Chapter 10
The Governance of Nature-Based Approaches to Flood Risk Management in the Lower Severn Catchment (England)

Daniel Keech and James Blockley

Abstract This chapter reports on a new arena of flood risk governance in the lower river catchment of the Severn, Britain's long river. As a result of Living Lab (LL) activity directed towards the natural management of fluvial, pluvial and surface-water run-off in the county, a new governance group was established. The 'Working With Natural Processes' (WwNP) sub-group reports to the regional, multi-stakeholder body The English Severn and Wye Regional and Coastal Flood Committee (RFCC), which advises on the allocation of state funds for flood protection along two river catchments. The chapter outlines complexities of flood risk management in Gloucestershire, describing locally specific flood policy and protection challenges in the light of a changing climate, plans for urban expansion and in light of defined political and geographical limits that complicate catchment-wide ESS governance. The establishment of the WwNP sub-group formalises a strategic approach to 'green' flood risk interventions and supports the networking of flood authorities and land managers. The chapter describes how the LL facilitated the group's establishment, not least by trying to align different interests, and particularly by helping to connect urban and rural spatial interests in natural processes for reducing flood risk, which are usually separated into rural and urban areas.

Keywords Nature-based solutions · Rural-urban synergies · Ecosystems services governance · Flood risk management

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10.1 Introduction

10.1.1 Objectives of the Chapter

This chapter outlines a Living Lab (LL)[1] experiment in Gloucestershire, which led to the establishment of a new governance mechanism to support decision-making in relation to nature-based flood solutions in the Lower Severn catchment in England. Within ROBUST, all LLs are founded on a collaboration between a research and a practice partner. In Gloucestershire these partners were staff at the University of Gloucestershire's Countryside and Community Research Institute (CCRI), and Gloucestershire County Council (GCC) respectively. Each LL prioritised three themes to work on, and in Gloucestershire these were ecosystem services, sustainable food systems, and finally business models and labour markets. The work outlined in this chapter links to the ROBUST theme of ecosystem services. The role of GCC as the Lead Local Flood Authority is therefore very significant in this theme as the County Council is principally responsible for local flood risk policy making and flood alleviation strategy.

The two objectives of the chapter are to:

(i) Examine how nature-based solutions to flood risk (specifically catchment) management represent ecosystems services that link rural and urban areas;
(ii) Share the experience of establishing new forms of regional governance of nature-based flood risk solutions, in the hope that practical lessons may be transferable.

The structure of the chapter is as follows. Firstly, the county's river catchments and flood contexts are introduced, followed by a description of the complex and multi-agency governance of flooding in the county and wider region, involving representation from state, private and civil society sectors. Thereafter, the LL experiment is described, resulting in the establishment of a new regional governance structure for nature-based flood solutions. Finally, some critical questions are asked about the process of the LL as well as the need to ensure that nature-based solutions are considered within an urban-rural continuum, rather than, as hitherto, a rural landscape intervention with marginal impacts in urban settlements.

[1] A detailed overview of LLs and their role in ROBUST will be included in the book's introduction.

10.1.2 Introduction to Gloucestershire's Water Resources, Catchments and Flood Contexts

Gloucestershire (Fig. 10.1) is a largely rural county in south-west England and includes several important rivers and wetland habitats. Gloucestershire borders Wales and lies immediately to the north of the city of Bristol. London is about 180 km to the east of the county town of Gloucester, past which the River Severn flows and becomes tidal soon afterwards. The Severn is Britain's longest river and its basin area covers over 11,000 km^2 extending from North Wales, into the English Midlands and parts of the south-west. Its estuary, which has the third largest tidal range in the world and is beloved by surfers for its 'bore[2]', a wave caused by a strong incoming tide moving against the river's current as the river narrows. The Severn Estuary is fed by the River Wye, which, in its lower reaches, forms part of the border between Gloucestershire and Monmouthshire in Wales. While the Severn and Wye meet the sea together in the west of the county, the River Thames rises in

Fig. 10.1 Location of Gloucestershire

[2] https://www.thesevernbore.co.uk/. Accessed 18th August 2021.

the east of Gloucestershire, flowing south and then eastwards to connect some of the densest urban settlements in England, including the capital. The county is, fluvially speaking, interesting because it contains both headwaters and estuary features and the multitude of tributaries is shown graphically in Fig. 10.2 (below), with the Cotswold plateau being a point of flow division, west and east.

Other local wetland areas include the Cotswold Water Park, an expanse of flooded sand and gravel pits; and the Cotswold River Valleys, which drain the Cotswold plateau and flow into the Water Park and The Thames. While the east of Gloucestershire is elevated, the centre (where a quarter of the population lives in Gloucester and nearby Cheltenham) and west lie in the Severn's flood plain.

This description of the county's springs and estuaries, as well as mineral excavation craters, provides a picture of a watery, lop-sided topography, sloping from north-east to south-west towards the sea, for which sea-level rises of around 20 cm by 2050 (Wye Valley AONB, 2016) are predicted, as well as the increased likelihood of serious fluvial-pluvial inundation (Environment Agency, 2020). Flood risk in the elevated Cotswolds is connected with run-off as a consequence of agricultural and rural development, rather than concerns linked to bursting banks or ground saturation. The agricultural run-off is quickly transported into the river system and poses increased flood risk downstream. These details reinforce the importance of the LLFA compared to contexts in catchments, and indicate that conventional 'hard' engineering may not, in isolation, alleviate catchment-linked flood risk.

In addition to these topographical, fluvial, climatic and pluvial considerations, plans have been drawn up to increase the size of the county's main settlements, by building 35,000 new homes and adding 192 hectares of so-called 'class B' light

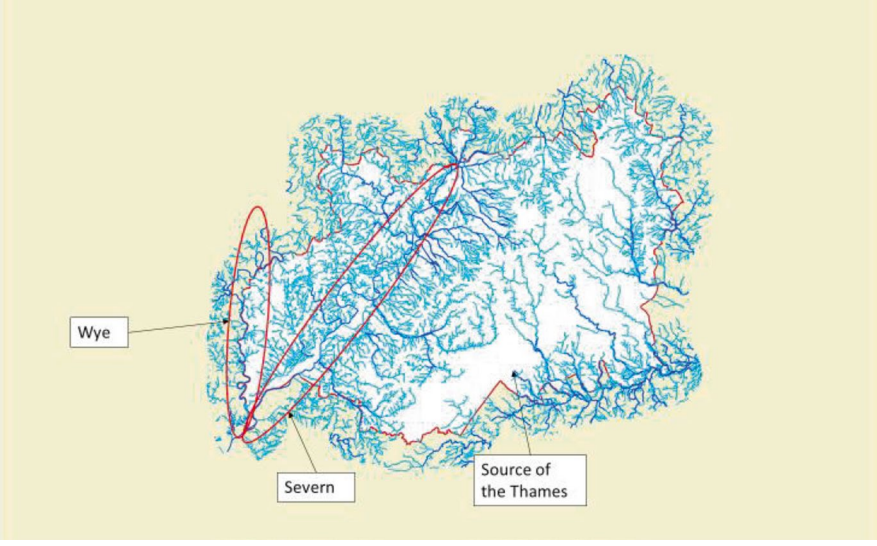

Fig. 10.2 Gloucestershire's river catchments. (© Crown Copyright and database rights 2022, Ordnance Survey 100019134)

employment land (offices, light industry and storage) (Gloucestershire County Council, 2017: Policy SP1). This will create the need to ensure that hard surfaces in the development plans do not exacerbate urban run-off, while the impact of any down-stream flooding may affect more people in expanded settlements.

Flooding has come acutely into local focus in the last decade or so:

> *devastating effects of flooding … following the unprecedented flooding in Gloucestershire in 2007, and … in 2012 and 2013* (Gloucestershire County Council, 2014: ii) (See also Fig. 10.3 below).

The floods were linked to extraordinary meteorological and physical factors including (i) heavy and unseasonal rains, (ii) the subsequent overflowing of the banks of the River Severn, and (iii) the nature of the tidal estuary of the Severn which has a high tidal reach, preventing outflow of the flood waters.

Meanwhile '[*m*]*uch of the western part of the borough [of Tewkesbury] is in an area at high risk of flooding.*' (Gloucestershire County Council, 2017: 2.19).

The mid-reaches of the Severn in neighbouring counties last burst their banks as recently as 2020, affecting 1600 homes.[3] The National Flood and Coastal Erosion Risk Management Strategy for England indicates that, although £2.6bn (€3.05bn) of government funds have been directed towards flood risk defences between 2015

Fig. 10.3 Tewkesbury flooded in 2007. (Image by C. Shervey (https://www.flickr.com/photos/34179117@N00/872788950 accessed 6th December 2021), source Gloucestershire County Council)

[3] https://consult.environment-agency.gov.uk/west-midlands/svwms/supporting_documents/201204%20Severn%20Valley%20Water%20Management%20Scheme%20FAQs.pdf. Accessed 15th July 2021.

and 2021, *'we cannot eliminate the risk of all flooding and coast erosion'* (Environment Agency, 2020: 11). This seems alarming, given that the increased frequency of severe weather events, including high-intensity rainfall, leads to severe fluvial and pluvial flooding incidents. Even so, existing land use is exacerbating flood risk and in recent years nature-based solutions have been tested in Gloucestershire as a way to meet future challenges.

10.2 Flood Risk Governance in Gloucestershire

10.2.1 Natural Flood Management and Urban-Rural Links

Natural flood management (NFM) is one of a broad range of nature-based solutions for addressing environmental challenges such as flood risk, and which constitute, according to the International Union for Conservation of Nature:

> *actions to protect, sustainably manage, and restore natural or modified ecosystems, that address societal challenges effectively and adaptively, simultaneously providing human well-being and biodiversity benefits* (Cohen-Shachman et al., 2016).

This means that, rather than relying on hard engineering such as the construction of dykes or flood barriers, NFM is *'the alteration, restoration or use of landscape features to reduce flood risk'* (Pescott & Wentworth, 2011). In other words, in some contexts NFM can be understood as a form of rural land/landscape intervention applied to manage the *'sources and pathways of floodwaters'* (Holstead et al., 2017), which Morris et al. (2016) have summarised in three ways:

- Retaining water in the landscape through infiltration and flow over land, for example through seasonal mires or water meadows;
- Managing (i.e. impeding) flow connectivity, for example through woody dams which hold back and slow seasonal flood waters;
- Water storage, such as attenuation ponds.

Although GCC holds important responsibilities in relation to flood risk management, the catchments of the county's major water courses reach beyond its borders. In 2014, a regional network, the English Severn and Wye Regional Flood and Coastal Committee (RFCC) secured funding for a rural sustainable drainage trial in Gloucestershire (see case study below).[4] Altogether, there are 12 RFCCs working across England. They were established by the national government and cover major river catchment systems. They are funded through a levy on member LLFAs and bring together local politicians and technical experts who advise on the allocation of state-provided (Environment Agency) funds to cover 6-year programmes of flood risk operations. The finance secured for the Gloucestershire trial via the RFCC helped to implement natural flood management techniques along a number of

[4] https://www.stroud.gov.uk/environment/flooding-and-drainage/stroud-rural-sustainable-drainage-rsuds-project. Accessed 12th March 2021.

tributaries of the Severn, including the River Frome. This revealed measurable flood attenuation results in settlements downstream from the interventions, as well as providing rural nature conservation, countryside management and community development benefits (Short et al., 2019).

Despite this and other interesting localised projects, the adoption of nature-based solutions in general have been suboptimal in the UK (Vilcan & Potter, 2020; Wingfield et al., 2019) and remain non-statutory. Instead, funding for flood risk management is:

> *targeted towards numbers of homes protected from the flood schemes invested in. This tends to mean that urban areas, which are more densely inhabited and where most businesses are clustered, are the main beneficiaries of the schemes.* (LL interview 18th Feb 2019).

Flooding is clearly an important expression of urban–peri-urban–rural relationships in the county in at least three respects. Firstly, because major flooding has been experienced three times since 2007, affecting large parts of the county, and substantial sea level rises are predicted. Secondly, areas of low-lying peri-urban land in Cheltenham are being identified for substantial urban expansion (Gloucestershire County Council, 2017 § 2.28). Thirdly, agricultural management has a significant impact, in Gloucestershire and beyond, on surface water flooding in urban areas and on the quality of designated rural and wildlife landscapes.

Consequently, GCC needs to work in partnership with other organisations that have separate or distinctive influence over flood risk. Key partners include:

- six district (sub-county) municipalities with delegated emergency response authority from GCC and support the development and implementation of planning and land use policies;
- the national (ie. English) Environment Agency, an important independent but publicly funded body responsible for environmental protection and, among other duties, maintains a strategic overview for flood risk management, and holds state funds for flood risk interventions.
- the Lower Severn Internal Drainage Board—drainage boards are also publicly funded bodies with elected local representation, and their duty is to manage and maintain sea and flood defences and drainage in low-lying agricultural and flood sensitive areas;
- the two privatised regional water companies (which provide sewerage, waste water drainage and drinking water services), Thames Water and Severn Trent Water. These are the principal water companies covering Gloucestershire but two more, Wessex Water and Dŵr Cymru (Welsh Water) supply water in the south and west of the county.

These partnerships are schematically presented in Fig. 10.4, below.

Within such official configurations, which clearly indicate the need for collaboration, are community groups and other interested parties who may be affected by flooding, including stakeholders such as the private owners of agricultural land. For example, there are 20,000 land owners alone in the area covering the 2014–2017 River Frome NFM trial within Stroud District, one of the six districts within Gloucestershire. The RFCC has recently extended funding by another 3 years, following its first successful phase (see case study below).

Case Study: Stroud Rural Sustainable Drainage

Following the floods of 2007, community flood action groups were established in river valleys in Stroud District. They campaigned for better protection for residents and properties from flooding, but over the years, communities and authorities have realised that the Upper River Frome and its tributaries are not suited to hard engineered solutions. This is in part due to the physical nature of the catchment and the distribution of the properties at risk, but also due to the heritage and aesthetic value of the Stroud valleys. In 2012, the Environment Agency commissioned a report into the feasibility and potential benefits of implementing Natural Flood Management (also called Rural Sustainable Drainage Systems) (RSuDS) throughout the catchment of the Frome and associated tributaries.

Acting on the findings of the study, the Severn and Wye Regional Flood and Coastal Committee and GCC agreed to fund a project officer to implement and promote RSuDS in the Frome catchment. Successfully implementing the approach to achieve real reductions in flood risk required extensive partnership working between communities, land managers and farmers (Short et al., 2019). The project has secured help from owners of riparian woodland and agricultural land to implement RSuDS measures to help reduce flood risk for downstream urban communities. The project has been extended by another 6 years with funding from GCC and the RFCC.

Source: Stroud District Council. https://www.stroud.gov.uk/environment/projects/stroud-valleys-natural-flood-management-project/

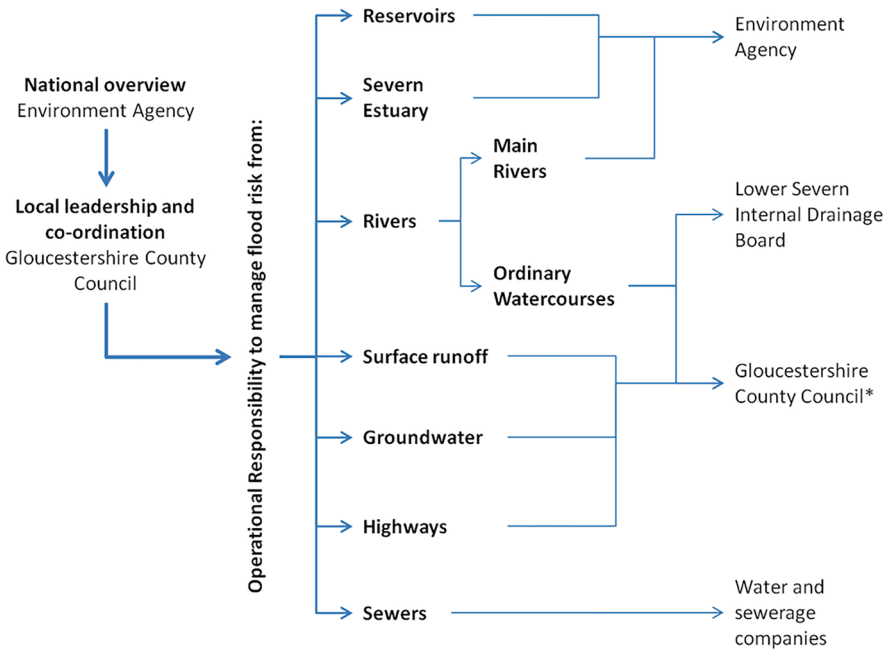

Fig. 10.4 Overview of connected watercourse management Gloucestershire. (Source: GCC 2014: 2)

To summarise, Gloucestershire faces a range of increased flood risks through a combination of climate change, land use, the proliferation of hard surfaces linked to urbanisation, and varied internal topographical contexts and catchment dynamics outside the boundary that require cross-border collaboration. It also has a complex but well-developed flood risk governance arrangement with a recent history of experimental investment in multi-stakeholder and community partnerships for natural flood management solutions across the rural-urban catchments of the Upper Thames and the Lower Severn, funded by the RFCC and substantially integrated into rural community networks. The timing and focus of the Gloucestershire LL was, therefore, fortuitous and met with enthusiasm.

10.3 The Living Lab in Gloucestershire

10.3.1 Background

Since 2010, Gloucestershire County Council (GCC) has had statutory responsibility as the county's Lead Local Flood Authority[5] (LLFA), concerned with flood risk coordination for surface water, ordinary watercourses (to be distinguished from 'main rivers' which fall under the responsibility of the Environment Agency) and groundwater. In 2014 GCC adopted a 10-year Local Flood Risk Management Strategy, and publishes annual progress reports on its implementation. A new flood risk plan is being drafted.

In the Gloucestershire Living Lab (LL), and under the leadership of GCC, the RFCC was targeted as an institution likely to be capable of improving rural-urban links through a more integrated approach to catchment management. Earlier NFM trials, which were multi-stakeholder arrangements including state agencies, local councils, private landholders and rural communities, had been linked to river systems rather than local authority areas. GCC is politically represented at the RFCC, and used to *'networking with other lead local flood authorities every four months … in the south-west and up to Worcestershire and Telford'* (stakeholder interview, 7th March 2019).

The RFCC already coordinates flood risk work across democratic and administrative boundaries along the Severn and Wye catchments (but not the Thames, for which there is a separate RFCC), and has been instrumental in supporting natural flood management (see above) in Gloucestershire. The RFCC was therefore the governance arrangement identified in the LL as likely to create change around ESS-related rural-urban links. Consequently, the innovation objective of the LL was to develop a special sub-group of the RFCC which would oversee natural flood

[5] https://www.gloucestershire.gov.uk/your-community/emergencies-and-your-safety/flooding-and-drainage/gloucestershire-county-councils-local-flood-risk-management-strategy-lfrms/. Accessed 12th March 2021.

management interventions and provide a form for research and practice exchange in the region including Gloucestershire.

10.3.2 Implementing the LL in Gloucestershire

As set out in the introductory chapter of this volume, the work of the LL followed four iterative stages, accompanied in parallel by monitoring and evaluation across all four phases. Table 10.1, below, sets out the activities in each phase. Within the Gloucestershire LL team, a total of three researchers from the University of Gloucestershire's Countryside and Community Research Institute and eight GCC staff were involved. In relation to the ESS theme, the two authors led the LL work, supported by Gary Kennison, the GCC County Ecologist at the time.

The table reflects the four-phase LL implementation process followed by all participating LLs, and which was outlined in methodological guidance (Maye et al., 2018). In the case of ESS rural-urban governance in Gloucestershire, the first phase involved exploratory interviews with five stakeholders with an interest and expertise in natural capital and water-related environmental issues in the county. As well as two GCC employees (the co-author and the county ecologist), this group included the out-going chair of the RFCC, a catchment control official at Thames Water and the co-ordinator of the multi-stakeholder Gloucestershire Local Nature Partnership. These interviewees variously suggested or supported a stronger and more strategic consideration of NFM in flood risk operations in the county and the region.

A policy review of flood risk, agri-environmental and coastal erosion policy documents, as well as a review of academic NFM literature (cf. 2.1 above) reinforced the piece-meal and project-specific implementation of NFM in the UK as a whole. Six additional interviews in phase 2 examined the implementation of NFM in the

Table 10.1 Pursuing ESS rural-urban governance innovation in the Gloucestershire LL

LL Phase	Time period	Activity
1. Envisioning—the focus of the LL experiments was jointly formulated, discussed, agreed and articulated in a *Research and Innovation Agenda*	Oct 2018–Feb2019	Joint development of the Research and Innovation Agenda. This followed 5 exploratory stakeholder interviews and policy analysis
2. Experimenting—Background research, consultations, prototype thinking and ideas testing	Mar–Sept 2019	Review of NFM literature. Further interviews with 6 additional stakeholders
3. Experiencing—Experiments were implemented and refined	Oct 19–Mar 21	Expert group workshop. Development of sub-group proposals, terms of reference and initiation
4. Reflecting	Throughout; final evaluation with the team in May 21	Formal interviews with ROBUST evaluation leader and short film produced by ICLEI (see below)

county and wider region in recent years. Interviewees included employees of two environmental NGOs, two local council officers who had been involved in NFM implementation in Gloucestershire, the current chair of the Severn and Wye RFCC as well as an independent member of the neighbouring Thames RFCC, where an NFM sub-group already exists.

10.3.3 Initiating a New Governance Structure

Earlier NFM trials, which were multi-stakeholder arrangements including state agencies, local councils, private landholders and rural communities, had been based within small tributaries of larger rivers, and while they proved effective, did not lead to the initiation of united strategic action in favour of wider, catchment based NFM. However, these projects were linked to river systems, rather than being confined to single local authority areas. GCC is familiar with such cross-boundary collaboration, as suggested above, through its membership of the RFCC.

After interviews with the officials of the RFCC, the LL team felt reassured that it was important and possible to move beyond project-based interventions towards a better integrated and strategic uptake of NFM as a multi-functional form of ecosystem service linking rural and urban areas. Because LLFAs hold responsibility for flood risk management in their local authorities, it was clearly vital to secure LLFA support in the region. After a delay due to the COVID-19 pandemic of about 7 months, the LL established a competency group composed of LLFA officers in the English Severn and Wye RFCC area. This comprised two members of the LL team, seven LLFA officers and the chair of the RFCC. On 5th November 2020, an on-line workshop proposed the establishment of a sub-group of the RFCC, and on 26th January this was approved by the RFCC, following the presentation of draft terms of reference (see Table 10.2). These were subsequently ratified on 20th April 2021.

Two key allies were instrumental in this development. The first was an independent RFCC member for the Thames region, where a similar group has been operating since 2018. This member was interviewed by the LL team and subsequently provided detailed guidance to the competency group. The second key ally was the equivalent member of the English Severn and Wye RFCC, who agreed to 'sponsor' the request for the establishment of the sub-group as its founding chair, immediately broadening the focus from NFM alone to all nature-based rural and urban flood management interventions. The sub-group's focus and name thus became *Working with Natural Processes*.

Since 26th January 2021, the LLFA competency group has been consulted on the (i) the broadening of the sub-group's objectives to include all nature-based processes in water management, to reflect the perspective of NFM as a management train, or continuum, from upper catchment land management to urban multiple-benefit urban SuDS (including water quality, water quantity, biodiversity and amenity); and (ii) the operational fulfilment of the sub-group's terms of reference, through the establishment of two activity 'tiers'. The first of these is an annual

Table 10.2 Terms of Reference Working with Natural Processes sub-group of the English Severn and Wye RFCC (as adopted on 26th January 2021)

1. To promote an integrated catchment management manifesto for flood and coastal erosion risk management (FCERM) in the English Severn and Wye RFCC area, working with natural processes, including natural flood management
2. To promote a co-ordinated cross functional approach to the delivery of environmental outcomes across the English Severn and Wye RFCC
3. To act as an impartial forum of experts to discuss and exchange information between partners and academia, providing a platform for engagement and sharing of best practice thereby raising awareness of possibilities of working with natural processes
4. To inform and advise the RFCC on environmental aspects of FCERM
5. To have oversight of all funded working with natural process/natural flood management projects in the ES&W RFCC area
6. To challenge the development of future capital programmes and ensure integration with other environmental programmes
7. To review projects and assess their environmental benefits and impacts before they are formally discussed and agreed by ES&W RFCC
8. To monitor the Capital Investment Programme, ensuring accountability for delivery of broad environmental outcomes
9. To regularly report progress to the RFCC, where necessary provide support to develop a greater understanding and knowledge and if necessary, to recommend specific action
10. To promote climate change resilience, adaptation, extreme weather response to influence and enable integration of key objectives in river basin and SMP planning
11. To review new evidence, research opportunities to help with engagement planning
12. To evaluate any gaps that exist in engagement work knowledge and facilitate information and research dissemination across the internal and external partnerships

information and exchange event for all regional NFM practitioners. The second is a biannual scrutiny group which will review all RFCC funded operations for their attention to nature-based flood solutions. In this way natural processes for water management will be strategically integrated in the regional flood management work as soon as they are planned by the RFCC, and regular data and practice developments will be systematically shared. The sub-group will have a very tangible, specialist advisory role to the RFCC.

10.4 Critical Reflections

10.4.1 Nature-Based Solutions to Flood Risk Governance as an Integration Tool

Two important new environmental concepts to emerge in the UK are *natural capital* and *environmental net gain*. In 2018 the UK government introduced its 25-year Environment Plan (25YEP), in which objectives to enhance natural capital are outlined.

Natural capital frames the environment as a valuable natural asset producing vital and cost-free ecosystem services, signalling a shift in the ways the impact of development on the environment are perceived. The prominent elements of natural capital in the 25YEP are clean air and water, reduced risk of environmental hazard (i.e. flood and drought), sustainable use of natural resources and greater human engagement with natural heritage and beauty (DEFRA, 2018: 23).

Some anxious voices were encountered in our interviews in relation to the relative contributions which housing development and agricultural land use can offer to achieving natural capital targets:

> *The biggest driver that has certainly degraded the natural resource [of Gloucestershire] but also has the ability to improve it, is agriculture. I get [irritated] when I hear people identifying development as being the biggest threat. I think it is [a significant threat], but nowhere near the biggest threat. I would say agriculture has to come first every time.*—26th Feb 2019.

This concern is emphasised in relation to debates about which land use blends can optimise natural capital in the county:

> *Changes in agricultural land use could help change the flood risk level, but that requires land managers to be able to pay for these changes, which may require a shift from food production. In some areas, food production is simply not a priority in terms of land use.*—24th January 2020.

Environmental net gain foresees the introduction of legal regulations to ensure that housing and infrastructure development balances the target to build 300,000 new homes a year in England by the mid-2020s, against the protection of biodiversity and the wider environment. These objectives are to be achieved without extra burdens being placed on developers. Much of the Plan's narrative on environmental net gain is linked to housing development and, while natural capital is represented within urban greenspace, it is closely linked to rural and agricultural land uses, including practical methods such as integrating habitat management and environmentally sensitive building and land management methods. Clearly, such objectives are ambitious and will require market-based mechanisms to fund natural capital improvements alongside legal enforcement and scientific monitoring.

Tensions between agriculture, urban expansion and conservation are inherent in ESS governance discourse. The emphasis here is that the success of NFM has been intrinsically connected to positive interactions between flood risk managers, local communities, farmers/land managers. It follows that a formal and accountable governance arrangement such as the RFCC sub-group—namely the ESS innovation in the Gloucestershire LL—will, firstly, regularly include landholders in best practice exchanges with NFM practitioners. Secondly, the sub-group, in embracing NFM, will advise the RFCC about the application of delegated funds for land-based flood interventions. In short, the new sub-group promises to be an arena of practical exchange in which farmers will be important participants. They will be informed of practical innovations and express views on how and where upstream land management can be integrated into RFCC projects.

10.4.2 Opportunities and Bottlenecks

10.4.2.1 Opportunities Arising from the New RFCC Sub-Group

Beyond its immediate potential for extending the focus of strategic nature-based solutions down from country to regional level, the RFCC sub-group also has the potential to co-devise new incentivisation tools to secure flood and habitat-related ESS in the region. This is helpful, for example in the context NFM, prototypes of which have been trialled in Gloucestershire. In addition, the RFCC could also inform non-state incentives, i.e. payment for ecosystem services. In relation to the latter, the River Severn Partnership[6] is a cross-sectoral partnership funded by the government which very clearly links the region's economic development to its environmental resilience. This is a departure from earlier silo-based policy-making which separated economic and environmental objectives, towards synergistic and systems-based approaches. The RFCC and the LLFAs have a role to play in cementing this link:

> *I feel positive about the potential benefits of NFM as a land use or water management practice. This is an area that we need more research and evidence-based data for greater investment.*—22nd Nov 2019.

10.4.2.2 Bottlenecks Inhibiting NFM Interventions

Even so, evidence and investment represent clear bottlenecks in the achievement of the LL innovation, alongside the complexity of flood risk governance in the region. In combination these factors make it difficult to find the right leverage for change.

The efforts needed to operationalise NFM in a case-by-case manner may exacerbate the ambivalence with which it is regarded as an effective flood risk strategy. A key critique of NFM schemes, many of which are run as civil society-led partnership initiatives, is the absence of adequate evidence for a causal link between NFM interventions and downstream impacts and, in the main, monitoring has taken place in small catchments (Lane, 2017). Sustainable Drainage Schemes, which are NFM interventions demanded of developers as a condition of planning permission, are commonly implemented in a piecemeal manner, and usually associated with new developments, even though they represent only 1% of buildings in the UK (Lashford et al., 2019).

Such scholarly views are echoed locally, where frustration at the strategic and cultural challenges to grasp NFM is tempered with optimism about its potential, informed by regional experiences:

> *regulations relating to SUDs…are pathetic and developers may be able to get around them to their advantage'. […] 'hard engineering remaining the prevalent intervention, including flood barrier construction and river dredging without an integrated consideration of*

[6] http://www.riversevernpartnership.org.uk/. Accessed 5th April 2021.

> *natural requirements. […] DEFRA and others including farming unions and commercial advisers still imagine that NFM somehow threatens the productivity of land management businesses […] as somehow distinct or a distraction from economic farming. A challenge is therefore to engage sensitively and positively with land managers around NFM.*—8th Jan 2020.

> *instead of getting the water past a development as quickly as possible, what is there that can be done upstream? [Such as] re-meandering rivers, woody debris dams.*—7th March 2019.

Water companies, especially Thames and Severn Trent, have been enthusiastic advocates of NFM in the region. However, an additional challenge relates to the 5-year Asset Management Period (period of infrastructural maintenance investment), which is shorter than both the life-cycle and assessment period needed to gauge NFM effectiveness.

NFM, as a nature-based catchment intervention, is neither statutorily or strategically enforced within regional development controls, and success depends on continued evidence-based monitoring and the support of thousands of land managers whose cooperation needs to be better incentivised. Despite this, some success has been noted following multi-stakeholder attempts to promote and adopt NFM locally through networks such as RFCCs already, which emphasise relational urban-rural water management concepts, such as catchment-based approaches (Dadson et al., 2017).

10.5 Conclusions

This chapter has set out how, in a county at the source and the estuary of two major river catchments, a LL methodology has been applied to experiment with novel regional governance innovations. The modest success of the experiment was linked to a range of advantageous contexts which included:

- The urgency of increased flood risk severity and seas-level rises;
- An existing regional and multi-stakeholder governance network which had already supported natural flood management measures and pilots;
- A cluster of Lead Local Flood Authorities already in contact with each other through the RFCC and other fora, and through shared flood risk exposure along the Severn;
- Recent national policy development linked to natural capital enhancement;
- Emerging scientific evidence in relation to the interdependence of rural land use and urban flood risk.

Undoubtedly, the LL came at a good time for Gloucestershire and expanded the capacity with which the issue of strategic nature-based flood risk solutions could be explored in practice, thanks to project funding and capacity from ROBUST. This allowed coworking between the University and GCC and additional stakeholder engagements in the region, and allowed GCC to become involved in the

international networks of ROBUST (including, for example, the 10th international Ecosystems Services Partnership conference in Hannover in 2019).

The chapter has also outlined how, as a consequence of flood policy in England, flood risk management resource allocation remains linked to interventions which seem most likely to protect lives and properties in the most densely populated urban centres. While this is understandable, it isolates land management as a rural concern linked to farming. Meanwhile, substantial urbanisation plans may result in exacerbated surface water run-off if nature-based urban sustainable drainage interventions, such as above-ground water storage, swales and water meadows and rain water gardens are not well-planned and managed. At the time of writing there is no legal compulsion for such measures to be included in development plans. As such, for counties like Gloucestershire, where river catchments flow in and out of rural landscapes and urban settlements, nature based solutions need to be seen along territorial continuums and the new sub-group will, it is hoped, enhance opportunities for networked governance of ESS implementation, performance and monitoring in the region. In time, the work of the sub-group could be extended to support calls for compulsory nature-based flood management solutions via the political representation within the RFCC. The subgroup might also see a role in advising regional reforms of post-Brexit agri-environmental subsidy where these can be linked to land management impacts on water dynamics and community engagement in the monitoring of nature-based flood installations.

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