The Sussex Flow Initiative (SFI)

Natural Flood Management Project

5 Year Achievements

Introduction and Project Background

In 2012, the Sussex Wildlife Trust, the Environment Agency and the Woodland Trust began an innovative project on the Ouse River in East Sussex, called [Sussex Flow Initiative](). The project aimed to investigate ways that catchment-wide natural flood interventions can help to reduce flood peaks in areas vulnerable to flooding, whilst increasing biodiversity and providing multiple benefits at a landscape scale.

SFI works with the Catchment Partnership and others to develop new approaches to natural flood management (NFM) measures across the 672 km² area and 1220 km of river in the Ouse catchment, and to make recommendations on how and where to target them. We are a pilot project to gauge the potential benefits of trees, woods and other low cost NFM measures in lowland UK rivers, delivering NFM measures in partnership with communities and landowners. SFI aims to lead the field in showing that there are positive NFM options which can work alongside traditional flood risk management in rural and urban communities.

One of the key targets of SFI is to promote and integrate a holistic approach to water and land management across the catchment, and to make the catchment more resilient to flooding and drought, through a combination of demonstration and advocacy. Although the effects of NFM such as tree planting can take time to show their benefits, multiple actions taken now can provide positive natural capital benefits far into the future. SFI hopes to understand and articulate the natural capital benefits of NFM, so that we can make the best choices for now and for future generations.

In 2016, we entered into a new partnership with a Local Authority, Lewes District Council, who pledged their support by collaborating with SFI on NFM upstream of Lewes town, and in 2017, the Environment Agency launched a National Programme of NFM. These are exciting times for the integration of landscape scale approaches to flood management. The following report is a summary of the achievements of the SFI and TrUck projects over the last 5 years. We hope that the information helps to provide further evidence of the need for future work in lowland Natural Flood Management.

Summary of Sussex Flow Initiative Project Achievements 2012 – 2017

Demonstration

SFI was established to create demonstrable examples of the techniques and applications of Natural Flood Management. Over the last five years we have demonstrated a range of techniques, providing case studies and working examples of what we think can be best used in a lowland catchment situation.

Techniques used:

SFI has used a range of NFM techniques to reduce landscape scale flood risk including :-

- Reforesting and re-hedging hill slopes, and planting floodplain woodlands
- Restoring and re-activating river channels, meanders and floodplain washlands
- Providing advice on land use and controlling excessive run-off and erosion
- De-gripping (reversing drainage) of heathland and other land
- Using and managing Large Woody Debris in watercourses
- Increasing surface water storage i.e. in ponds
- Using leaky dams and walls to abate flood run-off
- Promoting swales, permeable surfaces and rain gardens to capture and store run off

Woodlands and hedgerows:

Planting woodland and hedgerows formed the core of our NFM delivery. We have used trees and hedgerows to slow the flow of water across hillslopes and floodplains, and to encourage more active percolation of water into soils and woodland leaf litter. In the last 5 years we have :-

- Planted nearly 29,500 trees *(to end April 2017)* across more than 20 sites. This includes :-
  - 4.3km of new hedgerows [1]
  - comprising of 21,400 native hedgerow plants & 100 rare Black poplars
  - and 8,000 trees covering 5 ha including 3.5 ha of floodplain woodland.

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[1] or nearly 13 ha if counted as woodland at 2.5m spacing.

Flood Storage Ponds:

Storing rain and floodwater in ponds is a 'quick win' when delivering NFM. Pond flood water storage can be increased by removing existing silt, or by creating overflow areas on existing ponds which fill up during high rainfall and gently drain back to their normal capacity after the rain has passed. In the last 5 years we have :-

- Created one flood storage pond, to provide year round habitat with extra flood storage of approx. 270,000 litres of water.
- Created over 100 'pocket ponds' by digging out turves on heathland and using them to block drainage grips, providing around 27,000 litres of additional water storage
- Advised a number of other landowners on pond creation who have created additional pond storage of around 500,000 litres

De-gripping :

Even in many of our most natural landscapes, there is a legacy of historic drainage. Heathlands and woodlands in particular can be criss-crossed with surface and sub-surface drainage grips, which exacerbate flood run-off in areas which could be flood water stores. In addition, friable soils mean that soil run-off reduces flood storage by introducing silt into the system. Over the last 5 years, SFI has helped to block :-

- at least 20 surface water drainage grips
- resulting in an estimated extra temporary flood storage capacity of 762,000 litres of water [2]

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[2] Calculated as approximately 3" depth across 1 ha of land

Seasonal Water Storage:

One of the most useful ways we can help reduce the impact of heavy rainfall on floods, is to create seasonal and temporary water storage across the landscape. Features such as wader scrapes, and shallow in-field hollows can store vast amounts of water at the flood peak when we most need it. Sussex Flow Initiative has advised landowners on the creation of a number of these seasonal water features. Just one of feature, such as the one above created by a landowner we advised can ***store around 20,320 litres every rainfall event***[3]

Natural Woody Material

Many of our rivers and streams have been historically cleared of all natural woody material to speed the flow of water through them. However, in the right place, using natural woody dams to slow down and back-up flood water can make an impressive dent in reducing flood peaks.

SFI has been trialling different methods of using natural wood to reduce flood run off including gulley stuffing! And ditch top diverters. Thus far we have created :-

- nearly 20 woody dams which we believe will be storing around 1m^3 (1,000 litres) of water per dam in every rainfall event – or at least 20,000 litres of water.

We have assessed all the woodlands in the Ouse for their suitability for woody dams to help reduce slow storm flow, and are working with a local university to learn how they influence flood flows and channel geomorphology.

Sub Catchment Mapping

As a partnership we want to show that we are influencing NFM positively at a landscape scale. We also need to be able to go to landowners and funders with a costed list of measures we can use to reduce flooding, showing evidence of the multiple benefits of each measure such as biodiversity and water purification.

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[3] Calculated as 20m x 40m x 1" depth

One of our key outputs, in partnership with the Ouse & Adur Rivers Trust, has been to develop targeted sub-catchment mapping of NFM and multiple benefits opportunities. The sub-catchment reports highlight where to add hedgerows, woodlands, buffer strips, bankside trees, LWD, RAF's and other measures to facilitate the reduction of flood peaks, reduce drought and improve water quality. The map below shows an example of what the sub catchment maps can show. In the last 5 years we have :-

- Conducted detailed sub-catchment mapping of nearly 5,000 ha of the Ouse catchment
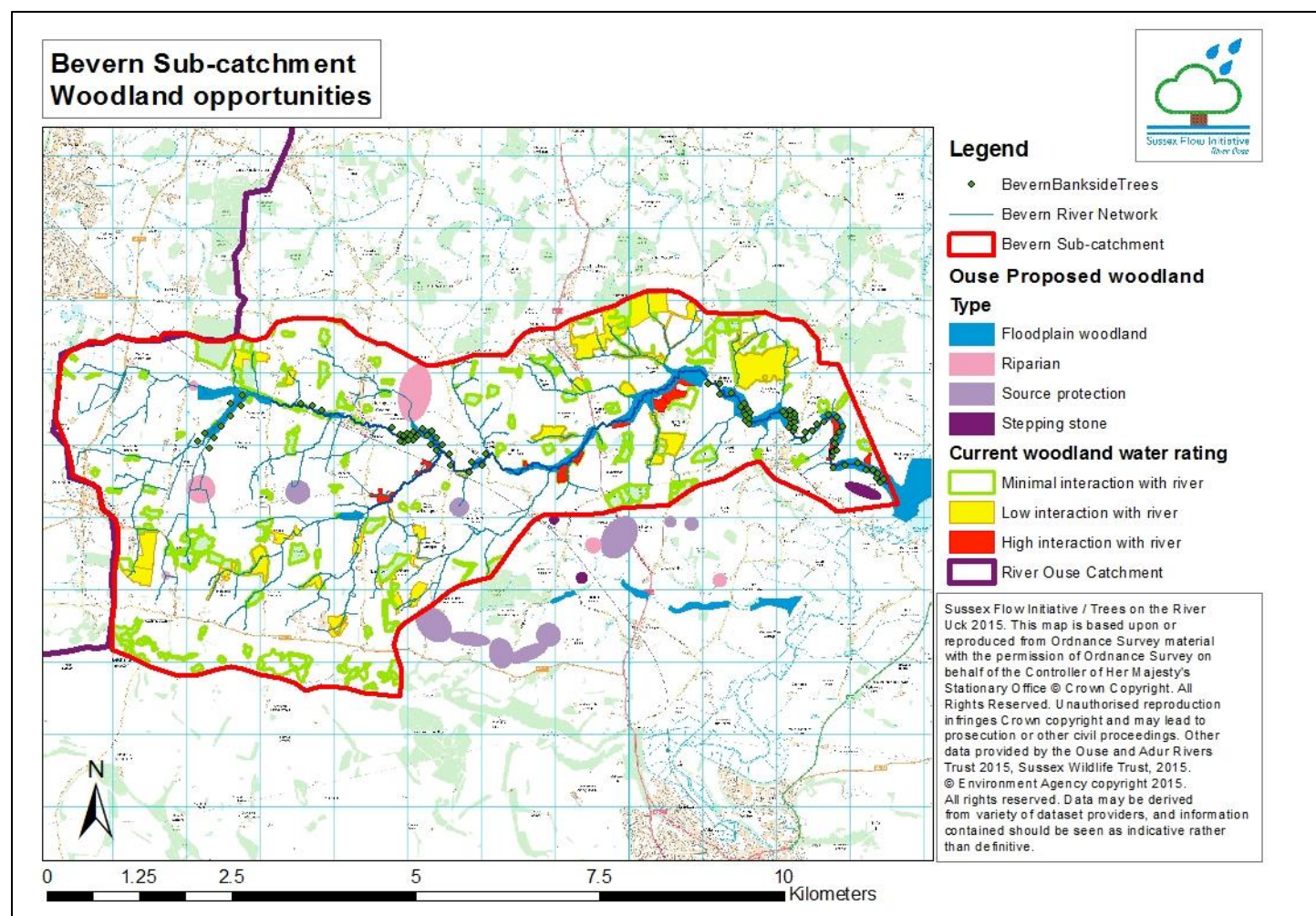
Length of River and Area of Land Influenced by our NFM measures:

It is difficult to measure how much of an influence we have had on the landscape with the NFM that we have implemented. However we believe our practical habitat restoration work has had a positive influence on at least 9.5 km of the river and stream network adjacent to our planting sites. We estimate that a minimum of 70 ha of land either directly downslope or downstream of our NFM measures is likely to have been positively influenced, not including the indirect influence that we have had on all the landowners that we have advised.

Volunteers & 'In Kind' Support

The work we do could not happen without the dedication, support and enthusiasm of our volunteers, as well as a great deal of time and effort that landowners, professionals and local people put into promoting and delivering natural flood management. We are very grateful to them all. In the last 5 years, we estimate that :-

- Our work has been supported by over 100 volunteers from Sussex Wildlife Trust, the Environment Agency, Woodland Trust and other partner organisations.
- Over 150 volunteer work days have been given to us on everything from GIS to hedge planting
- These volunteer days have a value in excess of £17,500[4]
- Our partner organisations have contributed around £175,000 of their time 'in kind'[5]
- Other organisations have contributed at least £50,000 of their time 'in kind'

Ecosystem Service Mapping

To help demonstrate to people how their local landscape supports them, an EcoServ-GIS model was produced for the SFI project area (Ouse catchment). This model shows where the following natural services are needed (demand) and where they are being provided (supply) to local populations. The model shows where there are gaps in the provision of these services, and where projects like SFI can help to fill these gaps:-
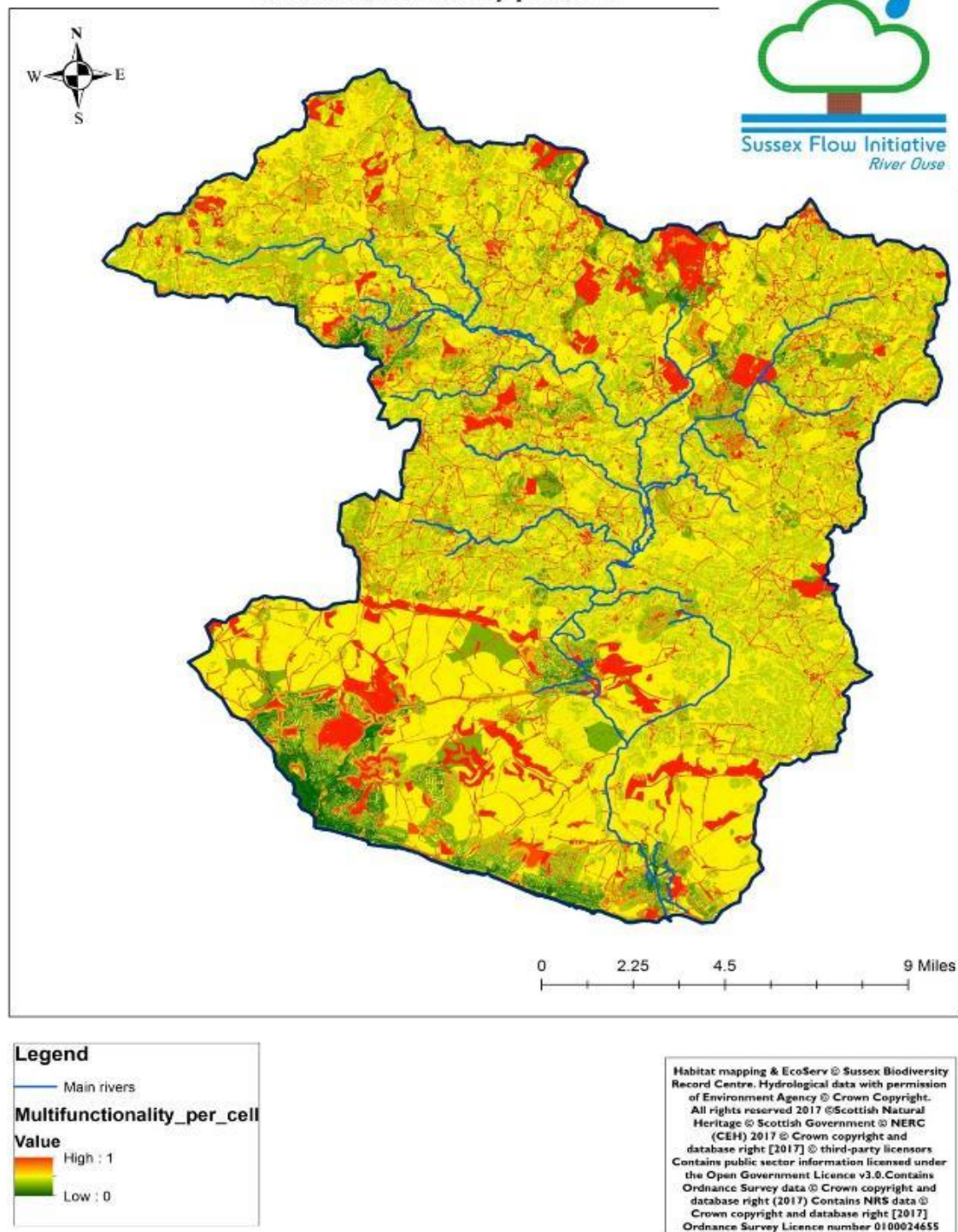
- Accessible nature
- Education
- Green travel
- Carbon storage
- Local climate regulation
- Air purification
- Noise regulation
- Water purification
- Pollination

The map below shows the multi – functional provision of these 9 ecosystem services across the Ouse catchment. A full report can be found on the [SFI Website](#). Areas highlighted in dark orange and red on the map, show the places where multiple ecosystem services are already being provided. Using this mapping tool, we can start to overlay information on sites that we've worked on for NFM, and see if we are helping to improve the provision of key ecosystem services such as water purification, in areas where they are needed.

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[4] Based on £100 per day for standard volunteers and £150 a day for professional volunteers
[5] Based on Woodland Trust, EA, Sussex Wildlife Trust & Sussex Biodiversity Records Centre including trees and comms support

SFI - River Ouse EcoServ GIS
Multifunctionality per cell

Legend

— Main rivers

Multifunctionality_per_cell

Value

High : 1

Low : 0

Habitat mapping & EcoServ © Sussex Biodiversity
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(CEH) 2017 © Crown copyright and
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the Open Government Licence v3.0.Contains
Ordnance Survey data © Crown copyright and
database right (2017) Contains NRS data ©
Crown copyright and database right [2017]
Ordnance Survey Licence number 0100024655

Providing Ecosystem Services through Natural Flood Management

To demonstrate the multiple benefits of Natural Flood Management, we can show how SFI has helped to enhance Ecosystem Services across the River Ouse landscape. When compared with a list of 30 Natural capital (Ecosystem service) benefits **(APPENDIX 1).** in the UK National Ecosystem Services Assessment (UK NEA, 2013) SFI is contributing to a minimum of 24 services through its main strands of work. This does not include carbon storage or pollination services which we have also enhanced across the Ouse. **We can quantify the natural services that we have helped to provide over the last 5 years including :-**

Provisioning Services

- **Biodiversity:** New woodlands, open water features and wetlands have been created/restored. Rare, native tree species have been planted. These works help to secure genetic and biological diversity. Hedges, new habitats and improved river quality help to create a more connected and resilient landscape for a range of species groups.

Regulating Services

- **Pollination:** Hedgerows have been planted using 21,500 native (flowering) hedgerow plants, **2.6 km of which are within Buglife's b-lines pollinator corridors**. Work on restoring fen, meadow, heathland and other habitats outside the SFI area are also providing pollination services.

- **Carbon Sequestration:** Every year, until they are mature, the equivalent of 19 ha of new Ouse woodland / hedgerow will be providing CO_2 storage. Total predicted carbon storage from SFI woodland and hedgerow work = **up to 15,200 tonnes of carbon stored.**[6]

- **Water Purification:** Our advice on land **covering 312 hectares of the Ouse floodplain (11% Floodzone 2**) has helped to improve land and water stewardship, and to reduce run-off.

- **Flood Storage:** Using flood storage ponds, de-gripping, seasonal water storage, woody dams and pocket pond creation **we have facilitated a total of 1,099,320 litres of additional flood storage**.

- **Water storage:** When mature we estimate that our **new hedgerows will help to store and slow down around 12,900 cubic metres of water during rainy periods**[7]. That is 12,900 tonnes of water.

Cultural Services

- With help from SxBRC Hedgerows Project we have mapped over 25 km of missing historic hedgerows. We have supported the River Ouse Meadows Project to protect culturally important meadow landscapes. We have provided advice, support and funding to local communities, **helping to create a more connected and diverse landscape with corresponding benefits to human health and welfare.**

Advocacy

One of the key roles of the Sussex Flow Initiative is to advocate the use of Natural Flood Management measures, to make others aware of NFM, and to support others to implement them. There are a number of ways that we have advocated NFM over the last 5 years, including the following :-

Landowner engagement:

- We have engaged with approx. 150 landowners, covering nearly 12% of the land upstream of Lewes
- On a total of at least *5,650 ha*

Floodplain Landowners:

- We have engaged with landowners covering approx. 33% of the Uck floodplain[8]
- and over 11% of the total Ouse floodplain[9]

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[7] *A 50m hedgerow at the bottom of a 1ha field can store between 150 and 375 cubic metres of water during rainy period".*
4300m of new hedgerow - divide this by 50m (length given in calculation), times 150 (as minimum water storage suggested).
[8] EA Floodzone 2

For a map showing the extent of the land that we advised over the last 5 years, see **APPENDIX 2.**

Developing Evidence

When we started the SFI project, Natural Flood Management was an emerging science and there was a need to evidence the effectiveness of different NFM measures, We needed evidence to show that we are targeting NFM measures to appropriate locations where they will have the greatest benefits, with 'guilt free', low risk methods that have no net dis-benefit to flooding or wildlife. In order to do this we developed a range of mapping and modelling methods to help to target our work.

Targeting and Mapping NFM

SFI developed a number of computer models and NFM targeting maps including :-

Woodland & Hedgerow targeting :

- Unsuitable locations for woodland planting
- Wooded Heaths (potential for drainage reduction)
- Sub catchment urban / (floodplain) woodland percentages (to target low woodland cover areas)
- Historic mapping of floodplain land use, ponds, hedgerows and river channels

RAF's targeting

- Woodlands with water features - Ponds - Potential RAF creation
- Woodlands with water features - Flood zones - Potential for increasing floodplain connectivity

LWD targeting

- Tertiary streams (best for targeting LWD)
- Forested Woodlands (potential for drainage reduction)
- Woodlands with water features - Watercourses - Potential LWD & RAF's

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[9] Uck 475 ha; Ouse 2,900 ha

NFM Warning Zones

- Backwater buffers (where not to plant woodland near infrastructure such as roads and bridges)
- Roads intersecting with fzone 3 & fmfsw
- Springs intersecting with river network (spring flow routes)

With partners and contractors we also developed the following :

- Habitat Potential Models (9 wetland habitats incl. woodland & lowland meadow)
- Compound Topographic Index of Wetness (CTI – showing places which accumulate flow/water)
- EcoServ ecosystem services model

We used a range of data available from partners and the Catchment Based Approach (CaBA) to target NFM further including :-

- Rivershade maps - Need for river shading to ↓ climate impacts
- Natural England Climate Change maps including woodland vulnerability to climate change
- Existing priority habitats and species data (SxBRC)
- The Durham University Uck CRIM's model
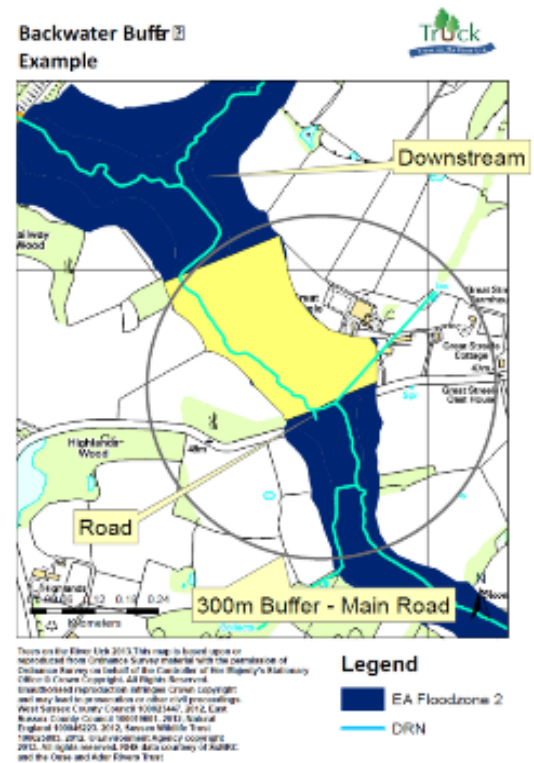
We want to be able to reassure flood risk management authorities that our work will not exacerbate flooding in any way. The map (above right) shows an example of our Backwater Buffer mapping, which shows areas where we need to be cautious or avoid planting woodlands / hedgerows and installing woody debris near roads and other infrastructure, where trees might 'back up' water and cause flooding.

Developing Scientific Evidence

We have supported academics and students up to PhD level to investigate aspects of NFM including:

- Design of Large Woody Dams and their influence on channel flow and geomorphology
- Water / ground infiltration rates adjacent to hedgerows
- Woodlands and water storage

We have worked with academics at :-

- Sussex University
- Brighton University
- Newcastle University
- Reading University
- Durham University
- University of Birmingham

We have also worked with, and been supported by other National Flagship NFM projects including :-

- Forestry Commission / Forest Research (Slowing the flow at Pickering)
- EA Working with Natural Processes (WwNP)
- National Environment Research Council
- SEPA

Working in Partnership

Over the last 5 years we have worked with a range of local and national groups and stakeholders including :-

Wakehurst Kew

Sussex Biodiversity Record Centre

Lewes District Council

WOODLAND TRUST

South Downs National Park

THE wildlife TRUSTS

Sussex Wildlife Trust

HIGH WEALD AREA of OUTSTANDING NATURAL BEAUTY

Adur & Ouse PARTNERSHIP

Southern Water

south east water

Environment Agency

NATURAL ENGLAND

Transition Town Worthing

Transition Town LEWES

WILD TROUT TRUST

OART

Freshwater Habitats Trust

East Sussex County Council

west sussex county council

National Trust

Lewes & Ouse Valley eco-nomics
Valuing Local Natural Capital

Forestry Commission

RBC Royal Bank

IUCN

European Commission

and many more.

Flood Risk Agencies and Organisations

It is important that SFI works closely with lead local flood authorities (LLFA) and others who have a statutory duty to prevent houses and human infrastructure from flooding. The more we can integrate and evidence NFM for LLFA, the better chance we have of creating sustainable flood management solutions in the future. SFI has engaged with the following flood authorities and flood groups over the last 5 years :-

- Lead Local Flood Authorities;
- Wealden District Council;
- Lewes District Council;
- East Sussex County Council;
- European Commission;

- Regional Flood and Coastal Committee;
- Flood and Coastal Risk Managers;
- Planning Authorities;
- Defra
- Local Flood Action Groups

**Working with Local Communities**

One of our most important functions is to help local communities understand and deal with flooding. In the last 5 years we have :-

- consulted and input to Local Neighbourhood Plans, highlighting local flood solutions;
- held local events to highlight issues around flooding;
- held workshops for landowners & community groups;
- participated in and presented at public debates and forums;
- conducted surveys to help understand the flood issues that local people face;
- held drop in sessions about flooding;
- presented to parish councils;
- worked with TTL to highlight surface water flooding issues in Lewes.

International Advocacy

We have consulted on and produced a range of NFM guidance both at a National and European Level, including

- The EC Guide to Natural Water Retention Measures in Europe
- Presenting at European conferences
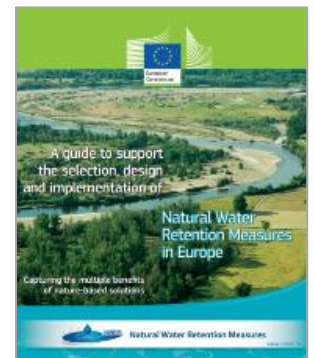
Events

Over the last five years we have run a range of landowner and public engagement events including :-

- **Land, Soils and Water** – Workshop for 40 landowners
- **Lewes Water Fair** – In partnership with OART
- **Bentley Wood Fair** – Which has 12,000 visitors
- **Uckfield Flood Drop In** –to discuss NFM with residents

Signposting

The SFI project wants people to have easy access to the information they need to help reduce flooding locally and naturally. We also want to signpost people to a 'shopping list' of targeted NFM measures that they can implement in a no fuss manner, knowing that they are well evidenced. We have helped others to facilitate NFM approaches including site specific recommendations, including:

- Mayfield Flood Storage Pond creating approx. 500,000 litres of extra flood water storage.
- East Sussex Ranger Service (Chailey Common SSSI).
- Lewes District Council (Meeching Valley SUDs investigations).

Surveys and Mapping

Knowing your landscape, and being able to accurately articulate both what is there already, and how it could be enhanced is an important step in knowing where to deliver NFM measures. Over the last 5 years we have :-

- Facilitated River Habitat Surveys of over 51km of the main river, covering 10 waterbodies

Websites

Creating information portals which are accessible to all is an important step in the dissemination of good quality information about Natural Flood Management. Over the last five years we have developed and maintained two project websites & an SFI partnership web page including :-

- [Sussex Flow Initiative](#) *(from Apr 16)*: 520 visitors
- [TrUck](#) *(from Jan 2013)*: 7500 visitors.

Sussex Wildlife Trust has also maintained an [SFI web page](#) which has had :-

- 545 visits (*since Nov 2015*)
- And 3903 visits to flooding blogs

Total combined website visitors: minimum 12,468

Social Media

Social media is increasingly relevant as a conduit for key messages on topical issues. One 3 minute video on NFM that we created had :-

- 70 you tube views, 1278 Facebook Views 2175 Twitter views in just over 1 week

Our Facebook page has had:

- 135 followers on our TrUck page
- 1278 views on the SWT SFI/TrUck posts (48 Likes, 3 Comments, 7 shares 3,900 Impressions)

Through Sussex Wildlife Trust Twitter we have had 2175 views (41 likes, 31 Retweets, 10,315 Impressions).

And on YouTube, our videos have had 130 views

Print Media

We have published articles and press releases including :-

- The SWT 'Wildlife' Magazine with a combined readership of over 32,000
- Articles in local press such as Sussex Express with a minimum of 7,500 readers

Radio

SFI has also been on the radio about flooding issues, including :-

- a piece to Uckfield fm which has around 13,000 listeners.

Publications

We realised there were gaps in the information available for certain Natural Flood Management techniques and measures. With the help of our partners we have produced a range of nationally available, printed and online materials which will help others to deliver NFM with more confidence. These include :-

- Woody Dams, Deflectors and Diverters Guidance
- Focusing on Flow in Sussex - A Woodland Trust case study
- Working with Natural Processes Case Study
- Sussex Wildlife Trust 'How you can help with flood management' Guidance
- A CaBa case study
- Produced a report for Re-wilding Britain on How re-wilding reduces flood risk
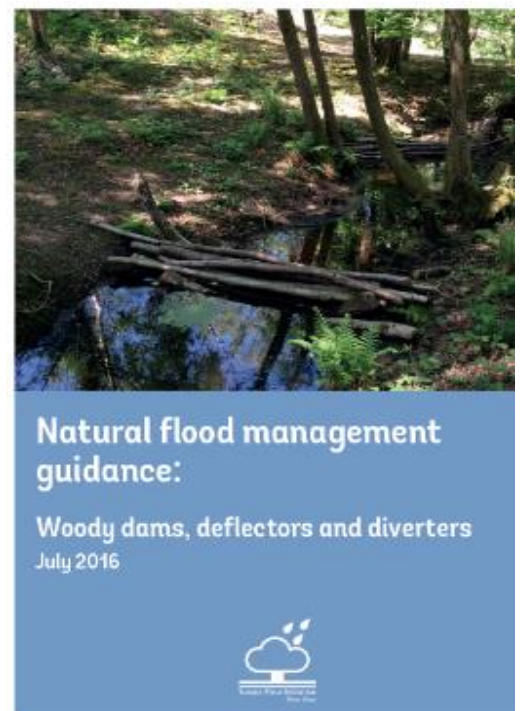
Wider Working

In addition to the agreed geographical scope of the project, our Steering Group and Project Officer have also worked outside the project area to demonstrate and promote Natural Flood Management. The NFM work that we have contributed to outside the project area includes :-

- Forestry Commission (Medmerry NFM scheme).
- Environment Agency (Powdermill stream and Unprotected Communities)
- High Weald Area of Outstanding Natural Beauty
- Worthing Transition Town
- Arun & Rother Connections Project (ARC)
- Hassocks woody debris project
- Knepp estate Re-wilding project

We have held Community River Habitat Workshops with local community groups, and have experimented with new tools for delivering NFM such as the Rotary ditcher.

NFM Futures and the Future of SFI

Following our first five years of working on NFM, the Woodland Trust, Environment Agency and Sussex Wildlife Trust have highlighted their desire to continue the SFI project, and to expand its delivery and influence.

In 2017, the Environment Agency launched a National Programme of NFM, which SFI will be helping to inform, support and deliver. We are pleased that this milestone has been reached, and that Natural Flood Management has been accepted nationally as one of the primary means to achieve sustainable flood and water management. We will be helping to train and upskill as many people as we can in NFM measures and how to apply them in an informed and effective way.

Over the next few years we hope to focus on delivery and advocacy – adding to our repertoire of NFM projects across the Ouse catchment and beyond, and building up a suite of case studies of NFM techniques.

We are committed to developing NFM at the landscape scale in the long term, and we look forward to seeing what can be achieved cumulatively across our catchment landscapes in the years to come. In a short space of time, lowland Natural Flood Management has proved its worth, and it is here to stay. We look forward to working in partnership with many different people to help reduce the impact of flooding naturally.
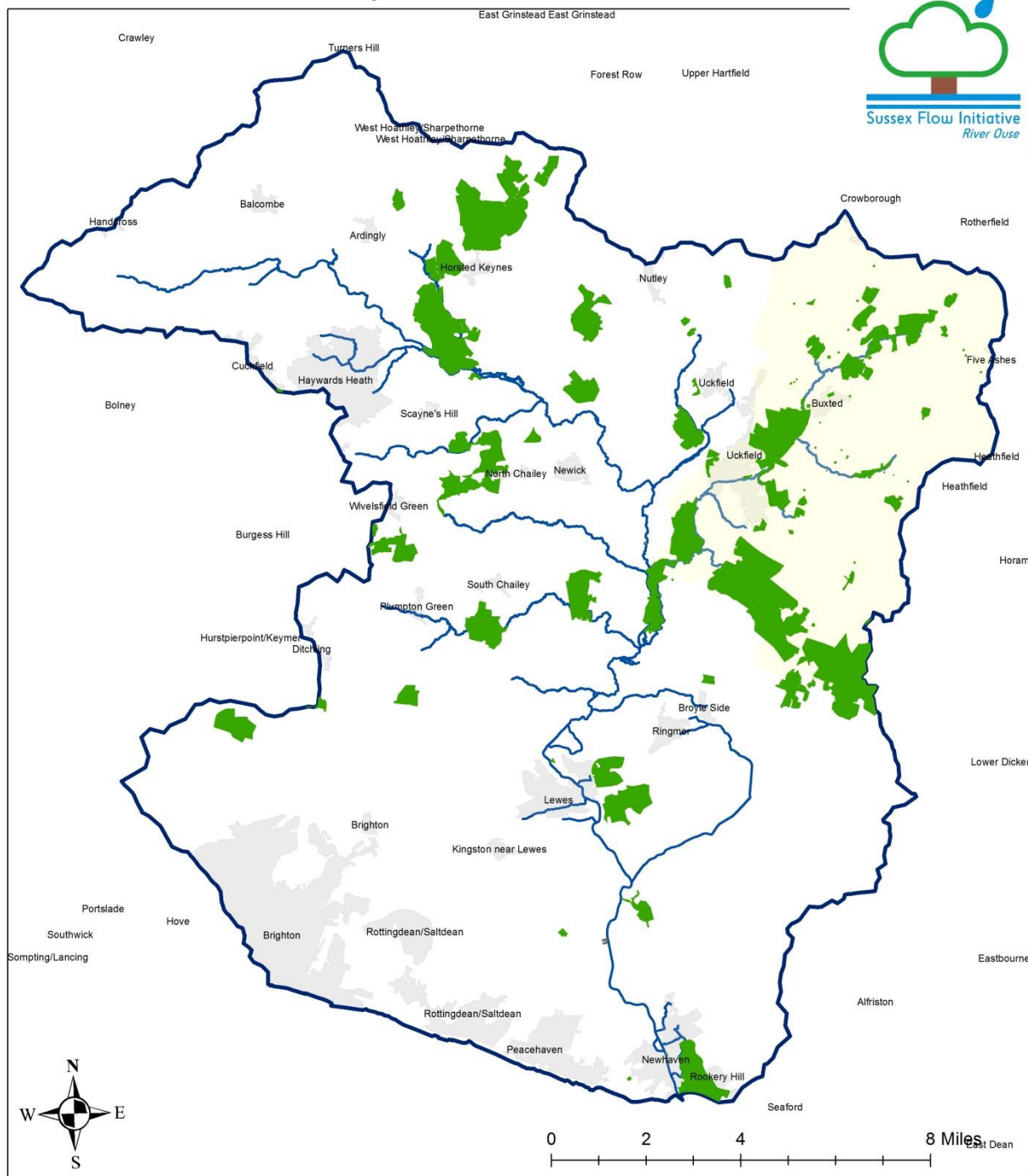
Appendices

UK NEA services provided by the 3 main strands of SFI Project work

Ecosystem service	ES from SFI Semi Nat Grasslands / Washlands	ES from SFI Woodland	ES from SFI Fresh & Openwaters, Wetlands & Floodplains
Food	●	●	●
Water	●	●	●
Timber		●	●
Woodfuel		●	
Biofuel (incl Peat)			
Bioenergy			
Health Products			
Fibre			●
Species Diversity	●	●	●
Genetic Reserves	●	●	●
Disease and Pest Control			
Climate Regulation	●	●	●
Erosion Control	●	●	●
Water Regulation	●	●	●
Flood Regulation	●	●	●
Fire Hazard Regulation			
Air Quality Regulation	●	●	
Water Quality Regulation	●	●	●
Soil Quality Regulation	●	●	●
Noise Regulation		●	
Recreation	●	●	●
Tourism	●		
Aesthetic Values	●	●	●
Cultural Heritage	●	●	●
Employment	●	●	●
Spiritual Values	●		
Education	●	●	●
Sense of Place	●	●	●
Health Benefits	●	●	
Navigation			
TOTAL	**20**	**21**	**18**

SFI Project Area - Landowners Advised

Legend

 Merged_FS_SMJ_Landownersclipped to Ouse

Uck Catchment

Urban areas

Main rivers