

NAIAD

NAture **I**nsurance value: **A**ssessment and **D**emonstration

**NAIAD Case Studies:
The Thames Basin
Demonstration Site**



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THE THAMES BASIN DEMONSTRATION SITE

The floodplains of the River Thames are characterised by high land prices and intense urbanisation, with few options for creating extra flood storage. A number of tributaries of the fluvial Thames suffer localised flooding in urban reaches, affecting local inhabitants, businesses, property and infrastructure.

NBS BEING TESTED

Recently there has been UK government investment in natural flood management (NFM) and there is growing interest in how land management such as Conservation Agriculture can provide water management for storing flood water as well as biological benefits. NAIAD is investigating the effectiveness of leaky dams, beaver dams, conservation agriculture and retention ponds in reducing downstream flood peaks. 'Effectiveness' means how well the intervention mitigates the hazard and prevents loss.



For example, we are investigating flooding in Dorking, Surrey where a local manufacturing business was severely affected by flooding of the Pipp Brook, an unmonitored headwater of the Thames. The Pipp Brook has a number of NFM upstream of the urban area; a large retention pond 800m upstream with capacity to store floodwater and new woody leaky dams in forested land in the upper reaches of the watercourse (see photo).

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TOOLS BEING USED:

The **Eco:Actuary toolkit** is a suite of tools developed to support risk analysis for natural hazards, investment planning for natural flood management (NFM), assessment of co-benefits and effectiveness monitoring for installed interventions.

The toolkit comprises three key components:

1. The **//Smart:River** and **//Smart:Soil systems for in field monitoring and web-based analysis of the effectiveness of specific interventions made.**
2. The **Eco:Actuary web-based Investment planner** - which is an empirical tool for understanding the magnitude and type of interventions necessary to make a significant difference to observed flood peaks within a set budget. Flood peak data are provided for application in England using the real time Environment Agency flood and river level data.
3. The **Eco:Actuary web-based spatial policy support system** - which maps risk, exposure, and avoided loss for current natural capital and mitigation scenarios for climate, land and nature-based solution investments. All data are provided for application anywhere, globally.

Freestations are web-connected, low cost, open source environmental monitoring equipment. They are designed to make reliable, detailed and local environmental data more accessible in areas that may have little local financial and technical capacity for the collection of such data. More information: freestation.org

Single interventions like this leaky dam are holding back rainfall from River Rom catchment in London and they have a very rapid decay of influence. Note the Freestation in the background of the photo measuring the water level held back by the dam.



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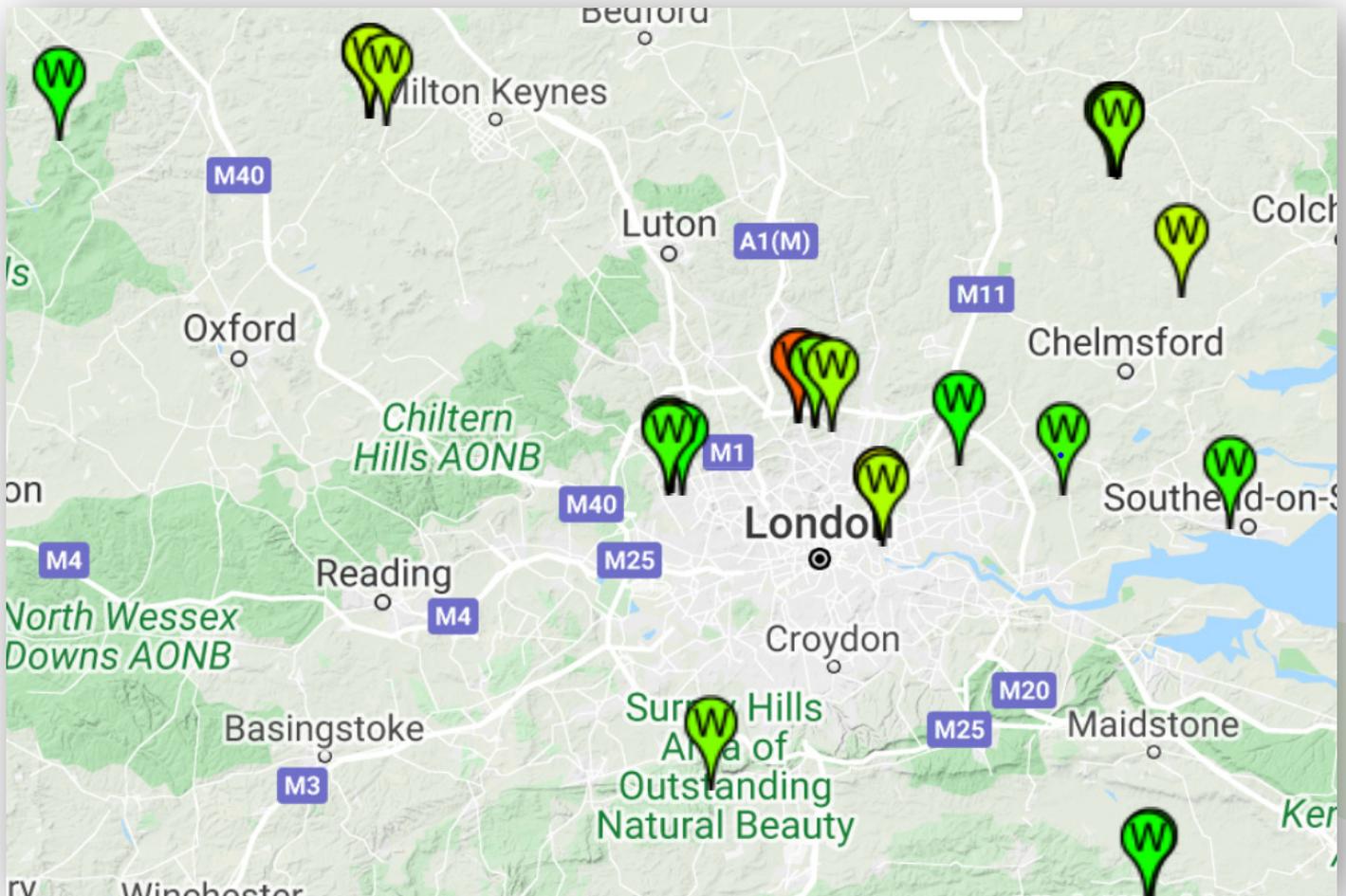
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We have deployed water level FreeStations and soil moisture FreeStations in small catchments throughout the south-east and Midlands of the UK for monitoring the effectiveness of specific in-place NFM as part of the NAIAD project (see maps).



FreeStation Stage Gauges (W) using //SmartRiver: (Colour indicates the number of hours since last reading was sent to servers)

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FreeStation Soil Moisture gauges using //SmartSoil: (colour indicates % soil moisture content. Red - high, green - low. S - soil moisture gauge, W means additionally measuring river stage).

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HOW DOES THE //Smart: SYSTEM WORK?

The //Smart: system consists of a series of web connected sensors (FreeStations) designed to monitor NFM effectiveness to assess the contribution of NFM to mitigate flooding.

The //Smart: System has two main applications in the Thames basin:

//Smart:River, for:

- Examining stage in relation to rainfall events
- Comparing stage either side of an intervention
- Examining storage relative to a downstream flow gauge

and //Smart:Soil, for:

- Calculating soil storage relative to a downstream flow gauge
- Calculating the marginal impact of a soil management intervention
- Calculating soil water fluxes

//Smart: is intended as a turnkey system and is used to monitor the effectiveness of specific in-place NFM accurately, at low cost and with ease. It comprises self-build open source hardware alongside on-device firmware and server-side software for near real-time monitoring and assessment of NFM including point source in-line storage (leaky dams, retention ponds) and non-point land management options such as conservation agriculture. //Smart: enables live website links on the contribution of NFM, for example the Beaver dam project live link at Spains Hall Estate, one of the NAIAD sites:

//Smart: 15/11/2019 09:39 (GMT): The beavers are currently holding back **1.181** olympic swimming pools of water.

//Smart: is accurate, low cost and easy to implement. Investors in NFM such as local Government and conservation organisations can easily assess the best options for investment. It can be applied anywhere in the world so it has a global benefit.

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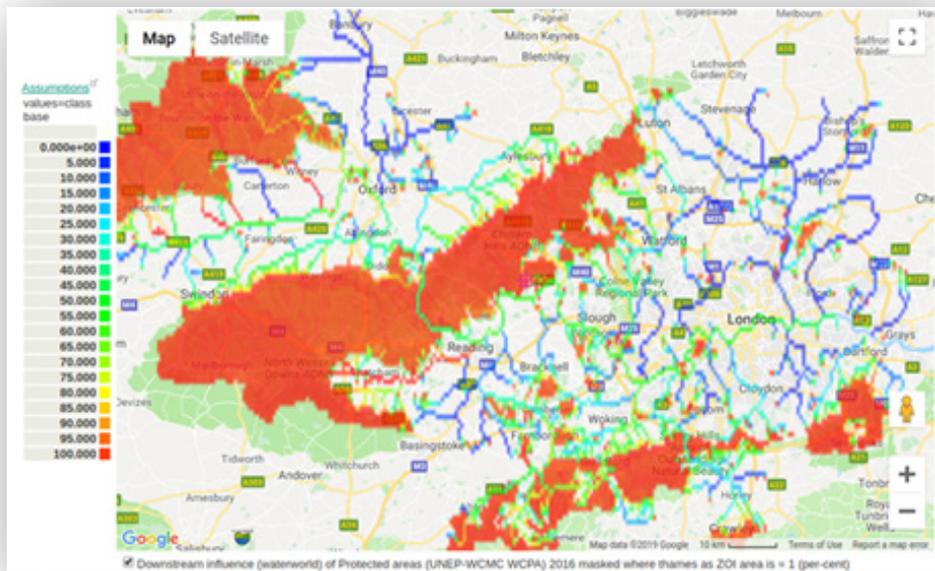


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HOW IS ECO:ACTUARY POLICY SUPPORT SYSTEM BEING USED IN THAMES?

Eco:Actuary is being used to map risk, exposure, loss, mitigation and avoided loss for current natural capital and scenarios for climate change and nature-based solution investments.



Example output of the open-access Eco:Actuary's hydrological influence metric for strategic planning: the downstream influence of protected areas in the Thames basin (coloured red in the map). Water from these protected areas mixes with that from other areas so the influence of the Protected Areas declines very rapidly downstream to less than 5% of the flow of the downstream (blue). Less than 50% of the flow past Central London is influenced by protected areas.

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Eco:Actuary in Thames demonstrates that:

- Small scale interventions will have little impact downstream,
- Not all interventions will work for all events,
- We still need insurance - the smaller the intervention, the fewer events that it will protect from.
- The sum of all interventions upstream of assets is what matters,
 - Interventions cannot be considered in isolation from each other,
 - Where you put the intervention in the catchment is also important, Small (or more) interventions should be located towards the top of catchments,
 - larger interventions should be located further downstream (where rivers have greater flow), or nearer to assets where their impact can be greater.

WHY ARE NBS A BETTER CHOICE?

An advantage of NFM is that they have **co-benefits** which grey infrastructure solutions do not. Co-benefits include biodiversity and other ecosystem services such as carbon, recreation etc.

Grey infrastructure may have **co-disbenefits**, such as higher resource costs, aesthetics etc. NFM also have **opportunity costs**, e.g. for agricultural production of retention ponds. There may also be risks for NFM, e.g. for water resources and dry season flows of more storage in the landscape and thus more water loss to evapotranspiration (the sum of evaporation and plant transpiration from the Earth's land and ocean surface to the atmosphere). Geography (context) and position in relation to assets at risk and potential beneficiaries of co-benefits is critical.

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THE MAIN MESSAGE OF THAMES DEMO:

NFM are not engineering solutions and thus **different methods are required to determine** :

- how much extra flood storage is needed in the landscape,w
- where the flood storage should be located to be most effective. Investors and planners can investigate this using the **Eco:Actuary web-based Investment planner** for understanding the magnitude and type of interventions necessary to make a significant difference to observed flood peaks,
- and **how effective** the NFM are for different events – for example using the **//Smart:** system with FreeStations, investors and planners can use the spatial **Eco:Actuary Policy Support System** to help assess the downstream flood damage losses that are mitigated.

AUTHORS

Mark Mulligan, KCL mark.mulligan@kcl.ac.uk, Sophia Burke, AmbioTEK CIC, Arnout van Soesbergen, KCL, Caitlin Douglas, KCL

About the NAIAD Project

'NAIAD' (Nature Insurance Value – Assessment and Demonstration) is an advanced, first of a kind, EU Horizon 2020 applied research programme focused on Nature Based Solutions (NBS) in risk management strategies, with a focus on water. NAIAD aims to operationalize the insurance value of ecosystems to reduce the human and economic cost of risks associated with water (floods and drought) by developing and testing - with key insurers and municipalities - the concepts, tools, applications and instruments (business models) necessary for its mainstreaming.

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