (rainfall-driven) flooding in 2007
- **Climate Change Act (2019):**
  - Commits the UK to 'net zero' by 2050 - **First major economy to legislate for net zero**
  - **Great implications for efficient water management**
- **Sewage (Inland Waters) Bill (2019-2021 – under review):**
  - Duty on water companies not to discharge untreated sewage into rivers
- **First river designated as bathing site (2020):**
  - This means tighter standards and closer monitoring
  - Citizen victory!
- **DEFRA-led Storm Overflows Taskforce:** to ensure that storm overflows cause no harm to receiving waters
- **Environment Bill (under review)**
  - Will bring into UK law environmental protections and recovery, inc. governance framework & standards
  - Expected to place a duty on water companies to reduce discharges from storm overflows

25 Year Environment Plan (YEP) (2018)

To improve the environment within a generation

25 Year Environment Plan (25 YEP)

- “Aim to deliver cleaner air and water in our cities and rural landscapes, protect threatened species and provide richer wildlife habitats”
- Living document: will continue to evolve and be updated as policies develop
- Calls for increased public engagement with the environment

25 Year Environment Plan (25 YEP)

- 10 boarder themes, 16 headlines, 66 indicators

WATER	**B1**	Pollution loads entering waters
	B2	*Serious pollution incidents to water*
	B3	*State of the water environment (headline 3)*
	B4	*Condition of bathing waters (headline 3)*
	B5	Water bodies achieving sustainable abstraction criteria (headline 3)
	B6	Natural functions of water and wetland ecosystems
	B7	Health of freshwaters assessed through fish stocks

Themes	Headlines	Goals
A. Air (A1-A7)	1. Air quality (A1,A3)	Clean Air
	2. Greenhouse gas emissions (A2)	Mitigating Climate Change
B. Water (B1-B7)	3. Water and the water environment (B3,B4,B5	Clean and plentiful water
C. Seas and Estuaries (C1-C11)	4. Diversity of our seas (C3,C4,C5)	Thriving plants and wildlife
	5. Health of our seas (C7,C8)	
D. Wildlife (D1-D7)	6. Wildlife and wild places (D2,D5)	
	7. Nature on land and water (D1,D4,D7)	
E. Natural Resources (E1-E9)	8. Production and harvesting of natural resources (E1,E3, E4, E7)	Efficient use of natural resources
F. Resilience (F1-F4)	9. Resilience to natural hazards (F1,F2,F3)	Reduced risk from environmental hazards
G. Natural beauty and engagement (G1-G7)	10. Landscapes and waterscapes (G1,G2,G3)	Enhanced beauty and engagement
	11. People enjoying and caring about the natural environment (G4,G5,G6,G7)	
H. Biosecurity, chemicals and noise (H1-H4)	12. Exotic diseases and invasive non-native species (H1,H2)	Enhancing biosecurity
	13. Exposure of people and wildlife to harmful chemicals (H3,H4)	Managing exposure to chemicals
J. Resource use and waste (J1-J6)	14. Resource efficiency and waste (J2,J4,J5,J6)	Minimising waste
K. International (K1-K4)	15. Impacts on the natural environment overseas (K1)	Global impacts
	16. Improving the environment overseas (K2, K3,K4)	

Beyond water security

Water as a key ecosystem and amenity asset

25YEP Implementation

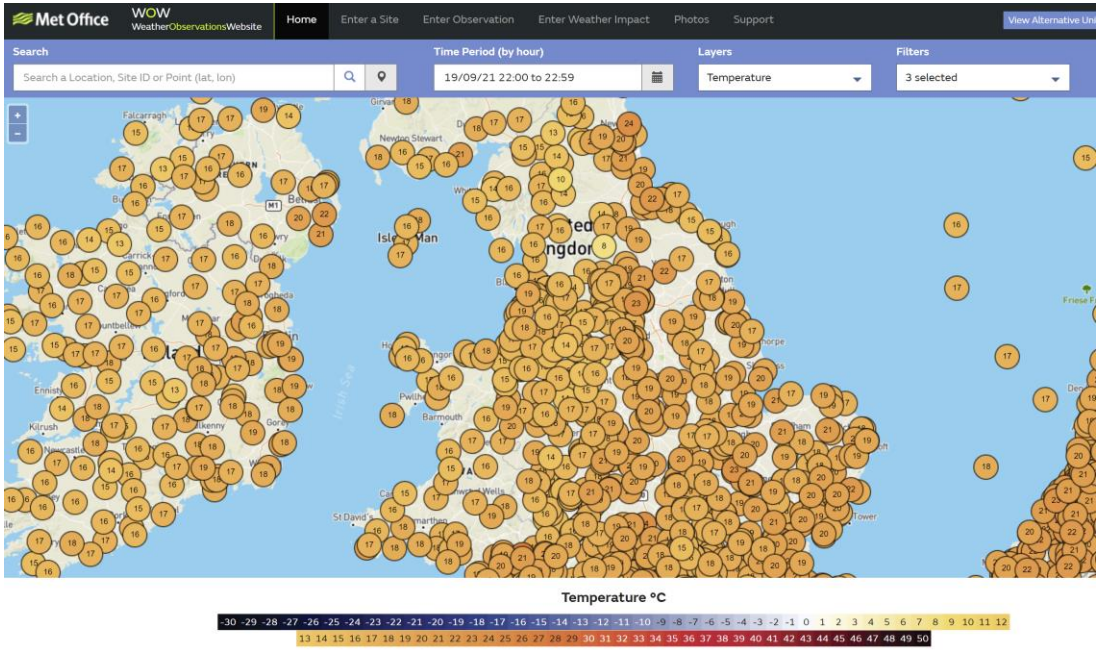
Implications for citizen engagement

- Freshwater is a key natural asset and its **monitoring is crucial** for 25YEP delivery.
- Freshwater indicators are well defined, but **regular monitoring at national scale is extremely challenging.**
- **Citizen science** has the potential to **help overcome monitoring gaps** while also **helping people connect with the environment.**
- **Freshwater monitoring** presents a **unique opportunity** for **piloting of citizen science**.
- **Environment Agency's (EA) SENTINEL Tool (under development):**
  - Aimed at bringing together citizen science data with EA monitoring data
  - To enable improved understanding of the freshwater environment

Example of similar tool

Met Office Weather Observations Website (WOW)
https://wow.metoffice.gov.uk/

- "A platform for the sharing of current weather observations from all around the globe, regardless of where they come from, what level of detail or the frequency of reports".
- Launched in June 2011
- Brings together Met Office, EA and citizen weather observations
- Comprehensive guidance for amateurs



Summary - Key points

- Switch to **integrated water management** over recent decades
- Focus **beyond water supply** – freshwater as a valuable natural asset with vital ecosystem and amenity benefits
- Recently, **great pressure on river (inland) water quality**, including on reduction of **sewage discharges**
- **Increasingly important role of citizen engagement and citizen science projects**, with multiple benefits arising from it
    - Citizens can help overcome monitoring gaps
    - Improved people's connection with the environment -> Public health and wellbeing benefits

Examples of national-scale UK citizen science projects for water management

英國公民參與水資源管理案例分享

FreshWater Watch (FWW)

Part of EarthWatch Europe
https://freshwaterwatch.thewaterhub.org/

- Monitoring phosphates and nitrates with standardised chemical Pack Tests (FWW Pack Tests).
- Replicate (and simplify) standard lab method comparable to EA monitoring.
- 1500 – 2000 measurements per year since 2012.
- > 85% accuracy
- WaterBlitz

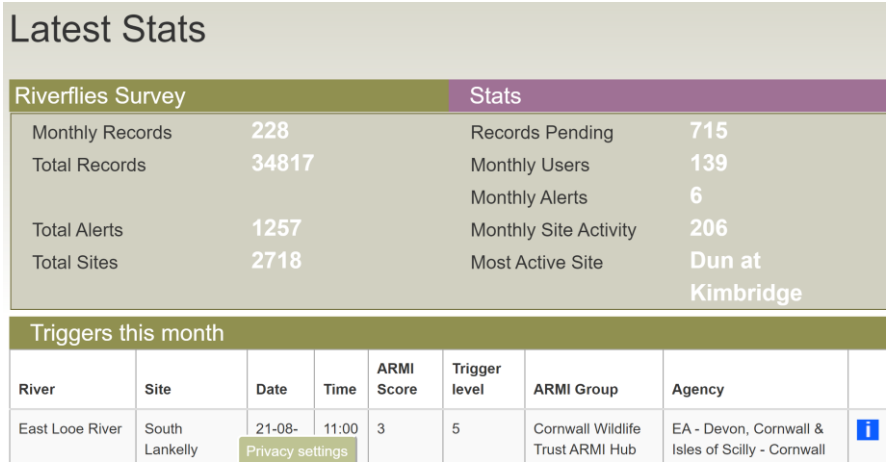
Angler's Riverfly Monitoring Initiative (ARMI)

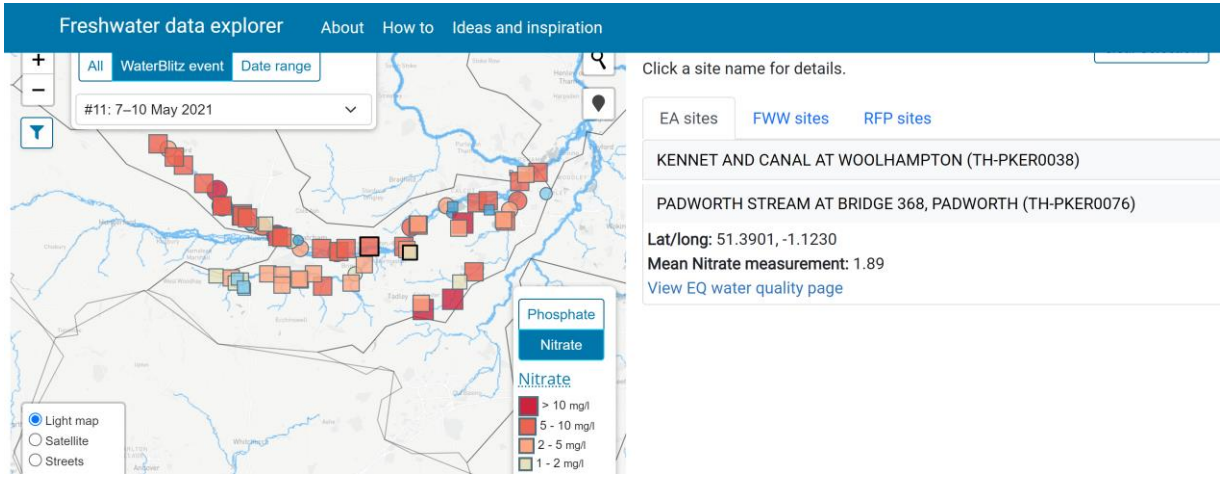
Part of The Riverfly Partnership
https://www.riverflies.org/rp-riverfly-monitoring-initiative

- Standardised sampling and recording of aquatic benthic invertebrate communities to produce a ARMI index.
- ARMI is directly comparable to EA monitoring
- Over 2500 sites monitored nationally per month.
- ARMI index = a simplified version of the Biological monitoring working party (BMWP) index
- ~ 0.86 correlation

Common success factors & challenges

- Work closely with the EA, co-design or provide comparable measurements to the EA monitoring
- Comprehensive and interactive data platform
- Global extent
- Quality assurance
- Oversampling in space and time





Projects I have been involved in

公民科學研究計畫：
個人經驗分享

Projects

FRMRC flood risk management research consortium

FloodCitiSense

2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020

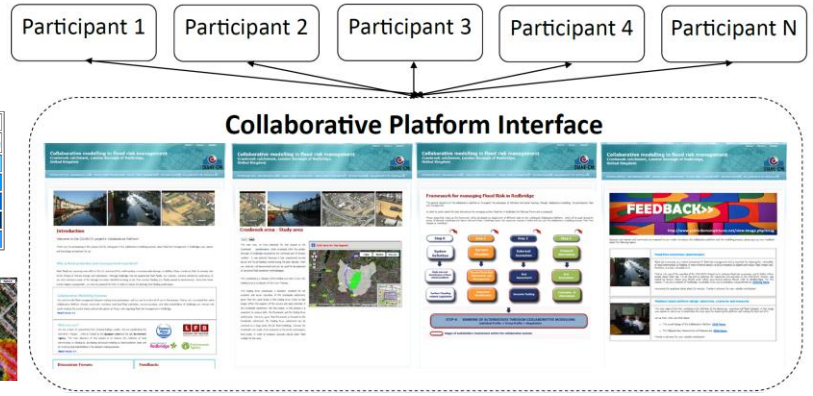
DIANE-CM

RainGain

2007 UK summer floods

UpStream

DIANE-CM (2009-2011): Collaborative modelling for active involvement of stakeholders in urban flood risk management (UK & Germany)

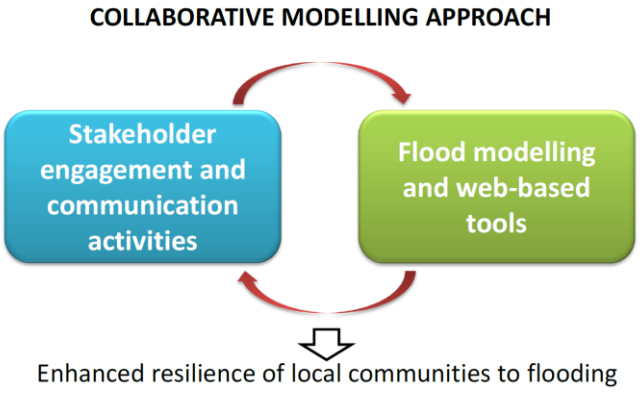


GROUP RANKING

Alternative	Rank	Score
1	5	16.49
2	4	28.33
3	2	29.86
4	1	30.83
5	3	29.79

Collaborative flood risk management supported by:

- Novel flood modelling and mapping techniques
- Web-based collaborative decision making support tools



Key findings:

- Shared knowledge development
- Improved understanding and acceptance of flood management strategies
- Increased awareness and personal responsibility

Challenges: Apathy, wider and more varied stakeholder engagement, high turnover rates, long-term engagement.

Evers et al. (2012)

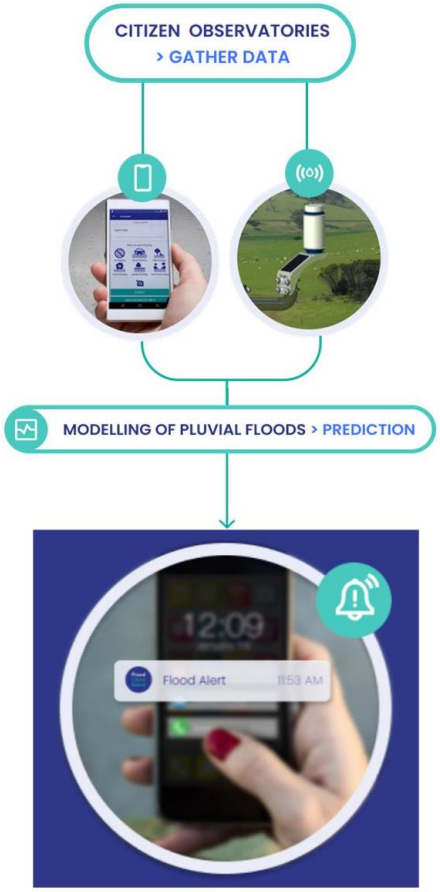
COLLABORATIVE URBAN FLOOD MONITORING AND ALERTING

FloodCitiSense

(2017-2020) http://www.floodcitisense.eu/

By and for citizens and city authorities

Pilot Cities



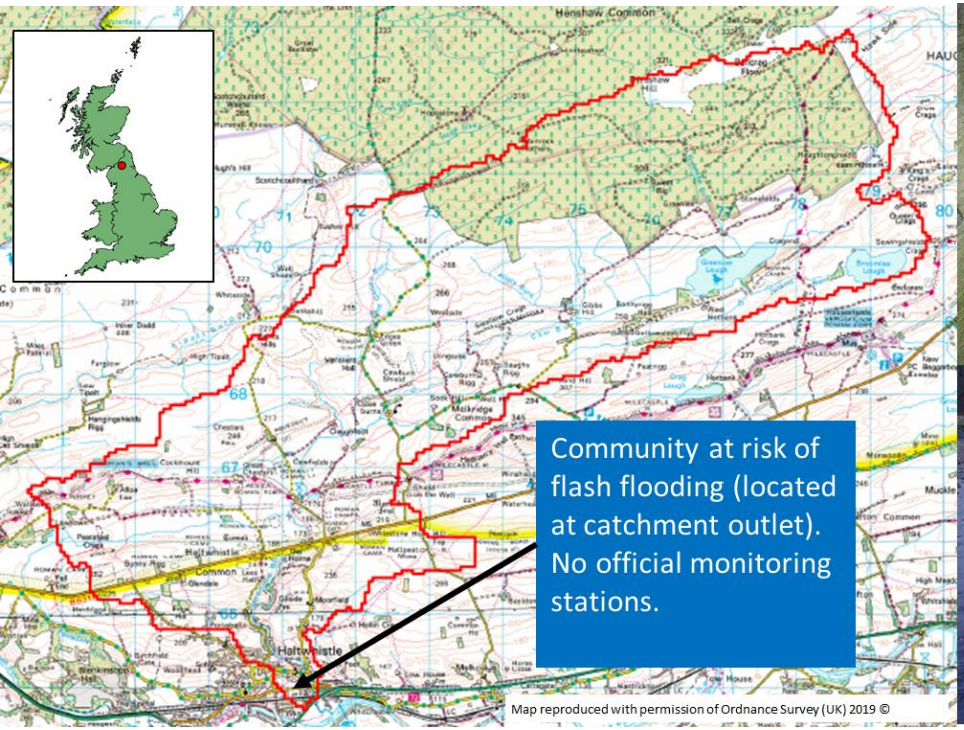
Various ML flood prediction models

Lessons I have learnt

- It is essential to **engage all relevant stakeholders from onset**, including government agencies -> thus ensuring that all needs are accounted for and that project outcomes can have real application and impact.
- **Clear communication and expectation management** is key.
- **Robust technologies** must underpin citizen science projects. Fragile or difficult to use technologies discourage citizen engagement .
- **Data reliability and trustability** is a common challenge in citizen science project – Adequate data validation can help overcome this (e.g. through comparison against standard/recognised sensors).
- **Long-term engagement remains a challenge**. Good data utilisation (answering relevant questions, providing relevant services) alongside communication and technology support can help address this.

Examples of local-scale UK citizen science projects for water management

英國公民參與水資源管理案例分享



Citizen science for catchment science: A rural case study from Northumberland

1. Haltwhistle Burn catchment, Northumberland, UK

NERC SCIENCE OF THE ENVIRONMENT

Tyne Rivers Trust

Newcastle University

eleanor.starkey1@ncl.ac.uk

1. Haltwhistle Burn catchment, Northumberland, UK

Newcastle University | 150 YEARS SCIENCE, AGRICULTURE AND ENGINEERING

flickr

Haltwhistle Burn river watch

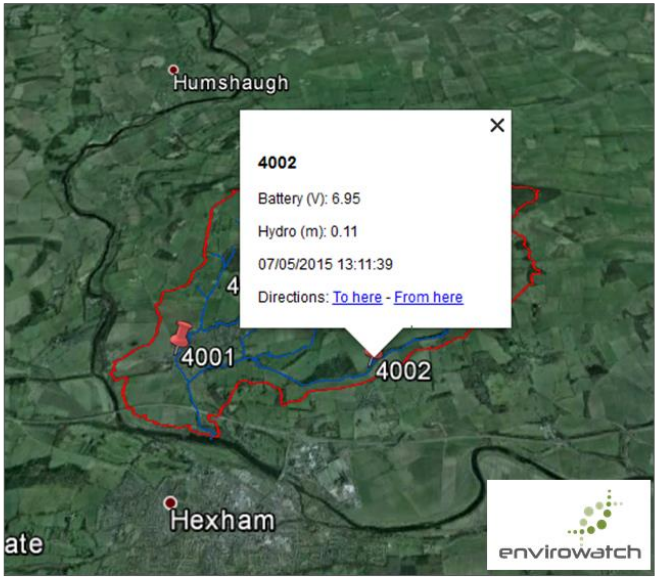
https://research.ncl.ac.uk/haltwhistleburn/ @HaltwhistleBurn

NERC SCIENCE OF THE ENVIRONMENT | Tyne Rivers Trust | Newcastle University

eleanor.starkey1@ncl.ac.uk

2. Action4Acomb, Northumberland, UK

- Community flood groups and flood plans – taking responsibility at a local level
- Community-led & community-owned water level sensors (real-time) provide flood wardens early warning information



https://action4acomb.co.uk/

Flooding

If you observe a FLOOD please telephone [redacted] on:

[redacted]

By calling this number, Flood Wardens in Acomb can activate the Community Flood Plan to assist residents and visitors

If at any time there is a danger to life

Call the Emergency Services

on 999 or 112

N.B. Inform the controllers that there is poor mobile phone coverage at Acomb

The Red Burn which flows around Acomb has overtopped at least 5 times since 1996 and flooded properties in 2008 and then again in 2012. The Birkey Burn to the south of the village has also broken its banks a number of times in the same period and flooded Garden House Farm in 2008.

These 'flash floods' can be sudden and serious and could happen again.

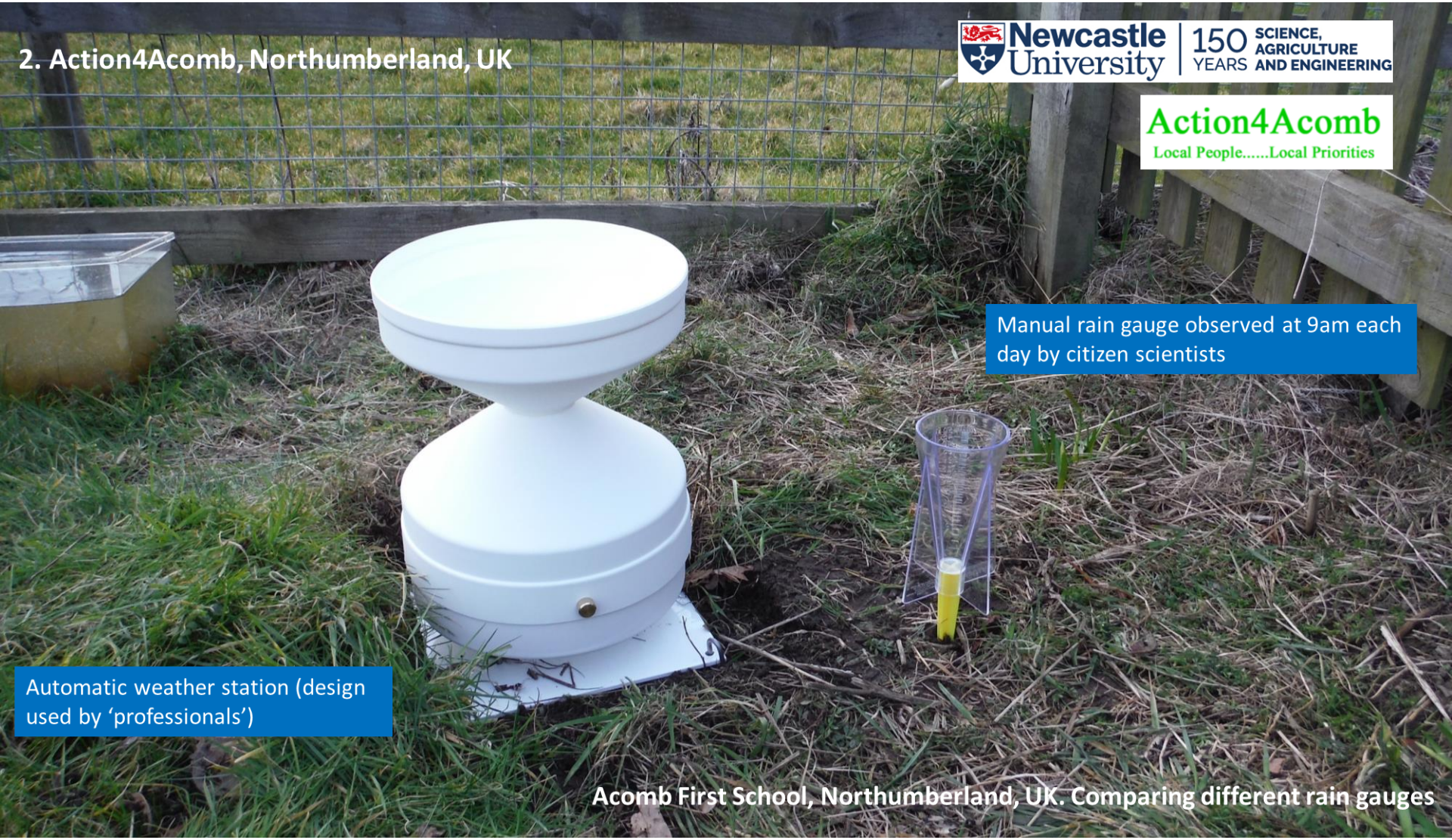
Some simple reminders should help you if there is another flash flood.

Flash Flooding

Revised2014

eleanor.starkey1@ncl.ac.uk

2. Action4Acomb, Northumberland, UK



Acomb First School, Northumberland, UK. Comparing different rain gauges

3. National Green Infrastructure Facility, Newcastle University, UK

Newcastle University | 150 YEARS | SCIENCE, AGRICULTURE AND ENGINEERING

Citizen science and flood risk awareness in an urban space