

Flooding in the UK

Flooding is the UK's most serious natural disaster with estimated annual damages totaling anywhere between £500 million and £1 billion. While 1 in 6 homes are already at risk of flooding, urban development continues on floodplains despite government warnings, predictions of intensified weather conditions due to climate change, and cuts in government funded flood defenses (Thorne 297). Calling these events natural disasters, therefore, is misleading, and ignores the social, political, and economic contexts in which these houses and communities were developed. *The state-funded, infrastructure based approach to flood management in the UK, born out of these contexts, expresses and reproduces increasingly unsustainable ideologies about nature versus humans and the role of the state in negotiating that relationship.* Moving forward the question of sustainability must be applied to this multi-faceted issue in order to find the best possible solution.

Ideologies of the state and the environment...

Modern, western understandings of “development” and “progress” assess nature as something to be made functional through human intervention. In the UK, this debate has a long history. For example, in Shakespeare's Henry IV a brief interaction between two characters exemplifies the way in which land management is guided by cultural understandings of the relationship between humans and nature.

Methinks my moiety, north from Burton here,

In quantity equals not one of yours:

See how this river comes me cranking in,

And cuts me from the best of all my land

*A huge half-moon, a monstrous cantle out.
 I'll have the current in this place damm'd up;
 And here the smug and silver Trent shall run
 In a new channel, fair and evenly;
 It shall not wind with such a deep indent,
 To rob me of so rich a bottom here.*

In this scene of Shakespeare's Henry IV, Hotspur, the son and heir to the Earl of Northumberland, is proposing to dam up a river that is thwarting his ability to capitalize off his land. Glendower, a Welsh-born, English-educated man who tends towards folklore and superstition throughout the play, objects to this proposal, saying that the river *must* run as it is. Hotspur dismisses Glendower and tells him to speak in Welsh so he can't understand him. For Hotspur, the Englishman, the river, as it exists, is effectively robbing him. Not only does this suggest an understanding of opposition between man and nature, it also justifies Hotspurs desire to change the course of the river and realize his right to profit off the land in the way he sees fit. Since 1597, when this play was written, Hotspur's nature capitalizing approach has most certainly been embraced over Glendower's spiritual conservatism. While flood management in the UK is certainly not seeing a return to spiritualism, the sustainability of infrastructure and settlement patterns in the name of development are increasingly being critiqued in a number of ways, at a number of levels.

The unsustainable cost to the state.

One of the biggest problems with the current approach to flood management in the UK is that it has become too costly for the state to maintain. Built capital is an expensive investment for

states because, while it may provide benefits in the near term, it depreciates in the long term because it is not self-maintaining and requires continuous funds for upkeep (Bronfin 7). The impact of climate change will only *increase* these expenses. But how did the UK government become so tangled up in building and paying for flood management infrastructure and what are the impacts of this relationship? Understanding how the government came to foot the bill allows us to see how this confrontation with nature has become as large and as complicated as it is today.

Although flood management is nothing new, for much of human history, substantial development on floodplains was not a practical investment (Werritty 16). Today, however, almost all major cities in the world are located next to a body of water and a record number of communities exist on flood plains because of strategic advantages such as trade, travel, and natural resources. Technological advances and state involvement in draining wetlands and building flood defenses has made it possible to reap the benefits of living near water by reducing the risks that accompany these settlement patterns on a large scale.

While early settlements across the UK wisely avoided land that was inundated part of the time, today an estimated 5 million homes in the UK are located on floodplains (Thorne 297). Expansion into the floodplains was a response to the impact of the world wars. The decimation of the European economy had forced the UK to make moves towards greater agricultural self-sufficiency (Thorne 302). Pre-1750 the UK had been almost completely self-sufficient but by the 1930's, the UK was only producing between 30-40% of its domestic agricultural consumption, an unfavorable relationship of dependency on the economically unstable European continent at the time (Defra, 2008, p. 16, 17). In order to provide for the population growth since the days of self-sufficiency, agriculture needed to expand onto the fertile floodplains and, consequently,

coastal communities increased (Werritty 17). To make this possible, the government created local Catchment Boards and agricultural subsidies to transfer the costs of drainage from land owners on to the state, effectively subsidizing the cost and encouraging these settlement patterns (Werritty 17).

However, these floodplains were inherently risky places to develop and on February 1st, 1953 a storm surge hit the Southeast coast of England, the Netherlands, Belgium, and Scotland, raising sea levels 5.6 meters in some places. In England, the surge killed 307, evacuated 32,000, and incurred £50 million in damages (£1.2 billion today counting for inflation). The Netherlands was the hardest hit, with a loss of over 1,800 lives (“1953 east coast flood - 60 years on”). Because of the amount of damage and assets lost, this event is considered by many as the UKs biggest natural disaster. However, the trend toward settling on flood risk areas complicates the understanding of this disaster as completely natural. The location of manmade development and infrastructure, which has since continued, was effectively manmade risk that was being realized in the event of this storm surge.

The political context of the 1953 flood also shaped how the UK responded to the issue of flood management and what kind of related bureaucracies were created. As a response to the storm surge, the Meteorological Office, known as of 2000 as the Met Office, created the Storm Tides Warning Service to modernize weather forecasting and develop a centralized emergency response program (“1953 east coast flood - 60 years on,” 2014). Today this service is provided by the Met Office through the Flood Forecasting Centre, and with technological advances, the ability to predict storms, like the one in 1953, is extremely accurate. At the time, however, there was no existing government body to specifically address the issue of floods because the issue itself was relatively new.

However, creating a modernized, centralized forecasting and alert system was not enough. *Prevention* became the long term goal and a government responsibility. This responsibility was attached to the central government in the post-WWII political climate, when individuals were demanding a variety of social services and publicly funded projects from the government. These expectations were in part due to rationing programs during both world wars which had strengthened the role of the UK government in its citizens' everyday lives (Werritty 19). This new kind of presence that the state was embodying created a political culture of commonwealth and socialist policies that was then extended to the issue of flood management after the 1953 storm.

This new paradigm for the role of government was accompanied by an emerging global fixation on large scale infrastructure which, at the time, served as symbols of development; development being understood "within the parameters of the project of modernity (Rajagopal 28)". This is evident in the dam building frenzy of the 20th century which was marked by the construction of the world's first major dam, the Hoover Dam, in 1937. Since then, more than 300 dams have been constructed that meet the 'major dam' height criteria of 150 meters and there are more than 80,000 smaller dams worldwide (Joyce 2). The efforts of the World Bank and other global development funds established in 1944 also reflected these development strategies through structural adjustment programs to stimulate economies in the 'underdeveloped world' through centralized state planning and infrastructure investment (Bear 31). In *Navigating Austerity*, Laura Bear traces how the Indian economy collapsed following these programs, leading to hasty decentralization and privatization causing the infrastructure that World Bank loans were used to build to fall into decay. The 20th century saw an explosion of expensive,

centralized state funding of large scale infrastructure largely intended to project an image of development without a critical approach to sustainability.

But how realistic and how productive is this confrontation with nature? John McPhee's book, *The Control of Nature*, answers this question in his description of the long, expensive battle that began in the early 1800's between the course of the Mississippi River and the Army Corps of Engineers as Congress funded project after project to raise the levees and contain the river. In spite of the labor and money poured into these efforts, the river continued to flood, the severity of these flood events increased with the height of the levees, development continued, and the loss of lives and capital also continued.

We see a similar scenario in the UK, as at-risk coastal communities look to Department for the Environment Food and Rural Affairs (Defra) for protection and assistance, which they blame when the flood defenses either fail or simply do not exist (Werritty 18). However, the expectations of UK citizens, the bureaucratic bodies and the subsequent infrastructure that emerged out of this time have become fiscally unsustainable for the government budget. We must ask whether it is worth it to continue pouring public funds into a battle that we will never win.

The unsustainable cost to individuals.

The current approach to flood management and mitigation is also costly to individuals. The government's assertive role in flood management through the creation of predictive models and investment in large scale infrastructure has created a false sense of security that has encouraged development on floodplains and created more risk and more cost to homeowners and the state.

Today, Defra is the lead government department on flood policy, among other responsibilities. Defra was created in 2001 after a merging of several other departments and it determines what subsequent non-departmental public bodies (NDPBs) can do which are quasi-autonomous non-governmental organizations that carry out the work of Defra. These NDPBs are responsible for management of flood risk through infrastructure projects and have an important role in making flood information available to the public through their websites, providing flood maps, flood warnings, and other information. If you live in England or Wales you refer to the Environment Agency, Scotland to the Scottish Environment Protection Agency, and Northern Ireland to the Department of the Environment (“Flood Forecasting,” 2012).

Although this centralization of public information is certainly a good thing, the availability of information unfortunately allows the real estate market and developers to omit relevant information about past flooding to potential buyers. According to government report on flood management, in 2008-2009, 55 percent of people living in flood risk areas knew they were at risk. Of that 55 percent, three out of five had taken some independent action to prepare for a flood. These actions could have been checking their insurance, signing up to the Environment Agency’s flood warning service, or installing flood resistance measures (Environment Agency, 2009, p.6). While this report frames these statistics to emphasize the amount of informed individuals, this also reveals that almost half of those living in flood risk areas were uninformed. And when we are talking about the physical safety of UK citizens, is half really good enough? These low levels of awareness are largely because housing developers and home sellers are not required to disclose this information to home buyers or renters. This omission of information is justified by the availability of flood maps provided by the aforementioned NDPBs across the UK. However, many sources online do recommend that home buyers investigate further by

talking to locals because these flood maps are not always applicable to each home and flood risk surveys are not currently a mandatory part of standard property sales ("Is My New House at Risk of Flooding?," 2015). The reason it has been difficult to change this buyer-beware approach and requiring careful flood damage surveys to be made public and mandatory during property transactions is because of how this would impact investments (Chen 3,10). For individuals who own houses and developers who have bought land, this stirs up fears of property value plummeting and loss of investments. However, masking the real risk of living in these areas is not a solution and results in greater damage and loss in the event of a flood.

Defra, Risk Models, and the false sense of security they create.

Moreover, the risk assessment models themselves are not completely reliable and this is problematic because their availability and authoritative source creates a false sense of security that encourages development and investment in flood prone areas. Despite efforts to predict and track floods, there are a number of factors that make this difficult in the UK. To begin, most UK flood records are only four or five decades long which means some form of extrapolation is required to create some sort of model (Lane 1794). The other obstacle to creating complete models for predicting floods is the variety of flooding and environments that make each space different ("Dredging, Drainage, and Defra: A Flooding Glossary - Carbon Brief," 2014) (Thorne 297). The types of flooding that have received the most attention and, therefore are the best understood, are *tidal* and *fluvial* flooding. Tidal flooding comes from surges caused by storms, like the tide surge experienced in 1953, and impacts communities located along the coast and tidal rivers. The Met Office has a 24 hour watch service to monitor weather patterns and alert systems in cases of emergency. Fluvial flooding, also known as 'river flooding', happens when

rivers overflow from prolonged rain and/or snow melt. This is made worse when rivers become blocked with sediment and, for most of the twentieth century, sediment was removed from the UK's rivers. However, dredging was phased out in the late 1990's because it was found to actually cause sediment deposition to increase, shortening the intervals between each dredging, making it both counterproductive and costly (Thorne 301).

In an interdisciplinary analysis of flood policies in the UK Tuart N. Lane, Catharina Landstorm, and Sarah Whatmore question these policies by examining the evidence base of the models used to predict floods and flood damages. Their research questioned the ability of using historical evidence to predict the future when historical evidence is limited and the future might look very different from the past because of environmental changes such as climate change. This creates practical problems in the application of different models or software packages for predicting floods. In one interview, a flood risk consultant confided that, "... in practice I am still sure today that if you take even six experienced hydrologists and you give them the same software and the same problem and you ask them to come back, something very simple, a 100 year return period flood estimate. Same software, same conditions, they would all come back with a different answer, the concerning thing is that the answer isn't going to be very very close..." (Lane 1802). Moreover, most floods are a combination of different types of floods which makes one flood model irrelevant for another. The purpose of their research was not to dismiss the potential for flood prediction, but rather to point out the substantive shortcomings of the science used to inform policy.

Unfortunately, improving risk assessment models would require waiting for an event or disaster in order collect data. However, waiting for evidence to improve models would mean inaction on flood defense construction, a politically unfavorable decision when the central

government is being held responsible for producing official knowledge. In Andrew Mathews' *Instituting Nature*, he explores the role of the Mexican state in silencing local forms of knowledge through the creation of official knowledge by Mexican forestry bureaucracies in what can be understood as a state-building tool. While this is might certainly be the case within the Mexican forestry service, this top-down relationship of official knowledge actively smothering or silencing other forms of knowledge is *not* the only reason why official knowledge is produced. Political pressure from communities that expect the state to be knowledgeable about certain issues, particularly that of risk reduction and protection, is also a way in which official knowledge is produced. This political pressure increases the likelihood of policy makers standardizing patchy models in order to justify or explain certain decisions and send a public message that something is being 'done about it' (Lane 1802). This is surely a problem of policy making that goes beyond flood control.

The last two types of flooding, surface water and groundwater flooding, are more difficult to predict. The severity of these types of flooding depends on local topographies, drainage systems, buildings, and storm severities. Because of this, managing these risks is the responsibility of Lead Local Flood Authorities who assess the risk of these types of floods at a local level. *Surface water* flooding, sometimes known as flash flooding, happens in urbanized areas when drainage systems are overwhelmed and made worse by large amounts of paving that does not allow water to be absorbed into the ground. Models for predicting the risk of surface water flooding do exist, although they require a combination of historical data and topographical screening techniques which makes them a local project. The last kind of flooding is *groundwater* flooding which happens when the earth becomes waterlogged and can no longer absorb water. While Defra stresses the availability of online flood maps for floods from seas and rivers, there

are actually no flood maps for groundwater flooding because they are extremely difficult to predict and no model has yet been adopted for it (Environment Agency 2011, p. 4). The state's inability to produce dependable models for predicting these types of floods is not a fault of the state. However, the state's role in flood management and mitigating flood risk for tidal and fluvial flooding does create a false sense of security for individuals. This impacts their choices about where to live and invest, putting them at greater risk.

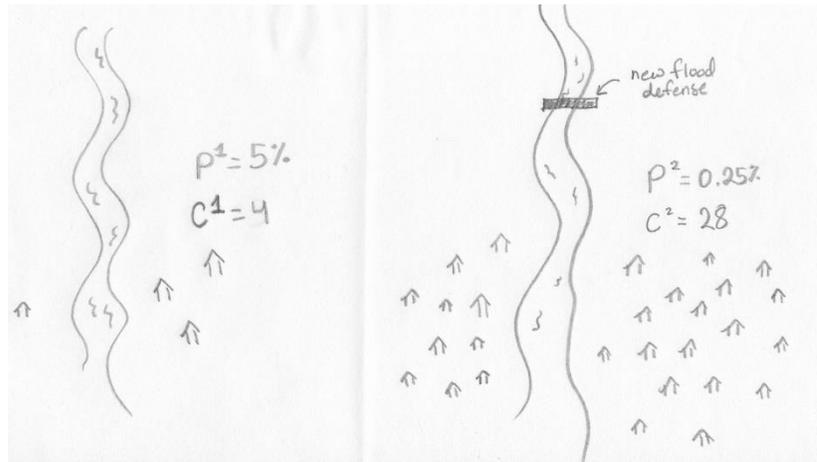
Laura Dekker, a London resident who recently bought an old fixer-upper pub in Llanrwst, Wales in late December 2015 was aware that it had a history of flooding. The pub is located next to a bridge which is almost four hundred years old and is aptly named Pen y Bont, meaning 'head of bridge' in Welsh. According to what locals told her, there has been an inn on the same site since at least the fourteenth century, though Pen y Bont only dates from about the eighteenth century. The river is tidal almost as far as Llanrwst, so if it rains heavily in the mountains and there is a high tide and the river levels can raise alarmingly fast, a combination of tidal and fluvial flooding. Embedded into the road next to the pub are fixings for the 'dutchdam' barriers, which are deployable flood defenses. This means that the barriers themselves have to be brought out from storage and put in place each time there is a high risk of flood.

When Llanrwst flooded On Boxing Day (December 26) 2015, several houses were flooded, including Pen y Bont. When Laura described the flooding, she described the water coming up out of the ground rather than out of the river and through the door. However, the fact that the dutchdams were not deployed was an important part of her description of the event. There was a sense of having been neglected by local authorities who should have been able to stop the flood damage. Yet she knew that they would not have been effective anyway, saying about them, "But this wouldn't have helped us - the water seems to come up from under the floors and then goes

back down again the same way!” This was because the visible dutchdams next to Pen y Bont had created a sense of security when Laura Dekker was making a decision to buy this piece of property and their disuse combined with seemingly unpreventable flood damage went against that sense of security. When certain kinds of floods are not well understood for lack of data or research, it is harder to invest in effective defenses. Moreover, when the average home buyer is not well versed in the varying types of floods and acute flood records are not kept, irrelevant flood defenses are only effective at reducing *perceived* rather than *real* risk. Using models that do not account for all the possible types of flood can lead to irrelevant or incomplete flood defenses that merely create a false sense of security. This is incredibly problematic for the sustainability of these communities because *illusions of security encourage continued residence and development on floodplains*.

Because of this, flood infrastructure can actually increase risk by creating a false sense of security and encouraging development in susceptible areas (Lane, 1786). This paradoxical impact of flood defenses can be demonstrated by the following model. Pre-flood defense risk can be understood as P1, probability of flood before flood defenses, and C1, the consequence, or cost of damages, based on *existing* development. The cost of flood infrastructure must, over time, pay for itself in hypothetical damages avoided for it to be a worthwhile investment. P2, the probability of flooding after the defenses are constructed, assuming they work and are maintained, will always be less than P1 (but never zero because of the chance of failure that is always calculated in) (Lane 1786). However, C2, the consequence, is less fixed and further development in protected areas makes sense because “given the choice of living in an undefended floodplain and a defended floodplain, the latter would prevail” (Lane 1786). Because of this, even if the probability of flood damages is reduced through chosen flood defenses, the

new understanding of these spaces as ‘safe’ encourages further development and effectively increases C_2 , the cost of damages in the event of a flood. This is further complicated when sketchy models that can only account for certain types of floods lead us to also question the validity of P_2 , the efficacy of chosen flood defenses. In this way, attempting to represent the world with a numerical value of risk and attempts to reduce this risk with infrastructure can effectively create more risk by encouraging continued development. This is another way in which the state’s investment in flood defenses depreciates, making it a waste of public funds and also posing a threat to public health and safety.



The probability of damage occurring goes down but potential damages go up.

Still, Laura Dekker was aware that Pen y Bont had a flood history and the dutchdams alone were not the only reason she decided to buy it. She told me, “We knew about the flood risks before we bought the place. But it was a shock when it did flood, just three days after we moved in. It hadn’t previously flooded for 11 years!” Laura’s reference to the last time it flooded speaks to the static narrative of risk that the 100 year time frame that Defra uses creates. Patchy historical records of certain kinds of floods are used to create 100 year time scales over which costs and benefits can be assessed. Increasingly, climate change is being incorporated into these

100 year predictions but the narrative of the “once-in-a-hundred-year” event that this method has created continues to influence how people understand the events they are experiencing (Lane 1789). In three separate interviews I conducted, each person gave an interesting variation on this 100 year time frame. A city councilman who oversaw the building of a £14.5 million surge flood barrier in 1993 described the 1953 flooding as a “once-in-a-lifetime” flood (Sinclair). Laura Dekker used “once-in-a-hundred-years” and another woman exaggerated this timeframe to “once-in-a-thousand-years” (Bartholomew, Dekker). These narratives which evolve out of the Defra approach to predicting events create a very linear understanding of the environment as unchanging and predictable. However, climate change is shortening these intervals and this use of the once-in-a-hundred-years narrative has created a false sense of security by asserting an understanding of the environment that does not acknowledge the always moving force of nature that is shaping our modern experience of flooding. Although Defra *has* begun to incorporate climate change into these 100 year time frames, this static understanding of risk is persistent in the public mind.

In a research project aimed at identifying on-going adaptation activities led by local communities in the UK published in 2012, five case studies of communities actively lobbying for flood defenses were undertaken by Sigrun Kaisch, head of the Department of Urban and Environmental Sociology in at the Helmholtz-Centre for Environmental Research. These communities were diverse, representing different specific coastal erosion or flooding issues, funding, and administrative levels. The goal was to better understand the relationship between national agencies and community members on coastal erosion and flood control projects in light of climate change. Her findings suggested that communities often feel that despite being “consulted to death” on policies, their opinions and priorities were meaningless and not taken

seriously. In general, Kaisch found there was a low awareness of climate change, specifically how it would affect their specific environment and many actually felt that it would not significantly impact them (Kabisch 61). Kabisch adds that many blamed authorities for increased risks because of a “perceived” reduction of available funding (Kabisch 62). This is actually not a perception, but a fact that this paper will discuss in the next section. The point of this example, however, is to show how, despite Defra’s incorporation of climate change into its 100 year models, the linear understanding of risk embodied in older official knowledge still characterizes how communities understand their environment. Because of this, the need to adapt or change methods of risk reduction understood by authorities was not shared by communities. Therefore, the solutions they were lobbying for were continued construction of flood defenses and sea walls to mitigate existing risk, which they understand as static rather than increasing.

Our ability to quantify risk and predict the future is based on existing records of past events. Because these statistics inform policy, the models that are used effectively create the future in seeking to predict it. Because of this, analyzing how the methods that produce these statistics come into being is vital to improving those practices in pursuit of more sustainable relationships between communities, nature, and the state. This is especially true because of how this numerical understanding of the world impacts the expectations and settlement patterns of communities. The UK’s approach to flood and coastal erosion management has encouraged continued development on floodplains and defined a government role in mitigating the inherent risk of these settlement patterns through infrastructure and flood warning services that rely on patchy models. The current system is unsustainable because attempts by Defra to predict and prevent floods has created more risk and damage by promoting a false sense security in the public mind and this has become far too expensive for both the state and the people.

An unsustainable dependence on state funding.

In addition to the imperfect attempt to calculate the risk of weather conditions and impact of flood defenses, there are even more incalculable risks concerning the economic and political security of government funding. Predictions of increased cost due to climate change are challenging the sustainability of these infrastructure-based, state-funded solutions to flooding.

The most obvious way to meet these new costs, and the solution that Kabisch's case study communities supported, is to increase state funding. In a report published by the National Audit Office on 28 October 2011, Defra recommended an increase of £20 million in flood defenses per year between 2010 and 2035, totaling a £0.5 billion increase, in order to maintain the current level of protection as climate change increases flood risk. This would bring the 2015-20 budget to £3.7. These recommendations in 2011 were also notably before the flood damage from the 2013 winter storms. According to the Met Office, individual storms that occurred that winter were comparable to storms during the previous two years. However, the rapid succession of these storms made them exceptional, raising concerns about climate change ("Winter Storms, December 2013 to January 2014.").

The call for increased funds in this report embraces the idea that the central government is obliged to a long term responsibility for mitigating flood risk through infrastructure. This embraces assumption of the role of the state in managing natural disasters and, thus, the sustainability of these state funded projects will become contingent on an increase in government funding. Therefore, any source of precarity for those living in currently protected communities is far more political than environmental. Yet, whatever moral or political obligations Defra imagined these

funds to be secured by, the agency knew it was not a guarantee. This can be seen in point fourteen of this 2011 report, which reads: “If central government funding does not increase after 2014-15, maintaining and improving current levels of flood defense will increasingly depend on significant additional funding being secured locally.”, followed by point fifteen: “The prospect of local bodies contributing additional funding is unknown.” According to this report, without increased funds, the private sector would be expected to cover over half of all expenditures and that securing supplementary funds from the private sector was a risk that budget cuts would create

Just a year after those 2013 winter storms, budget cuts were made in parliament against the 2011 advisement report. In December 2014, Defra released an investment plan stating that £2.3 billion, down from would be invested in defenses over the next 6 years (United Kingdom “*Reducing the Risks of Flooding and Coastal Erosion: An Investment Plan.*” 2014, pg 2). Interestingly, the new 2015-20 budget, *which the report is about*, is actually omitted in the introduction. Instead, the document begins its introduction with an emphasis on the 2010-15 expenditures of £3.2 billion compared to £2.7 billion from 2005-10, distracting us from the current budget cut by bringing up past budget increases. This is, apparently, the best way to bury a £0.9 budget cut and maintain a public image of strong capacity.

In order to supplement these budget cuts, the investment plan emphasizes the importance of “partnership” with local authorities and the private sector, a common strategy in the face of austerity. Budget cuts become complicated when they remove funding from existing projects that are highly technical like some flood infrastructure. By placing more of the cost onto local governments, the likelihood of improper maintenance to flood infrastructures increases when funds simply don’t exist. In these events, the statistics of risk reduction presented to communities

when they first received funds and project plans will no longer be accurate. This complicates our understanding of risk as we see the way in which roughly quantifiable statistics of risk reduction are emphasized over the risk of the government later cutting funds, despite the direct relationship. Both the state and the environment are constantly changing, somewhat unpredictable entities with a relationship largely guided by money, an unsustainable foundation for any relationship. This was not something communities thought to consider at the time and it is unrealistic to expect local governments to pick up a bill that the central government can no longer afford. There is too much physical and psychological damage at stake for communities to depend on unsustainable amounts of funding and therefore should seek out less expensive, more sustainable means of mitigating the damage of floods to their communities.

A more sustainable future.

While it is not something that Parliament or Defra would explicitly state, part of the solution to compensate for recent budget cuts to flood defenses is to address the issue of flood insurance. Insurance has been something that homeowners on floodplains have had an extremely difficult time getting. As Laura told me, having a house with a history of flooding “..makes it really hard to get house insurance. Most insurers won’t touch it, or if they do, they won’t cover for flood damage.” This is in part why flood defenses have been such an important solution. However, as budget cuts increase damage risks, compensating for damages has become the next priority.

Flood Re, a reinsurance company, essentially insurance for insurance companies to enable them to provide affordable flood insurance to high-risk homes, is set to launch April 4, 2016. This plan, which has been under construction for some years, was created through insurance laws

passed in Parliament and will be overseen by Defra. The money for this reinsurance company will require an additional annual £180 million levy on UK home insurers, distributing the cost across all customers and making it possible for homeowners in high risk areas to qualify for flood insurance (*"Flood Re Explained,"* 2016). New insurance laws passed in Parliament that created this new program were targeted at keeping new expenses confined to the private sector, a selling point for conservative Members of Parliament. In designing Flood Re, there were built in constraints so that it would not have an "impact on the public finances" (*"The Flood Reinsurance Scheme – Regulations,"* July 2014, point 24). In other words, the private sector will increasingly be responsible for flood damages because government spending cuts to Defra will make it increasingly difficult to prevent those damages from occurring. This is an example of the privatization and increased risk that the 2011 Defra report warned against and the 2014 investment plan was forced to integrate after budget cuts were made. The cost of this will be spread across the board, much as it would have been anyway through taxes. The only difference is that the cost will now be for damages done rather than projects to avoid damages and the bill will be picked up through private insurance companies.

What this insurance strategy fails to acknowledge is that the impact of flooding goes beyond physical damage. In a qualitative study of flood victims from the Flood Hazard Research Centre published in 2006, researchers found that two thirds of their participants suffered from mental health problems based on the General Health Questionnaire-12 scale (Tunstall 365, 379). Some even suffered long term psychological trauma from the event. Certainly, with increasing costs due to climate change, reducing dependency on the currently unsustainable infrastructure based flood defenses is something that needs to be further explored. However, the main goal in flood management is to protect individuals from experiencing the damages and trauma of

flooding and Flood Re is a solution that, unfortunately, reduces government spending rather than protecting individuals.

Natural flood management has also been a response to limited resources due to government budget cuts and increased risk due to climate change. A 2011 report by The Parliamentary Office of Science and Technology, entitled *Natural Flood Defenses*, stresses the importance of investing in low infrastructure flood defenses that utilize natural processes on the landscape. Citing the average annual cost of damages and predictions of future increases due to climate change, the motivation of this report is economics. The report presents four succinct, natural, and low cost alternatives that also seek to reduce the risk created by high dependency on precarious state funding.

- **storing water** by using, and maintaining the capacity of, ponds, ditches, embanked reservoirs, channels or land
- **increasing soil infiltration**, potentially reducing surface runoff, although this can be offset by greater subsurface flows. Free-draining soil will make saturation less likely, and evaporation from soil can also make space for water
- **slowing water** by increasing resistance to its flow, for example, by planting floodplain or riverside wood
- **reducing water flow connectivity** by interrupting surface flows of water, for example, by water storage or planting buffer strips of grass or trees (United Kingdom, 2011, pg 2).

Of course, one might point out that there is nothing “natural” about manipulating the environment in this way and that the name of these practices is somewhat misleading. However, at this point in history, during the epoch of the Anthropocene, there is very little left on this planet that would fall under such a stringent definition of ‘natural’. Human activity is now

embedded in everything we understand to be 'nature' and this approach to flood management requires us to know our limits and respect the forces of our environments. It also requires us to know the limits of the state in defining our relationship with nature. Because of this, embracing low infrastructure approaches to flood management is a crucial part of creating a sustainable future that is economically feasible, environmentally friendly, and, most importantly, safe.

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