Nature-based approaches for catchment flood management: an online catalogue

September 2015
W15-0603

The JBA Trust is an independent charity, registration No. 1150278.
The JBA Trust promotes knowledge and skills development in environmental risk management.

Authors

Duncan Nicholls – Lancaster Environment Centre, Lancaster University

Dr Barry Hankin – JBA Consulting, Warrington

Acknowledgements

We are grateful to Lancaster Environment Centre and British Water for funding D Nicholls through an internship to work on this project.

The JBA Trust is very grateful to a range of agencies for permission to include data of schemes studied in the database.

The assistance of staff from JBA Consulting in providing data and also reviewing the report draft is also appreciated.

Front cover photograph: Natural flood management measure in the Holnicote floodplain - earthen bund with pipe outlet © JBA Consulting

Purpose

This document has been prepared as a resource to help inform further research. The JBA Trust makes no representations or warranties of any kind concerning the material contained within this report, whether express, implied, statutory, or other. This includes, without limitation, warranties of title, merchantability, fitness for a particular purpose, non-infringement, absence of latent or other defects, accuracy, or the presence or absence of errors, whether or not known or discoverable. In no event will the JBA Trust be liable for any legal theory (including, without limitation, negligence) or otherwise for any direct, special, indirect, incidental, consequential, punitive, exemplary, or other losses, costs, expenses, or damages arising out of this material or use of the material.

Copyright

License

Summary

This report documents the process involved in creating a geo-database of schemes where nature-based approaches to catchment improvement have been deployed with the objective (not necessarily exclusively) of helping to manage flood risk.

The **first objective** of the work was to catalogue and map projects where catchment managers or partnerships are working with natural processes, or undertaking feasibility analysis through modelling.

The **second objective** was to compile meta-data about each project, and in particular to record, as far as possible, whether and how the projects include monitoring or on-going assessment of the performance of measures implemented on the ground, in terms of evidence about the benefits of the those measures in practice, and experience gained about their robustness over time.

Many agencies in the last ten years have been implementing or testing schemes to manage flooding at local scales by working with natural processes instead of, or as well as, "hard engineering" such as flood walls and raised banks. By studying published resources and a list of projects provided by the Environment Agency in England, 136 schemes across Britain have been included, spanning a range of spatial scales and with varying levels of evidence about performance. Nature based schemes are attractive due to their likelihood of having lower up-front costs compared to "hard engineering", their potential to create multiple ecosystem benefits and their scale of deployment, which may help to stimulate or encourage community involvement.

The project adds to information compiled previously by the Environment Agency by presenting it through an online map interface. The map has been produced using open source software and background mapping data.

The majority of schemes identified in the catalogue cite improved diversity of wildlife in areas where they were implemented.

Of the projects reporting on performance of implemented measures, about 30% include quantitative assessments, but the majority are qualitative. However the impact on wildlife species and human interaction with the new measures is widely reported.

Dissemination and further updates

Basic information can be obtained from the JBA Trust website:
http://www.jbatrust.org/workingwithnaturalprocesses

The on-line mapping can be accessed at: http://naturalprocesses.jbahosting.com/

To feedback additional information, corrections or comments, and to access further background information, please contact the JBA Trust via the "Contact Us" page at www.jbatrust.org

Contents

List of Figures

List of Tables

Abbreviations

CEH	Centre for Ecology and Hydrology
GIS	Geographical Information System
WWNP	Working With Natural Processes

1 Introduction

1.1 Summary

Nature based schemes to improve catchment resilience to flood and diffuse pollution risks have gained popularity in the last ten years and are now present in all regions of the United Kingdom. The size and effectiveness varies for each scheme. In order to try and quantify the effectiveness and spatial distribution of these schemes a geo-referenced database was created. The results of this have been represented in map form using open source JavaScript based Leaflet map software.

1.2 Objectives

The objectives of the present study were:

- To create a map-based asset database of “nature-based” experimental or pilot study schemes for flood risk management and diffuse pollution control.
- To analyse the data to show
    - What nature-based asset types are being tested
    - How many exist
    - How often multiple benefits for flood risk management and diffuse pollution are being considered jointly
    - What information exists about the performance and benefits of the schemes

This report is published for use as a research and educational resource.

1.3 Scope

To achieve the objectives listed above the following work was carried out:

- A review of case studies of where nature-based approaches have been used for flood risk management.
- Research using publicly available data from a range of agencies and news sources to gather data on schemes already implemented.
- Email enquiries to agencies to obtain supplementary information not found in the public domain.
- Data were compiled as a database and published as an online map using Leaflet and the open source GIS package QGIS.

Our research and consultation sought to collate the information described in Table 1.

Table 1: Information sought

Database field	Details
Name	The name given to the scheme
I.D.	A unique identification number
Aims – Flood Risk	Aims of the scheme in terms of flood risk
Aims – Diffuse Pollution	Aims of the scheme in terms of diffuse pollution
Region	Region of the UK in which the scheme resides
Grid Reference (OS)	A grid reference for the scheme, in large schemes a central point was used
Easting	Easting value for the scheme
Northing	Northing value for the scheme
Rainfall (mm)	Rainfall at scheme location, sourced from Met Office historical data
Altitude (m)	Altitude of the scheme above ordnance datum
Type	If the scheme is an implementation of WWNP or identifying if there is an opportunity too
Measures	What measures where applied at the scheme to achieve results
Construction	What the measures used were built from and how they were distributed
Size (km2)	Area of the scheme
Date Implemented	When the scheme was first implemented, not noted how long it lasted
Maintenance Checks	What maintenance will be required at the scheme to keep it operating properly
Who Implemented	Which agencies or bodies were involved in implementing the scheme
Investment (£)	Funding available to the scheme
Additional Storage	Resultant extra storage created by measures
Elevation of Defences	Height of any measures used in the scheme
Risk Reduction	The method used to reduce the risk of the project
Photo	A photo of each scheme was sourced and attached
Performance/Ecosystem Benefits	Results of scheme on flood risk and habitats
Negative impacts	Any dis-benefits of the scheme
Scaling up	If there is possibility to scale the project up in the future
Links	A hyperlink to the public domain information source
Comments	Any extra comments not already noted

2 Interim analysis of data

2.1 Data collection

After eight weeks of work a database with 136 schemes has been collated. Across all the schemes to date 56 measures have been identified that help reduce flood risk using natural processes (Table 2). The range of organisations implementing such measures varies from national bodies such as Defra and the Environment Agency to local organisations such as the River Ribble Trust and Southern Cumbria Rivers Trust. In total 142 implementing bodies have been identified.

2.2 Map production

Using only open source software a high resolution Leaflet based map has been produced. This has been modified to allow better data representation and display results in a spatial context.

2.3 Nature-based asset types tested

For a full list of nature-based schemes documented to date see Table 2. These have been used individually and in combination depending on the given scheme. Over the 136 schemes studied it was found that 13% used only a single measure, the rest had between two and six measures in place. Amongst the most commonly implemented measures are constructed debris dams, these are seen as easy and cheap to build, whilst increasing upstream storage sufficiently to reduce flood effects on communities downstream.

2.4 How many nature-based schemes exist

The 136 projects included here are not an exhaustive catalogue of schemes in the United Kingdom. The database is derived from Environment Agency information and desk-top research undertaken over 2 months. Some schemes may exist without having been advertised in the public domain and therefore may not be included in the database.

It was observed that the 89% of schemes identified were actual implementations of measures working with natural processes measures. The remainder are potential opportunities including modelling studies.

2.5 What information exists about performance and benefits

In a few cases, watercourses have been gauged to monitor performance of a scheme. Others have included some analysis based on modelling. However in schemes that are not modelled there is far less quantitative data. Qualitative data is provided in most instances describing the change seen in an environment and reduction in peak flows observed due to the schemes implementation.

Table 2: Nature-based asset types used

Nature-based asset types used	
Bed re-naturalisation	Peat regeneration
Buffer strips alongside watercourse	Planted fibre rolls
Catchment sensitive farming (CSF) measures	Pond creation
Coastal realignment	Pond deepening
Compaction relief	Pre-planted coir rolls
Conifer Planting	Rain garden
Creation of offshore reefs to dissipate wave energy and create habitat	Reconnect rivers to floodplain
Crop rotation	Recycled Christmas trees to stabilise dunes
Cross-slope woodlands & tree shelter belts	Reinforced earth
Culvert throttling	Re-meandering straightened rivers
Deculverting	Removing redundant in-stream structures
Deflectors	Riparian management
Ditch blocking	Rock rolls
Earth bunds	Rural sustainable drainage
Engineered debris dams	Sand dune restoration
Flood storage areas	Sediment traps
Floodplain and riparian woodlands	Set-back defences
Gabions	Set-back embankments
Ground level lowering	Soil conservation
Gully woodlands	Stone revetments
Hazel faggots	Timber piling
Heather no burn zone	Two-staged channels
Intertidal habitat creation scheme	Urban flood corridors
Land and soil management practices	Use of vegetation to dissipate wave energy
Leaky sluices	Vegetation planting
Moorland grip-blocking	Wetland creation/restoration
Offline ponds/scrapes	Willow spilling
Overland flow interception	Woody debris

3 Map results

Figure 1: Leaflet map displaying location of schemes in database, 136 locations included.

Due to the number of schemes clustering was introduced to keep the map interface looking cleaner. To see individual schemes the user zooms in and they are displayed.

The map is interactive and displays data from each scheme upon interaction.

4 Dissemination and updates

4.1 Contact for further information

Basic information can be obtained from the JBA Trust website: http://www.jbatrust.org/node/97

The on-line mapping can be accessed at: http://naturalprocesses.jbahosting.com/

To feedback additional information, corrections or comments, and to access further background information, please contact the JBA Trust via the “Contact Us” page at www.jbatrust.org

4.2 Updates

We would be pleased to hear about any further information sources that could help in improving the historical records for future updates. Please contact us at www.jbatrust.org as above if you have any further information that you would like to tell us about.

Registered Office:
South Barn
Broughton Hall
Skipton
North Yorkshire
BD23 3AE
United Kingdom

t:+44(0)1756 799919
e:info@jbatrust.org

JBA Trust Ltd.
Registered Charity 1150278

Visit our website:
www.jbatrust.org