Grantham Research Institute on Climate Change and the Environment

Centre for Climate Change Economics and Policy

Submission to the Environment Agency's consultation on the Draft National Flood and Coastal Erosion Risk Management Strategy for England

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About this submission

In May 2019 the Environment Agency launched a consultation to seek views on its draft strategy that sets out a vision for a nation ready for, and resilient to, flooding and coastal change now and in the future. The revised Strategy is due for publication in Spring 2020. See https://consult.environment-agency.gov.uk/fcrm/national-strategy-public/ for more information.

This paper summarises the submission to this consultation by Swenja Surminski, Viktor Roezer, Sara Mehryar, Rebecca Byrnes, Bob Ward and Josh Burke on behalf of the Grantham Research Institute on Climate Change and the Environment at the London School of Economics and Political Science and the ESRC Centre for Climate Change Economics and Policy (CCCEP). A pre-published version was submitted to the call for evidence on flooding and coastal erosion policy on 4 July 2019. This version of the submission was copyedited by Georgina Kyriacou.

Authors' note

The Grantham Research Institute welcomes this opportunity to assist and support the work of the Environment Agency. We have been actively working with policymakers and researchers for a decade to address issues around climate change adaptation and flooding. The evidence provided in this submission is based on this work, in particular the Zurich Flood Resilience Alliance project, where we are collaborating with communities at risk of flooding; the EU-FP7 project ENHANCE, which focused on flood insurance; our work on the UK Climate Change Risk Assessments (CCRAs) 2 and 3, which explores risks to businesses and industry; and recent engagements with the Geneva Association on Flood Risk Governance in England and the Cambridge Institute for Sustainability Leadership on implications of flood risk for mortgage portfolios. The Institute also works closely with the financial sector on integrating physical climate risk such as flood risk into scenario planning.

Our research experience and engagement ranges from sustainable flood insurance to testing pre-event flood risk reduction strategies at community level, investing in a just transition, understanding litigation risks, and the role of risk transfer in driving climate resilience in developing countries. Progress has been made in many of these areas, with genuine efforts from some industry leaders to mainstream sustainability and demonstrate that this is good for their business, clients and society. But at the same time there are challenges that have not been resolved and which will require joint efforts to address.

This paper was first published in October 2019 by the Grantham Research Institute on Climate Change and the Environment and the Centre for Climate Change Economics and Policy.

Summary recommendations

The Grantham Research Institute on Climate Change and the Environment and CCCEP support the development of the Environment Agency's Draft National Flood and Coastal Erosion Risk Management Strategy as it is both timely and needed. We also welcome the fact that the Environment Agency is taking the lead on strategic thinking and planning on flood management. We support the vision outlined in the Strategy, in particular the long time horizon to 2100. However, we see a number of ways to further strengthen the vision of the Strategy and we group our recommendations within three broad categories:

1. **Flood resilience cannot be considered in isolation.** Instead it must be mainstreamed into thinking and planning with respect to future climate change and broader economic and social policy, and should be holistic in its definition, including through increased emphasis on surface water flooding.
2. **High-level strategic thinking needs to be backed up by policy, regulation and funding.** This will require collaboration with other agencies that have the regulatory power and mandate to fulfil some of the functions identified in the Strategy.
3. **Effective communication is vital.** The Strategy should develop and disseminate a clear narrative on the importance and benefits of flood resilience, including through communicating both the incentives for acting and the risks associated with not doing so.

Responses to selected consultation questions

Introduction and setting the context

To what extent do you agree with the vision: 'A nation ready for, and resilient to, flooding and coastal change – today, tomorrow and to the year 2100'? (Q1)

The Grantham Research Institute supports the development of this Strategy as it is both timely and needed. We also welcome the fact that the Environment Agency (EA) is taking the lead on strategic thinking and planning on flood management. We support the vision outlined in the Strategy, in particular the long time horizon to 2100. However, we see ways to further strengthen the vision of the Strategy and hence we make the following recommendations.

a) Increase policy engagement: The EA can only enforce flood management actions to a limited extent. It is therefore vital that this Strategy is followed by policy and regulation and supported by additional funding.

b) Mainstream flood resilience: Flood resilience should not be considered as a stand-alone issue but needs to be integrated into relevant policy objectives and their local implementation, such as the objectives within the UK Government's Industrial Strategy, Clean Growth Strategy and the 25 Year Environment Plan. This is also particularly important in the context of managing the transition to a zero-carbon future and addressing the fairness and social justice aspects that might arise. The Draft Strategy does not provide enough ambition on aligning flood risk management with other national strategies and targets. Reinstating 'adaptation champions' across government departments could be one step towards achieving this alignment.

c) Specify more immediate timeframes: The timeframes outlined in the Draft Strategy could be more ambitious. In many areas of flood and coastal erosion management there is a need for immediate action, whereas the Draft Strategy makes inadequate, aspirational commitments. For example, the concept of 'building back better' – the principle that all repairs and construction following flooding and coastal erosion events is designed to be resilient to future events – should be enshrined into policy immediately. The concept has been well understood for some time but not implemented. The urgency is growing, as without mandating such a requirement in policy or regulation, we will see continuation of risk creation rather than risk reduction.

d) Create a clear narrative to secure buy-in and support: This includes ensuring transparency on the risks and challenges in managing flooding and coastal erosion, in order to manage expectations. Historically, framing the approach to erosion management as an attempt to 'win the war against flooding' contributed to unrealistic expectations for flood and coastal erosion victims and stakeholders. A more effective and realistic framing should revolve around what the acceptable levels of damage are from flooding and coastal erosion and how those affected by such events will be supported, to place the onus on increasing resilience rather than 'controlling' risks. Furthermore, investing in resilience is not a cost but an opportunity that delivers a wide range of benefits beyond avoiding losses from flooding and coastal erosion. One concept that supports broadening the view of and strengthening the business case for resilience investment is the so-called 'Triple Dividend of Resilience' proposed by Surminksi and Tanner (2016), which extends the focus beyond avoided losses. Using the framework, flood risk management projects would broaden their existing appraisal approaches to consider additional benefits that create an immediate return on investment, such as supporting economic development or improving the wellbeing of communities. The Grantham Research Institute is currently working with local authorities in Lowestoft and Felixstowe to implement the concept of the Triple Dividend of Resilience into planning policy.

e) Take a holistic view of flood resilience: Creating resilience does not only mean 'protection now and in the future', but also reducing 'risk creation'. It requires an understanding of flooding as a multi-faceted phenomenon that can only be tackled through a broad array of measures that extend beyond the domain of engineers, hydrologists and statisticians. Although a lot has been done to increase awareness of a holistic understanding of flood risk and resilience, as yet such an understanding is rarely operationalised (Keating et al., 2014). An important starting point for increasing this understanding is to consider different drivers of resilience. The Grantham Research Institute is a member of the Zurich Flood Resilience Alliance, which has developed a framework and associated tool for measuring community flood resilience in various contexts (developed and developing countries, rural and urban areas) across the world. This framework and tool – called Flood Resilience Measuring for Communities (FRMC) – combines: the five capitals of resilience (human, social, physical, natural, financial); four properties of a resilient system (robustness, rapidity, redundancy, resourcefulness); and five stages of the disaster risk management cycle (prospective risk reduction, corrective risk reduction, preparedness, response and recovery), to measure and support community-level flood resilience (ZFRA, 2019; Campbell et al., 2019). This holistic view of resilience should be applied to the EA's Strategy.

f) Make stronger links to climate change: The Strategy needs to demand a greater focus on climate change, including through a Government mandate, to ensure that future risks from climate change are a key focus area of flood and coastal erosion management plans and policies. We recommend that the EA plays a major role in the UK's Climate Change Risk Assessment (CCRA) process in 2019 (in the lead-up to publication of the next CCRA in 2022), and, more widely, collaborates closely with the Committee on Climate Change (CCC). There should also be links made between the EA's Strategy and climate change mitigation plans, to ensure a holistic approach is taken to managing flooding and environmental change. For example, as noted recently by Emma Howard Boyd, the EA's chair, while the EA had used diesel-powered pumps in response to recent floods, it is looking into new technologies to deal with floods in a 'greener and cleaner' way; these kinds of actions are to be encouraged.

To what extent do you agree with the Environment Agency's proposed strategic overview role as set out in the chapter 'Setting the context for the draft strategy'? (Q2)

The Grantham Research Institute welcomes an enhanced role for the EA, which would need to be backed up by additional financial support for the agency. The Draft Strategy indicates a clear vision from the EA for a comprehensive and anticipatory approach to flood risk management in England. Turning this vision into reality will require significant funding, cross-sectoral collaboration and hard political choices. It is essential to align incentives and financial support for taking risk reduction and flood resilience measures, and to ensure that risk trends are well understood among decision-makers at different levels.

While the strategic overview role of the EA is valuable, the Strategy should also outline how the EA's role will cover the following important areas:

More attention to surface water: Despite some efforts to give it more focus, surface water is still the 'poor relative' in flood risk management discourse. This is reflected in the Draft Strategy, where it is not given sufficient attention or integration with other issues, even though the impacts of surface water

flooding are felt right across the country. The EA could play a coordinating role to ensure stakeholders give adequate attention to surface water.

Climate change links: It is not clear that in producing the Draft Strategy the EA has fully considered the work of the CCC Adaptation Committee. For example, the Adaptation Committee published a report on managing the coast in a changing climate in 2018 (Committee on Climate Change, 2018), which the Strategy could make explicit links to.

Planning: The Strategy should outline matters including how current and future risks are to be taken into account in planning processes, whether such considerations should be mandated, and what role the EA can play in bringing about the necessary changes. The Committee on Climate Change has regularly highlighted that the overall effectiveness of the current planning regime in relation to flood risks is unclear. Development on floodplains is still permitted and 12 per cent of new residential development between 2001 and 2014 occurred on floodplains, 25 per cent of which was in medium or high flood risk areas (Committee on Climate Change, 2015), and in its recent progress report the Committee on Climate Change argued that the planning system needs to be updated to ensure better alignment with the aims of the Flood and Water Management Act 2010, particularly for implementation of Sustainable Drainage Systems (SuDS) (Committee on Climate Change 2019).

Monitoring: Despite several reviews of lessons learned from the flood risk management practices, our stakeholder discussions indicate that there is a lack of transparency over the speed and level of implementation of such practices (see forthcoming report by Geneva Association). The EA could play a stronger role in monitoring progress both through the implementation of this Strategy and in the implementation of flood and coastal erosion management policies and practices more broadly using existing reviews and lessons learned.

Championing multi-sectoral work: As flood risk is a multi-faceted challenge, it requires action across a wide range of stakeholders. For this, clear roles, responsibilities and collaborations are needed in addition to an understanding of motivations and incentives that determine the actions of different stakeholders. The Strategy aspires to multi-sector collaboration, but it could include more specific proposals on how this collaboration can be achieved, particularly with regard to the private sector and finance. The high level of insurance penetration seen in England has also meant that for some sectors flood risk has tended not to be considered a priority – this is the case with mortgage providers, for example (see Crick et al., 2018). The EA should play a central role in achieving greater transparency about current and future risks and risk ownership. This is also important in the context of the risk disclosure currently undertaken by many businesses under the guidelines of the Task Force on Climate-related Financial Disclosures (TCFD). Physical risks such as flooding are recognised in this disclosure process, but there is still little understanding of how they can be assessed, and, therefore, of how to report, manage and, ultimately, reduce the risks. The EA can play a role in supporting and advising on how current and future flood risk should be assessed and disclosed.

Climate-resilient places

To what extent do you agree with strategic objective 1.1: 'Between now and 2050 the nation will be resilient to future flood and coastal risks. Over the next year the Environment Agency will work with partners to explore and develop the concept of standards for flood and coastal resilience'? (Q3)

Working to standards is a useful way to manage flood and coastal erosion risk. However, to ensure standards are effective, there is a need for clarity around who is responsible for designing and enforcing the standards, how they will be assessed and where the liability for failing to comply with standards lies. Also, standards should not apply only to new developments. Setting standards for flood-resilient building materials for homes and businesses is an important step in making new homes more flood-resilient (strategic objective 3.4). However, efforts also need to include approaches for 'building back better' (reconstructing damaged infrastructure so that it is more resilient in the future) and incentives for retrofitting, which also need to be linked to climate change mitigation efforts to avoid trade-offs, for example when home owners consider installing energy efficiency and flood resilience measures.

Standards are only one part of the overall solution. Even with higher standards in place, floods will occur and disaster resilience must also include plans for disaster management. Human behaviour also

significantly contributes to flood risk and so objective 1.1 needs to be considered in conjunction with objectives below relating to education and awareness.

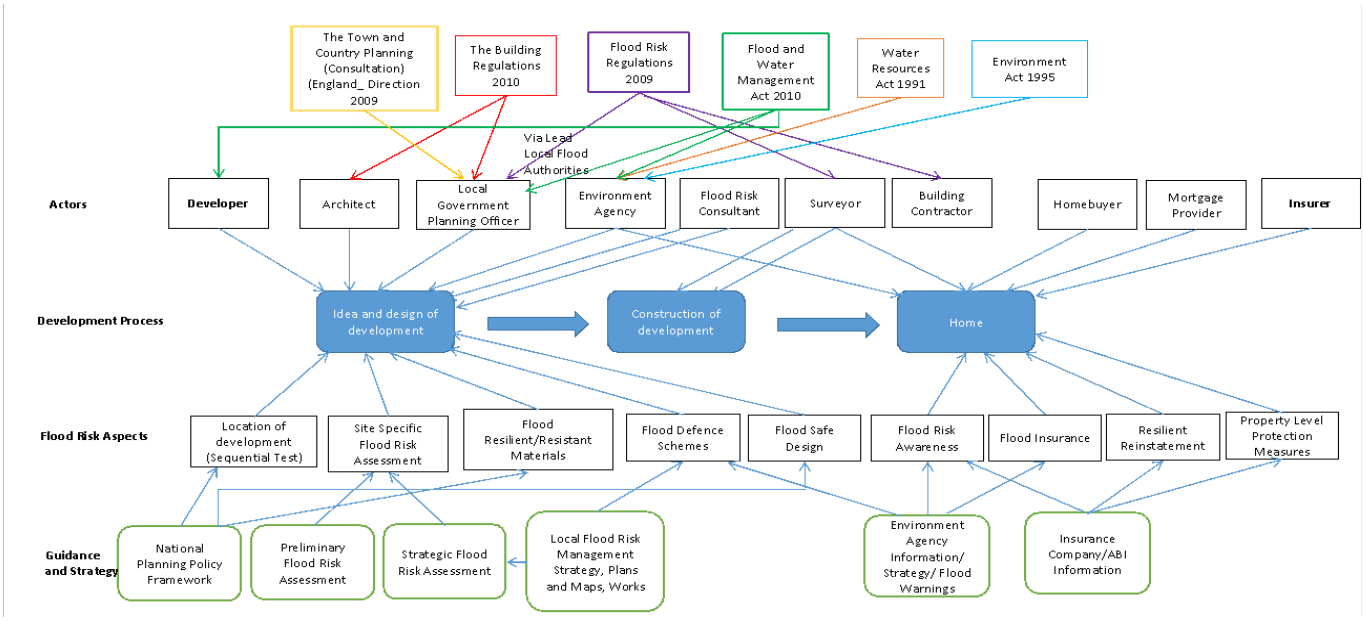
Standards also need to be matched by appropriate investment. For example, significant funding will be required to maintain dams against flood risk.

To what extent do you agree with strategic objective 1.2: Between now and 2050 risk management authorities will help places plan and adapt to flooding and coastal change across a range of climate futures'? (Q4)

Planning for, and being able to adapt flexibly to, a range of future scenarios is an important objective. This objective would be further bolstered by taking into consideration:

- **The interplay between different risk trends** such as wider socioeconomic developments, implications of low-carbon transitions and land-use.
- **Improvements to existing modelling and measurements**, noting that decision-makers consistently underestimate existing precipitation variability and so may fail to correctly estimate the extent to which future climate variability will impact on the geographical distribution of flood risk.
- **Adaptive and participatory decision-making:** The diagram below provides an overview of the different stages of a development project (from initial concept to delivering a home), the stakeholders involved in each stage and the range of flood-related rules, regulations and policies that can influence the planning process and stakeholders. As different stakeholders involved in such processes may have different interests and values in terms of development and flood risk management, integrating the different perceptions of stakeholders into flood resilience decision-making is important. A participatory approach to flood resilience decision-making links expert risk analysis to stakeholders' perceptions and collective knowledge. This is an adaptive approach that provides feedback for learning and future adaptation or transformation. However, a participatory approach is not often applied in relation to flood risk. Ignoring the perception and knowledge of stakeholders whose wellbeing, business or interests are impacted by flood risk management interventions may result in counterproductive impacts. The EA should have a key role in ensuring a participatory approach is used and these perceptions are not ignored.

Key actors and stages at which flood risk considerations can be incorporated in the progress of the development: from initial concept to delivering a home



Source: Crick et al. (2016)

To what extent do you agree with strategic objective 1.3: 'Between now and 2030 all those involved in managing water will embrace and embed adaptive approaches to enhance the resilience of our environment to future flooding and drought'? (Q5)

The important questions that the Strategy should address under objective 1.3 are: What does being resilient to flood and drought look like and consist of, how is the EA defining 'adaptive approaches', and what are the legal mandates and accountability mechanisms for embracing and embedding such approaches? The Draft Strategy does not elaborate on these important considerations.

These matters are particularly important in relation to the concept of resilience. 'Resilience' should also be clearly defined, to prevent any reinterpretation of the term that may lead to targets being missed or progress being seen as unmeasurable. The definition needs to encompass a holistic understanding of resilience, based on 'system thinking' (see ZFRA, 2019), which is missing from the Draft Strategy. The Zurich Flood Resilience Alliance provides a useful guideline, defining community flood resilience as "bouncing forward" instead of "bouncing back" and "the ability of a system, community, or society to pursue its social, ecological, and economic development and growth objectives, while managing its disaster risk over time in a mutually reinforcing way" (Keating et al., 2016; Keating et al., 2017). An important aspect of this definition of resilience is the emphasis on the need to embed resilience in a development perspective and to focus on the interdependency between natural and social systems.

To what extent do you agree with strategic objective 1.5: 'Between now and 2030, risk management authorities will use funding and financing from new sources to invest in making the nation resilient to flooding and coastal change'? (Q7)

While finance is an essential component of improved flood and coastal erosion management, this objective lacks ambition and clarity. To improve it, it is important to:

- **Clarify what new sources of finance are required as well as planned,** and how they will be made available.
- **Promote a greater recognition of flood resilience in the context of sustainable finance.** Currently, innovative financial instruments are being explored at several levels, with new guidelines being designed for incorporating resilience into investment decisions, for example by the Climate Bonds Initiative.
- **Make resilience an investable proposition.** There is growing interest in generating returns from investments in resilience and climate adaptation but a good formula is still missing. A recent blogpost by the Grantham Research Institute identifies the challenges, opportunities and five priorities for a sustainable insurance industry (Surminski et al., 2018).

Today's growth and infrastructure – resilient to tomorrow's climate

To what extent do you agree with strategic objective 2.1: 'Between now and 2030 all new development will contribute to achieving place based resilience to flooding and coastal change'? (Q8)

As with other objectives in the Strategy, it is important to clarify what achieving this objective will entail so that it can be measured, monitored and communicated clearly to stakeholders. The following questions should be addressed:

- Who is responsible and accountable for enhancing flood resilience at different stages of development projects?
- What is the role of the EA in such processes and what are the relevant legal tools or requirements that apply to the EA?
- How are current and future risks taken into account?
- How will this objective be assessed?

Implementing measures 2.1.1 and 2.1.2[1] requires a legal framework that supports flood resilience in planning and land-use management. Under the National Planning Policy (2019) new developments in

[1] Measure 2.1.1: "From 2021 risk management authorities will invest in planning skills and capabilities to ensure they can advise planners and developers effectively to enable climate resilient places." Measure 2.1.2: "From 2025 the Environment Agency and

high-risk zones are possible if a wider societal interest can be proven. What amounts to 'societal interest', and the level of acceptable trade-off in such cases, should be defined, otherwise this policy could easily be misused in development projects in high-risk flood zone areas. Moreover, because developers typically refer to publicly available flood maps and models provided by government to quantify the risk of flooding and to consider the use of risk reduction measures, the future risk of flooding – considering climate change – should be taken into account in these maps and models. Ideally, this would be mandated through legislation or regulation.

It is important to note that the burden of flood risk does not rest with developers but with home-owners, who then use flood insurance to transfer this risk, either voluntarily or as required through their mortgage provider. However, flood reinsurance is not available for properties built after 2009, and there are first signs that mortgage providers may start to consider flood risk in their valuations (CISL, 2019).

To what extent do you agree with strategic objective 2.3: 'Between now and 2030 all risk management authorities will contribute positively to local economic regeneration and sustainable growth through their investments in flooding and coastal change projects'? (Q10)

The Grantham Research Institute shares the view that investments in flood risk management should support local economic regeneration and sustainable growth, especially when considering the growing concern about flood risk becoming a divisive issue and concern for social justice and fairness (see Sayers, Horritt et al., 2017). Understanding flood risk management as a tool for economic regeneration and inclusive growth and development, while avoiding the creation of more vulnerable communities, could generate greater support and buy-in from across the political spectrum and provide a new, more positive framing for flood risk management.

To do this requires a clear strategy for how to consider the wider benefits of investments in flood risk management. The Draft Strategy does not make it clear how project appraisals and decision-making projects will be changed to reach strategic objectives 2.2[2] and 2.3. Drawing on the concept of the Triple Dividend of Resilience, as outlined in Question 1 above, can provide a useful framing and toolkit for effective decision-making on resilience through understanding the potential opportunities that enhancing resilience presents. This aspect is also important for identifying and securing innovative ways of funding flood resilience projects as well as for attracting private sector partners.

Quantifying the wider benefits from flood risk management investments is a significant challenge, as highlighted by Defra's Economics of Climate Resilience project and other recent studies (Surminski and Tanner, 2016; Sayers et al., 2018; Sayers, Penning-Rowsell et al., 2017; Tanner et al., 2015). In order to reach strategic objective 2.3, significant efforts are needed to develop new decision-making and project appraisal tools that are able to quantify the wider benefits of flood risk management projects.

To what extent do you agree with strategic objective 2.4: 'Between now and 2050 places affected by flooding and coastal change will be "built back better" and in better places'? (Q11)

The Grantham Research Institute appreciates the efforts of the Government, the EA and industry to increase flood resilience of homes and businesses through supporting post-flood repairs that are designed to be resilient to future flooding (building back better). However, the time frames currently in place to carry this out are not ambitious enough: immediate action is needed to ensure that post-flood repairs take into account projected future risk levels. Despite several rounds of intensive work and declarations, including in the Property Flood Resilience Action plan (Bonfield, 2016) and from Defra's Resilience Round-Table which brings together industry and government, progress on building back better is still limited.

Building back better and in better places requires all stakeholders involved in the reconstruction of damaged buildings as well as the erection of new dwellings to have a solid understanding of the current and future risk from flooding. Therefore strategic objective 2.4 should also include strategies on how to improve the understanding of flood risk by stakeholders that currently do not see flood risk as a priority in their decision-making. For example, a study by Vivid Economics for the Cambridge Institute for

lead local flood authorities will advise local planning authorities on how adaptive approaches should inform strategic local plans."

[2] Strategic objective 2.2: "Between now and 2030 all new development will seek to support environmental net gain in local places."

Sustainability Leadership provides real estate investors and lenders with a means of understanding the potential physical risks of climate change on their portfolios and shows the importance of resilience and adaptation measures (CISL, 2019).

Incentives are key to supporting building back better. To reach the anticipated behavioural changes outlined in measure 2.4.1[3] it is necessary to build an incentive structure that encourages home-owners and business-owners to invest in property level flood protection. Insurers can play a major role in creating financial incentives. If the EA outlined a clear strategy on how to incentivise building back better approaches together with the insurance industry and other relevant stakeholders, it would help to translate ambitions into prompt actions.

A nation of climate champions, able to adapt to flooding and coastal change through innovation

To what extent do you agree with strategic objective 3.1: 'Between now and 2030 young people at 16 should understand the impact of flooding and coastal change, but also recognise the potential solutions for their place, and opportunities for career development'? (Q14)

Our answer to this question applies to strategic objectives 3.1–3.4.

The Draft Strategy rightly recognises through its stated ambition of creating 'a nation of climate champions, able to adapt to flooding and coastal change through innovation' the need to raise awareness across the UK of the risks from various forms of flooding, and how these risks are being affected by climate change. However, it understates the size of the challenge and does not present a clear strategy for addressing it.

The Strategy states the finding that in 2018 only 34 per cent of people with properties in areas identified as having a flood risk believed that they are probably or definitely at risk of flooding. This figure shows a deterioration in flood risk awareness over the four years to 2018: a similar survey commissioned by the EA in 2014 found that 44 per cent of people living in flood risk areas believed they were probably or definitely at risk. The fact that awareness has apparently decreased reflects a significant failure to communicate the risks of flooding to those who most need to understand and act on the information.

Recent results from the Public Attitudes Tracker commissioned by the Department for Business, Energy and Industrial Strategy (BEIS) show the challenge of increasing public awareness of the fact that climate change is affecting flood risk. Wave 29 of the tracker, carried out in mid-March 2019, found that 69 per cent of the public knew that "climate change is already having an impact in the UK" but only 31 per cent recognised the impacts in the UK as including rising sea levels and more flooding. The survey found that a little more than half – 56 per cent – of people thought that rising sea levels and more flooding are likely to occur in the UK over the next 15 to 20 years as a result of climate change.

These low levels of awareness are perhaps not surprising given that the Government and its agencies have reduced their support for communications about climate change and its impacts over the past few years. In particular, Defra has made funding cuts that ended most of the local climate change partnerships that were funded through the EA, and halted the EA's Climate Ready programme, which aimed to "provide tools and information to help businesses and other organisations live with the changing climate, now and in the future". No Government department or agency has explicit responsibility for communicating to the public about the impacts of climate change on the UK.

The Committee on Climate Change has urged the Government on a number of occasions to improve the provision of information about climate change but without success. For instance, in its 2017 report on adaptation progress, the Committee stated: "In our 2015 report we recommended that the Government should engage the general public about climate change and its consequences for the UK. The Government endorsed the recommendation in principle, but felt it appropriate to continue to focus on individual issues such as flood risk, and provide specific incident-based advice to vulnerable groups, for example during periods of high temperatures. This approach only addresses immediate issues, it does not prepare the country for the inevitable and increasingly severe changes to come." It added: "Awareness of the expected impacts of climate change enables people to plan for the future and take action for their

[3] **Measure 2.4.1:** "By 2025 the Environment Agency will work with government, insurers and financial institutions to review the legal, policy and behavioural changes needed to 'build back better and in better places' and improve the resilience of homes and business."

own benefit. Failure to provide authoritative advice to the general public will leave ministers increasingly exposed to criticism as these impacts become clearer. As with other issues involving complex science, it is important that the public are given robust and unambiguous advice from one or more trusted voices" (Committee on Climate Change, 2017).

The Committee went on to recommend that, "The Government should explore cost-effective ways to communicate the risks from climate change and the actions that can be taken to reduce vulnerabilities", and that the priorities should include "engaging vulnerable groups and communities exposed to specific risks such as higher temperatures, coastal change, and increases in flood risk" (ibid).

In its response, the Government accepted that "increasing awareness of risks and the actions that can be taken to manage those risks is important to stimulate action and to reduce vulnerabilities" (HM Government, 2017). It pointed out that "a range of communication avenues and approaches already exist relating to major risks, such as flooding and overheating that will be exacerbated by climate change". It suggested: "Across a range of specific issues such as responding to heatwaves or reducing water use targeted messaging is closely tied to those individual risks. This enables those affected to relate tangible impacts with practical actions that they can take to adapt and increase their resilience." The Government also stated that "In developing the next NAP [National Adaptation Programme] we will be exploring how this can be reinforced through, for example, embedding climate change impacts and adaptation more strongly as an inherent consideration within a broader range of awareness raising activities" (ibid.).

However, the National Adaptation Programme (Defra, 2018) devoted only one of its 128 pages to "raising awareness and promoting action". It did not provide a strategy for communicating climate change risks but noted that the Met Office Hadley Centre Climate Programme 2018–21 will "increase their commitment to communicating climate change to a wider range of audiences" (ibid.). It is not yet clear what impact this has had. For instance, there has been no public roll-out of the new UK Climate Projections 2018 beyond posting information on the Met Office's website. The 'headline findings' published on the website (Defra et al., 2018) are expressed in technical and inaccessible language, including: "In UKCP18, the probabilistic projections provide local low, central and high changes across the UK, corresponding to 10%, 50% and 90% probability levels. These local values can be averaged over the UK to give a range of average precipitation changes between the 10% and 90% probability levels. By 2070, in the high emission scenario, this range amounts to -47% to +2% in summer, and -1% to +35% in winter (where a negative change indicates less precipitation and a positive change indicates more precipitation)." The information focuses on averages instead of the extremes of rainfall that might lead to flooding. The 'headline findings' state only: "Regional model projections enable users to look at greater detail over the UK including a greater focus on climate extremes, for example, localised heavy rainfall for flood risk assessments" (ibid.).

Given the described shortfall in information and communication, we recommend that the EA's strategy should include a commitment to develop a comprehensive plan for engaging the public and businesses about the risk of flooding from all sources and how these risks are being affected by climate change. To be most effective, this plan should form a component of a wider communications strategy by government to engage the public and businesses in England and elsewhere in the UK on the direct and indirect impacts of climate change on the UK. This strategy should be developed in consultation with other stakeholders, including research institutions and NGOs.

To what extent do you agree with strategic objective 3.2: 'Between now and 2030 people will understand the potential impact of flooding and coastal change on them and take action'? (Q15)

This objective could be strengthened through defining more clearly who should understand the potential impacts and who should be taking action. For example, while it is important for the home-owners to understand flood risk and support resilience measures, other stakeholders such as banks, insurers, investors, planners and developers need to play a role in this too. The Strategy should therefore put greater emphasis on cross-sectoral engagement in flood resilience.

One example is insurance: the insurance industry has been collaborating with different stakeholders for some time, most prominently through the public–private partnership on risk transfer, but also in areas such as risk information, data sharing, risk reduction and investment, but the nature of the private and

highly competitive market makes some of this difficult. For example, there is no formal requirement for the insurance industry to share flood risk information with their customers or the Government in England. This is a missed opportunity. The Strategy should outline how flood risk information could be collected and used more broadly by a wide range of sectors, groups and institutions, as this could become a powerful tool for flood resilience and climate change adaptation. The EA can facilitate data sharing across sectors to help them recognise and manage current and future risk levels, enabling different stakeholders to incorporate this into their day-to-day decision-making. For an example of the challenges and opportunities as they relate to the insurance sector, see Surminski (2017).

The Strategy needs to address objectives for awareness and preparedness specifically for surface water flooding. There are significantly shorter lead times in warnings for the convective rainstorms that lead to surface water flooding, and this type of flooding can happen in places not obviously prone to flooding (Houston et al., 2011). This poses significant challenges to reaching strategic objective 3.2, in addition to achieving the aims of this Strategy more broadly.

In conclusion, surface water flooding should be specifically addressed in strategic objective 3.2 with the aim to (i) significantly improve early warning systems for surface water floods and (ii) increase awareness of surface water flooding and make recommendations on how to take action to those at risk.

In measure 3.3.2,[4] particularly, flood warning systems should also be available for surface flooding in addition to flooding from river and sea.

To what extent do you agree with strategic objective 3.3: 'Between now and 2030 people will receive a consistent and coordinated level of support from all those involved in response and recovery from flooding and coastal change'? (Q16)

This objective should include considerations of fairness and social justice. A recent UK assessment report on flood vulnerability and disadvantage highlighted the equity considerations associated with flood resilience (Sayers et al., 2017). This needs to be integral to the Strategy and its vision.

To what extent do you agree with strategic objective 3.4: 'Between now and 2030 the nation will be recognised as world leader in managing flooding and coastal change, as well as developing and attracting talent to create resilient places'? (Q17)

With regards to measure 3.4.1,[5] setting standards for flood-resilient building materials for homes and businesses is an important step towards making newly built homes more flood-resilient, but efforts need to include approaches for building back better and incentives for retrofitting, and they need to be linked to climate change mitigation efforts.

This objective could be more specific: for example, the Property Flood Resilience Action Plan suggests several actions to increase property-level resilience during the recovery from a flood (Bonfield, 2016).

References

Bonfield P (2016) *The property flood resilience action plan – An action plan to enable better uptake of resilience measures for properties at high flood risk*. London: Department for Environment, Food and Rural Affairs.

Campbell KA, Laurien F, Czajkowski J, Keating A, Hochrainer-Stigler S, Montgomery M (2019) First insights from the Flood Resilience Measurement Tool: A large-scale community flood resilience analysis. *International Journal of Disaster Risk Reduction*: 101257.

Cambridge Institute for Sustainability Leadership [CISL] (2019) *Physical risk framework: Understanding the impacts of climate change on real estate lending and investment portfolios*. Cambridge: University of Cambridge Institute for Sustainability Leadership. https://www.cisl.cam.ac.uk/resources/publication-pdfs/cisl-climatewise-physical-risk-framework-report.pdf

Committee on Climate Change (2015) *Reducing emissions and preparing for climate change: 2015 Progress Report to Parliament*. London: CCC. https://www.theccc.org.uk/publication/reducing-emissions-and-preparing-for-climate-change-2015-progress-report-to-parliament/

[4] Measure 3.3.2: "By 2022 the Environment Agency will have expanded their flood warning service to all places at a high risk of flooding from rivers and the sea."

[5] Measure 3.4.1: "By 2022 the Environment Agency will continue to work with standards setting organisations to encourage flood resilience requirements to be incorporated into the building and materials standards for homes and businesses built in places at risk of flooding."

Committee on Climate Change (2017) *2017 Report to Parliament – Progress in preparing for climate change*. London: CCC. https://www.theccc.org.uk/publication/2017-report-to-parliament-progress-in-preparing-for-climate-change/

Committee on Climate Change (2018) *Managing the coast in a changing climate*. London: CCC. https://www.theccc.org.uk/publication/managing-the-coast-in-a-changing-climate/

Crick F, Jenkins K, Surminski S (2018) Strengthening insurance partnerships in the face of climate change – Insights from an agent-based model of flood insurance in the UK, *Science of The Total Environment*, 636, 15 September: 192–204. http://www.lse.ac.uk/GranthamInstitute/publication/strengthening-insurance-partnerships-in-the-face-of-climate-change-insights-from-an-agent-based-model-of-flood-insurance-in-the-uk-2/

Crick F, Jenkins K, Surminski S (2016) *Strengthening insurance partnerships in the face of climate change – insights from an agent-based model of flood insurance in the UK*. Grantham Research Institute on Climate Change and the Environment Working Paper 241. http://www.lse.ac.uk/GranthamInstitute/publication/strengthening-insurance-partnerships-in-the-face-of-climate-change-insights-from-an-agent-based-model-of-flood-insurance-in-the-uk/

Department for Environment, Food & Rural Affairs [Defra] (2018) *The National Adaptation Programme and the Third Strategy for Climate Adaptation Reporting*. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/727252/national-adaptation-programme-2018.pdf

Department for Environment, Food & Rural Affairs [Defra], Department for Business, Energy and Industrial Strategy [BEIS], Met Office Hadley Centre and Environment Agency (2018) *UKCP18 Headline Findings*. https://www.metoffice.gov.uk/binaries/content/assets/metofficegovuk/pdf/research/ukcp/ukcp18-headline-findings-2.pdf

Her Majesty's Government (2017) *Government response to the Committee on Climate Change. 2017 Report to Parliament – Progress in preparing for climate change*. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/659283/CCS207_CCS0917051660-1_Un_Act_Govt_Response_to_CCC_Report_2017_Accessibl..._.pdf

Houston D, Werritty A, Bassett D, Geddes A, Hoolachan A, McMillan M (2011) *Pluvial (Rain-Related) Flooding in Urban Areas: The Invisible hazard*. York: Joseph Rowntree Foundation. https://www.jrf.org.uk/report/pluvial-rain-related-flooding-urban-areas-invisible-hazard

Keating A, Campbell K, Mechler R, Magnuszewski P, Mochizuki J, Liu W, Szoenyi M, McQuistan C (2016) Disaster resilience: What it is and how it can engender a meaningful change in development policy. *Development Policy Review* 35 (1): 65-91. DOI:10.1111/dpr.12201.

Keating A, Campbell K, Szoenyi M, McQuistan C, Nash D, Burer M (2017) Development and testing of a community flood resilience measurement tool. *Natural Hazards and Earth System Sciences* 17(1): 77-101.

Keating A, Mechler R, Mochizuki J, Kunreuther H, Bayer J, Hanger S, McCallum I, See L, Williges K, Hochrainer-Stigler S, Egan C (2014) *Operationalizing resilience against natural disaster risk: opportunities, barriers, and a way forward*. Zurich Flood Resilience Alliance. http://pure.iiasa.ac.at/id/eprint/11191/

Sayers PB, Brisley R, Wingfield S, Warren S, Mattingley P, Robinson P, Horritt M, Lamb R (2018) *A national analytics toolset to support an exploration of alternative investments in flood risk management infrastructure: A report for the National Infrastructure Commission by JBA and Sayers and Partners*. Sayers and Partners and JBA Consulting. http://www.sayersandpartners.co.uk/uploads/6/2/0/9/6209349/2018_sayers_et_al_national_infrastructure_assessment_report.pdf

Sayers P, Penning-Rowsell E, Horritt M (2017) Flood vulnerability, risk and social disadvantage: Current and future patterns in the UK. *Journal of Regional Environmental Change*,18: 339–352. DOI https://doi.org/10.1007/s10113-017-1252-z

Sayers PB, Horritt M, Penning-Rowsell E, Fieth J (2017) *Present and future flood vulnerability, risk and disadvantage: A UK assessment. A report for the Joseph Rowntree Foundation*. Sayers and Partners LLP.

Surminski S, Tanner TM (eds) (2016), *Realising the 'triple dividend of resilience': a new business case for disaster risk management*. Dordrecht: Springer International Publishing.

Surminski S (2017) Fit for the future – The reform of flood insurance in Ireland: resolving the data controversy and supporting climate change adaptation. London: Grantham Research Institute on Climate Change and the Environment. http://www.lse.ac.uk/GranthamInstitute/publication/fit-for-the-future-the-reform-of-flood-insurance-in-ireland-resolving-the-data-controversy-and-supporting-climate-adaptation/

Surminski S, Robins N, Irwin W (2018) Where next for sustainable insurance? Five priorities for the next decade. Commentary, 5 November, Grantham Research Institute on Climate Change and the Environment. http://www.lse.ac.uk/GranthamInstitute/news/where-next-for-sustainable-insurance-five-priorities-for-the-next-decade/

Tanner TM, Surminski S, Wilkinson E, Reid R, Rentschler J, Rajput S (2015) *The Triple Dividend of Resilience: Realising development goals through the multiple benefits of disaster risk management*. Global Facility for Disaster Reduction and Recovery (GFDRR) at the World Bank and Overseas Development Institute (ODI), London. https://www.gfdrr.org/sites/default/files/publication/The_Triple_Dividend_of_Resilience.pdf

Zurich Flood Resilience Alliance [ZFRA] (2019) *The Flood Resilience Measurement for Communities (FRMC)*. https://floodresilience.net/resources/item/the-flood-resilience-measurement-for-communities-frmc