REGIONAL WORKSHOP

Delivering Nature-Based Solutions: Learning from international best practice

16th-17th May 2019, Edinburgh, UK

COST Action – CA 16209
Natural Flood Retention on Private Land (LAND4FLOOD)

Middlesex University London
Environment Agency
Scottish Government Riaghaltas na h-Alba gov.scot
NNBF
LAND4FLOOD NATURAL FLOOD RETENTION ON PRIVATE LAND
The James Hutton Institute
SEPA Scottish Environment Protection Agency Buidheann Dìon Àrainneachd na h-Alba
EWN Engineering With Nature
cost EUROPEAN COOPERATION IN SCIENCE & TECHNOLOGY

IMPRINT: AUGUST 2019

Authors:
Sally J. Priest
(Flood Hazard Research Centre, Middlesex University, UK)
Mark E. Wilkinson
(The James Hutton Institute, UK)

Graphic design template:
Sophie Spanlang
(TU Vienna, Land Policy and Land Management, Austria)

Acknowledgements: This LAND4FLOOD workshop was initiated jointly in collaboration with the Environment Agency (England), Scottish Environment Protection Agency and the Scottish Government. It was undertaken as part of a wider collaborative workshop funded by the Environment Agency. Special thanks to the group facilitators Lydia Burgess-Gamble, Oliver Burns, Heather Forbes and Rhys Evans.

The workshop was funded by the COST Action "Natural Flood Retention on Private Land" (CA16209). COST is supported by the EU Framework Programme Horizon 2020.

Cover photos: Todd Swanack

TABLE OF CONTENTS

>> Summary and overview <<

Leaky barrier, Eddleston Water; Sally Priest

LEARNING FROM INTERNATIONAL BEST PRACTICE

>> Bringing communities of practice together <<

PREMISE

The co-organised event brought together experts from around the world to discuss the challenges and opportunities of funding, designing, implementing, maintaining and monitoring the effectiveness of Nature-Based Solutions (NBS) as part of flood risk management plans. Its goal was to facilitate the knowledge exchange between international researchers, practitioners and policymakers.

Importantly, the aim was to create an open forum, and the time and space for free discussion, in addition to plenary sessions where participants were introduced to a number of existing and planned initiatives.

PARTICIPANTS

Invited participants represented 15 countries (Belgium, Canada, Czech Republic, England, Germany, Hungary, Ireland, Israel, Malta, the Netherlands, Norway, Poland, Scotland, Sweden and the United States).

Participants were drawn from a range of disciplines including engineering, natural sciences, ecology, economics and social sciences. Additionally, participants represented those:

- developing policy for NBSs;
- tasked with implementing NBSs in practice;
- researching the effectiveness and benefits of these types of solutions.

"Challenges still remain but we must not forget how far we have come, 15 years ago we could not have convened this symposium as there would not have been the interest, this suggests our flood risk management culture is changing"

Symposium Participant

Symposium, Rhianne Locke

COMMUNITIES OF PRACTICE

In addition to LAND4FLOOD participants, there were a number of existing communities of practice represented at the workshop event:

Natural and Nature Based Features: International guidelines

A collective initiative of the US Army Corps of Engineers, the Environment Agency (England) and the Rijkswaterstaat (The Netherlands) to identify and deliver international guidelines and examples for natural approaches to managing flood risk. This links to the US Army Corps of Engineers, Engineering With Nature (EWN) and the Environment Agency's Working with Natural Processes initiatives.

Building with Nature (North Sea Region)

An EU funded North-Sea region Interreg project focussing on demonstrating the effectiveness nature-based approaches to delivering flood risk and coastal erosion management, whilst improving ecosystems. At 7 coastal and 6 catchment sites in Belgium, the Netherlands, Germany, Denmark, Scotland and Sweden, the evidence base for the implementation of solutions will be established.

SYMPOSIUM SPEAKER PROGRAMME - 16TH MAY 2019

- *Introduction to the event and summary of the communities of practice attending* – Jo Guy, Environment Manager, Environment Agency
- *Welcome to Scotland - Natural Flood Management the Scottish context* - Rosanna Cunningham MSP, Cabinet Secretary for Environment, Climate Change and Land Reform, Scottish Government
- *Natural Flood Management in the English Context* - Julie Foley, Director of Flood Risk Strategy & National Adaptation, Environment Agency
- *Holding Water in the Landscape : Working with communities in India and Latin America* - Minni Jain - Director, The Flow Partnership
- *Communicating about Opportunities and Best Practice: Engineering With Nature - An Atlas 2 and Natural and Nature Based Features Guidelines* - Todd Bridges, Senior Research Scientist, USACE
- *Recovering from Storm Desmond, the role of Natural Flood Management in Cumbria* - Daniel Bond, Area Flood Risk Manager, Environment Agency
- *Land for Flood – how land matters in flood risk management* - Thomas Hartmann, Assistant Professor Wageningen University, Netherlands
- *Sandy Reinforcement Houtribdijk* - Rinse Wilmink, Advisor Coastal Flood Risk, Rijkswaterstaat
- *Building with Nature: Developing the evidence base and sharing international perspectives* - Chris Spray, Senior Research Fellow and Emeritus Professor, Dundee University
- *Natural and Nature Based Features the US context* - Todd Bridges, Senior Research Scientist, USACE
- *Wrap up, summary of the day and next steps*, Hans Pietersen, Senior Advisor International Affairs, Rijkswaterstaat

In addition to the plenary sessions, symposium attendees also participated in 90 minute workshop sessions, each focussing on the delivery of different types of NBSs or issues surrounding their implementation (see pages 8 & 9).

The first day closed with the Scottish Government hosting a networking event in the evening.

Rosanna Cunningham, MSP

Todd Swanack

Thomas Hartmann

Todd Swanack

Todd Bridges

Todd Swanack

SYMPOSIUM PLENARY OVERVIEW

The symposium was honoured to welcome the Scottish Government's Cabinet Secretary for Environment, Climate Change and Land Reform, **Rosanna Cunningham** MSP to open proceedings. She highlighted the work currently taking place in Scotland to mitigate the impact of flooding and coastal change; including the use of NBS in catchments and coasts. The Cabinet Secretary also highlighted the importance of international collaboration and knowledge exchange around the concept of working with nature to protect communities from flood impacts. **Julie Foley** (Director of FCRM Strategy and National Adaptation, Environment Agency for England) then gave a keynote speech on Flood Risk Management (FRM) from an English perspective. She spoke of the recent £15m investment in NBS to reduce flood risk and provide wider benefits. The talk also discussed the recently launched WWNP evidence directory and the consultation on the draft National FCERM Strategy. **Minni Jain** (Director, the Flow Partnership) provided an overview of NBS in India and how holding water in the landscape can help to mitigate both floods and droughts. She described how c.15,000 Johad structures have been built and seven rivers have been revived since 1985. Recent work in India was also discussed which includes community-driven decentralised water management and the further construction of 75 structures in Karauli. **Todd Bridges** (Senior Research Scientist, U.S. Army Corps of Engineers) introduced the work of the Engineering with Nature initiative including a call for new cases in the next edition of the 'Engineering with Nature: an atlas'. He also updated the audience on the international guidelines on NNBF that are currently being produced. **Dan Bond** (Flood Risk Manager, Environment Agency for England) presented the role of NBS in Cumbria, England. He introduced the £2.5m programme of flood risk management works being undertaken which includes upland moor restoration, leaky barrier installation and an associated monitoring programme. **Thomas Hartmann** (Wageningen University) spoke about how land matters for flood risk management (and the LAND4FLOOD EU COST action). He highlighted how resilient cities require the action of private landowners and the importance of starting with the land, not the hydrology when it comes to FRM. **Rinse Wilmink** (Rijkswaterstaat) then gave a coastal perspective of NBS speaking about the Houtribdijk in the Netherlands. This case used NBS to manage flood risk, providing sandy shores and a nature area in Trintelzand and illustrated the need for adaptive management. **Chris Spray** (University of Dundee) summarised the Interreg 'Building with Nature' project which aims to increase the climate resilience and adaptability of coasts, estuaries and catchments of the North Sea Region. NBS solutions are being used in catchment and coastal cases studies across the North Sea region; it is an active research project which is learning from doing and sharing this knowledge more widely. **Todd Bridges** gave a view of NBS from the US context introducing the importance of Engineering with Nature in the USA and how the U.S. Corps of Engineers are delivering NBS and associated training. Cases were presented from Hamilton and Sears point wetlands and an NBS example in Back Bay, New Jersey. **Hans Pietersen** (Rijkswaterstaat) concluded the symposium by emphasising the key messages and synergies.

Rinse Willmilk; Todd Swanack

Storage Pond at Eddleston Water, Lydia Burgess-Gamble

WORKSHOP DISCUSSIONS

>> Delivering Nature-Based Solutions: Learning from international best practice <<

Each of the five workshop groups began with a brief overview from a selection of the 27 submitted cases (from 14 countries). Also click here for a more detailed description of group discussions.

Common themes then discussed amongst all working groups were as follow:

- **Funding and Financing**

It was widely acknowledged that more measures are needed. Therefore, in order to implement more NBS measures new novel funding mechanisms are required. It was recognised that there needs to be greater efforts in engaging private funding for implementing NBS approaches. Two cases discussed catchment/ performance-based bonds as a novel type of payment. Where funding already existed, it was noted that capital works funding was not the only issue rather greater funding efforts for continued maintenance are also needed. Also with existing examples measures are small and dispersed. Small scale temporary water storage results generally inundate farmland for a shorter period (compared to a large feature) and therefore the likelihood of crop damage will be smaller. However, larger scale measures or more complex measures do require a form of compensation. Institutions working in silos can sometimes result in dispersed funding and a lack of coordination of measures. There is a greater need for stakeholders to work and collectively bring funds together for more efficient delivery. But efforts are stifled by limitations in valuing ecosystem services benefits and uncertainty in the effectiveness of measures.

- **Evidence and upscaling**

Some cases highlighted successful NBS installation. However, flooding to property still occurs and more measures are required. These floods are usually more extreme highlighting that catchments will require a large volume of available storage prior to a flood and these storage areas must still have capacity during the storm. The amount of storage needed increases with catchment size. It was therefore suggested we need a mixture of structural and NBS approaches at these larger scales. The runoff reduction potential of NBS measures depends also on their placement within the catchment. Evidence is needed to perform an accurate cost-benefit analysis, but can be challenging. Citizen-driven monitoring can help provide evidence and deliver wider community involvement. Valuing the wider multiple scheme benefits is important to achieve a positive cost-benefit priority score.

Breakout workshop; Sally Priest

WORKSHOP SESSIONS

- Realising Natural and Nature-Based Solutions: Accessing land, financing & stakeholder engagement
- Storing flood runoff over varying scales
- Natural and Nature-Based Solutions: Measures in combination
- Natural and Nature-Based Solutions: Measures in coastal and island environments
- Fluvial Natural and Nature-Based Solutions

- **People and communities**

Some cases highlighted conflicting views between farming and urban communities; i.e. urban communities perceive upstream land uses to increase flooding whilst the farmers might not be willing to install measures as they question why houses are being built on floodplains in the first place. It was noted that a flood has a way of encouraging behaviour change. Access to live data such as river levels can bring communities on board and citizen-driven monitoring was highlighted as another approach to get communities involved.

Many cases suggested that the use of Non-Governmental Organisations or a central coordination body is critical to the successful delivery of measures. A trusted intermediary can help landowners deliver measures but also locate funding. They can also communicate and involve communities. Financial resources for these intermediaries are important as landowner engagement can be time consuming (some cases illustrated that this can be many years).

There was consensus that a bottom-up approach to stakeholder engagement is usually the most effective. Although this approach is time consuming it usually results in more effective engagement and commitment to projects. Critical to this process is the need to engage in early dialogue with the landowners and tenants, especially those making a living from the land.

One remaining evidence gap is how to initiate landowner action and how to maintain and accelerate the process. In some regions of India, a collaboration whereby all partners physically sign up to a management plan was a successful approach. NBS has also been seen to bring communities together (e.g. N. England). Collaboration between all partners was key to the success in most cases.

Some cases pointed out the challenge of working with tenant farmers who wish to install measures, but where the land owners refuse. Therefore, how can landowners be encouraged to adapt land uses and management strategies which allow for increased water retention capacity? The range of different terminologies can also cause issues when communicating between stakeholder groups. The fact that delegates used different terms, e.g. NFM, NBS, EwN and WWNP at the symposium is illustrative of this confusion.

- **Management, processes and liability**

Governance can be a barrier to delivery when it disconnects between those managing different drivers, planning systems and national/ local policy. Additionally, management of measures post-construction can be problematic. A selection of cases highlighted that the budget for future management is often more difficult to attain than capital costs. Also, it is difficult to determine who will manage the measures. Some delegates discussed that the most efficient way to do this might be to get landowners to maintain measures but that would require changes in to agri-environment schemes and payments. However, there is still a need to discuss issues surrounding liability behind these measures if something were to go wrong (albeit most measures are highly unlikely to go wrong if designed correctly). In delivering certain measures it was suggested that governmental bureaucratic processes can put off those trying to implement measures and these processes are not always fit for purpose. This may take time to overcome but by building some demonstration/ initial measures and inviting inspection of what is possible can provide proof of concept and overcome some hurdles.

Breakout workshop; Thomas Hartmann

FIELD VISITS - 17TH MAY 2019

>> Exploring the implementation of Nature-Based Solutions <<

The event offered two parallel field visits: one to Eddleston Water in Scotland and the second across the border to Belford Burn in England. These cases offered attendees the opportunity to view sites where NBS measures have been installed.

The site visits offered attendees different experiences of NBSs at varying scales, examples of implemented measures and in different regional administration and policy contexts.

"There was constant discussions, questions and answers. Nothing was off limits! So challenging questions that drew on the benefits and the limitations."

Workshop participants

EDDLESTON WATER	BELFORD BURN
Scale: 70 km^2	Scale: 6 km^2
Properties at risk: 582 properties (1:200 year; Peebles and Eddleston)	Properties at risk: 54 properties (1:100yr; Belford village)
Key aims: Explore the effectiveness of NFM and improve river ecology	Key aims: Reduce flood risk and provide wider ecosystem services
Measures: Re-meandering, flood restricting log jams, native tree planting, storage ponds, removing artificial banks	Measures: Offline storage areas, overland flow disconnection bunds/ ponds, online ponds and wetlands, leaky barriers, riparian planting, upland farm drain management, sediment traps
Cost: £1.4 million	Costs: £0.45 million
Funding: Varied mix of government, charity, research and private land owner	Funding: Mix of Regional Flood and Coastal Committee (RFCC) local levy and research projects

Click here for further information on Eddleston Water

Click here for further information on Belford Burn

Eddleston Water field group; Chris Spray

Belford Burn field group; Mark Wilkinson

Offline storage area in Eddleston Water; Sally Priest

EDDLESTON WATER, SCOTLAND

Participants were given an informative presentation introducing the flood risk issues within the catchment and the NBS measures implemented to reduce flood risk and provide wider ecosystem services. The importance of partnership working including the vital role and communication with local landowners and how challenges were overcome were introduced.

Following on from this enlightening contextual introduction, we visited three key locations as part of the field visit. The first stop was in the downstream part of the catchment where we were hosted by a local landowner who was passionate about providing environmental solutions which held multiple benefits (biodiversity, recreation and flood risk reduction). He has been instrumental in the acquisition of land and the driving force in terms of implementing NBS. He gave a landowner's perspective of the implementation challenges and benefits. This landowner had worked closely with the Tweed Forum (a charity working to promote the sustainable use and management of the River Tweed catchment) to access funding to plant a variety of tree species and create an offline storage area that can be used at times of flooding, but that also was sympathetic to local wildlife needs.

The group then moved further upstream to visit a river restoration site. Here, the aim was to slow the flow of the water, improve channel morphology and ecological habitats. We heard detailed information about the negotiation process with local farmers and how working with their needs had led to positive outcomes (e.g. the re-meandering of sections of river and additional offline storage ponds). At this location it was possible to view sections of watercourse where re-meandering had matured and the diversity of plants and wildlife encouraged, as well as a less mature stretch. It was interesting to hear the circumstances of where this had been successful as well as examples of where the Tweed Forum were still negotiating with local landowners to provide measures and identify solutions to ongoing implementation challenges. Finally, the field visit moved to the headwaters of the catchment where a programme of tree planting was introduced and over 30 leaky barriers (woody debris) had been installed within the channel. We also learnt about NBS opportunity mapping of the Tweed Forum how these are providing to be invaluable tools for discussion with local stakeholders for future implementation of measures.

We would like to extend our gratitude to the Tweed Forum for hosting the field visit to Eddleston Water.

Landowner discussion; Sally Priest

Leaky barrier; Sally Priest

River restoration; Sally Priest

Runoff attenuation feature; Todd Swanack

BELFORD BURN, ENGLAND

The visit began in Belford village beside the main channel. A history of flood events and rationale for the project was introduced. Some information was given on small scale engineering works that have taken place alongside the main catchment-based measures. The bus then drove to the top of the 6 km^2 catchment to visit a large Runoff Attenuation Feature designed to hold ~1000m^3 of storm overland runoff and flood flow being diverted from a small channel. The structure was constructed from timber, an alternative approach to soil. The temporary storage pond is designed to leak and can empty in approximately 12-24 hours (therefore ready to collect runoff from proceeding storm events). The maintenance costs are low, but one repair has been required owing to a burst field drain underneath the feature.

The group then moved to another temporary storage feature in the corner of an arable field. This feature not only helps to mitigate flooding in Belford but also mitigates surface water flooding that can affect the local road.

"The visit to Belford was extremely useful to understand the potential and limitations of a catchment scale project"

A woodland area surrounding the channel was the next stop in the central catchment. Here we saw some of the large woody debris dams created from locally felled sycamore trees. This has improved light reaching the woodland canopy leading to more diverse vegetation. Low growing species of Holly and Hazel have been planted to roughen up the floodplain area. The idea is the woody debris spills flood water out onto this rougher floodplain.

After a sunny lunchtime stop in the village the delegates then visited one final offline storage area close to the village. Here we discussed how measures are also being used to mitigate diffuse pollution in the catchment. Some measures are designed to capture soil (sediments) which have been eroded from the upslope fields during intense storm events. We finally discussed the important role of the farmers in the catchment. The team have been working closely with the farmers since the project inception and they are critical to its success

"...great discussion about real aspects - dealing with farmers, Environment Agency, realisation...Paul was a great guide"

The study has benefited from a dense hydrometric network and scientists involved in the project have published 6 peer reviewed scientific papers showing the effectiveness of the features for mitigating flooding locally and providing wider benefits such as improved water quality and sediment capture.

We want to extend our thanks to Paul Quinn (Newcastle University) and Mark Wilkinson (James Hutton Institute) for hosting the participants attending the Belford field trip.

Leaky barrier; Mark Wilkinson

Belford Village; Todd Swanack

Runoff attenuation feature; Mark Wilkinson

Re-meandering at Eddleston Water; Lydia Burgess-Gamble

BENEFITS AND TESTIMONIALS

The workshop provided benefits to participants both at a personal level but also through knowledge exchanged. It is hoped that the event will also impact on implementation of NBSs in some of those countries represented. Key benefits included:

Widening their NBS knowledge was a key outcome of the workshop (e.g. new measures and measures implemented in different international contexts):

"International case studies were really impressive. The scale (both temporal and spatial) was a new insight"

...or from different perspectives

"We got the opportunity to hear some very interesting examples of how nature-based flood protection measures are benefiting communities all over the world"

"...exposed to a different approach to look at our common problems"

Building wider networks:

"As an early career researcher...the workshop was important for me to network with other more experienced researchers and stakeholders"

"Extended my natural flood management network fantastically."

...and some participants reported already been utilising the new connections:

"I am currently involved in discussions regarding potential research funding applications"

Other attendees reported that attending the workshop may impact their practice both in terms of the measures implemented:

"Push forward with the implementation of similar NBS features in my home country"

"I was introduced to the concept of a leaky dam which is new to me... [and] may consider that as a possible intervention if our NBS projects are funded"

....and how the impacts are assessed

"Instead of just trying to model at which location NBS measures will have the most impact on flood risk reduction, I will try to incorporate a cost factor based the extent to which the existing landscape needs to be adapted"

Academically, preparation for the workshop has led to the production of case studies (see here to access these) and also wider benefits for some attendees:

"The preparation of a study case for the workshop and the lively debate and engagement that resulted from that has led me to further develop the case study for presentation in a scientific conference in early 2020"

Networking event hosted by the Scottish Government, Todd Swanack

LIST OF COST FUNDED PARTICIPANTS

The workshop funded 19 members as part of the LAND4FLOOD COST Action from academia, policy and practice. They engaged with 90+ other symposium participants.

Name	Country	Affiliation	Role
Rachelle Alterman	Israel	Technion - Israel Institute of Technology	Researcher
Miroslav Bauer	Czech Republic	Czech Technical University in Prague	Researcher
Anita Bergstedt	Sweden	County Administration of Västra Götaland, Vänersborg	Policymaker/ Practitioner
Mary Bourke	Ireland	Trinity College, Dublin	Researcher
Lydia Burgess-Gamble	England	Environment Agency, England	Policymaker/ Practitioner
Rhys Evans	Norway	Norwegian University College of Agriculture and Rural Development	Researcher
Karen Gabriels	Belgium	KU Leuven	Researcher
Jenia Gutman	Israel	Ministry of Agriculture	Policymaker/ Practitioner
Jo Guy	England	Environment Agency, England	Policymaker/ Practitioner
Thomas Hartmann	The Netherlands	Wageningen University	Researcher
Paul Hudson	Germany	University of Potsdam	Researcher
Carlos Loureiro	Scotland	University of Stirling	Researcher
Tamás Právetz	Hungary	Flood defence expert, Middle-Tisza Region Water Directorate	Policymaker/ Practitioner
Sally Priest	England	Flood Hazard Research Centre, Middlesex University	Researcher
Ine Rosier	Belgium	KU Leuven	Researcher
Anna Ternell	Sweden	PE	Practitioner
Gábor Ungvári	Hungary	Regional Centre for Energy Policy Research	Researcher
Andrew Vella	Malta	Ministry for Transport, Infrastructure and capital projects, Malta	Policymaker/ Practitioner
Weronika Warachowska	Poland	Adam Mickiewicz University in Poznań	Researcher
Mark Wilkinson	Scotland	James Hutton Institute	Researcher

LAND4FLOOD
NATURAL FLOOD RETENTION ON PRIVATE LAND

Further information: www.land4flood.eu

#NNBFedinburgh