Technical User Guide

This document is part of a series of documents to help you make the most out of the information included in Climate Just. It is for use with the latest flood vulnerability and disadvantage data (Sayers et al., 2017)[1] and original heat vulnerability and disadvantage data (Lindley et al., 2011[2], subsequently updated for 2011). The technical user guide explaining the original social vulnerability to flooding and flood disadvantage data (2011 version) can be found here.

This technical guide summarises the methodology employed and some of the concepts. It is a more technical summary which builds on the information provided in the Climate Just website. It is important to understand the limitations of the mapping work, which can be found on the map limitations[3] document and recommendations for how these can be addressed in work carried out at the local scale.

Other documents available to help you are:

1. How to create your own maps
2. User guide to interpreting the maps
3. Technical document (this document)
4. Roles based diagram
5. Task based diagram
6. Limitations

Introduction

The University of Manchester, the Joseph Rowntree Foundation and the Environment Agency (Midlands) region have worked together to develop Climate Just: an online resource to support local authorities and other service providers in developing socially just responses to climate change. There have been other contributions to the resource, including from expert reviews, additional specialists and the authors of later work, e.g. on flood disadvantage.

A key resource informing Climate Just, and underpinning the data provided for the purposes of this project, is the socio-spatial vulnerability assessment undertaken by the University of Manchester as part of its 'Climate change, justice and vulnerability report' for the JRF in 2011 (Lindley et al., 2011)[4]. The socio-spatial vulnerability assessment has been updated taking into consideration the census 2011 data and other recently published datasets.

[1] Sayers, P.B., Horritt, M., Penning Rowsell, E., and Fieth, J (2017). Present and future flood vulnerability, risk and disadvantage: A UK assessment. A report for the Joseph Rowntree Foundation published by Sayers and Partners LLP.

[2] Lindley, S., O'Neill, J., Kandeh, J., Lawson, N., Christian, R. and O'Neill, M. (2011) Climate change, justice and vulnerability. Joseph Rowntree Foundation, York. http://www.jrf.org.uk/sites/files/jrf/climate-change-social-vulnerability-full.pdf

[3] Add link to http://climatejust.cc.demo.faelix.net/messages/benefits-and-drawbacks-maps

[4] Lindley, S., O'Neill, J., Kandeh, J., Lawson, N., Christian, R. and O'Neill, M. (2011) Climate change, justice and vulnerability. Joseph Rowntree Foundation, York. http://www.jrf.org.uk/sites/files/jrf/climate-change-social-vulnerability-full.pdf

Since this web resource was launched, the framework has been further developed for finer scale assessment of flood vulnerability and disadvantage across the whole of the UK (Sayers et al., 2017)[5] . New data are provided in our map tool for England, Scotland and Wales. Heat-related data have not been changed and are still only available for England via this resource (although analysis for the devolved nations for 2001 has been published separately).

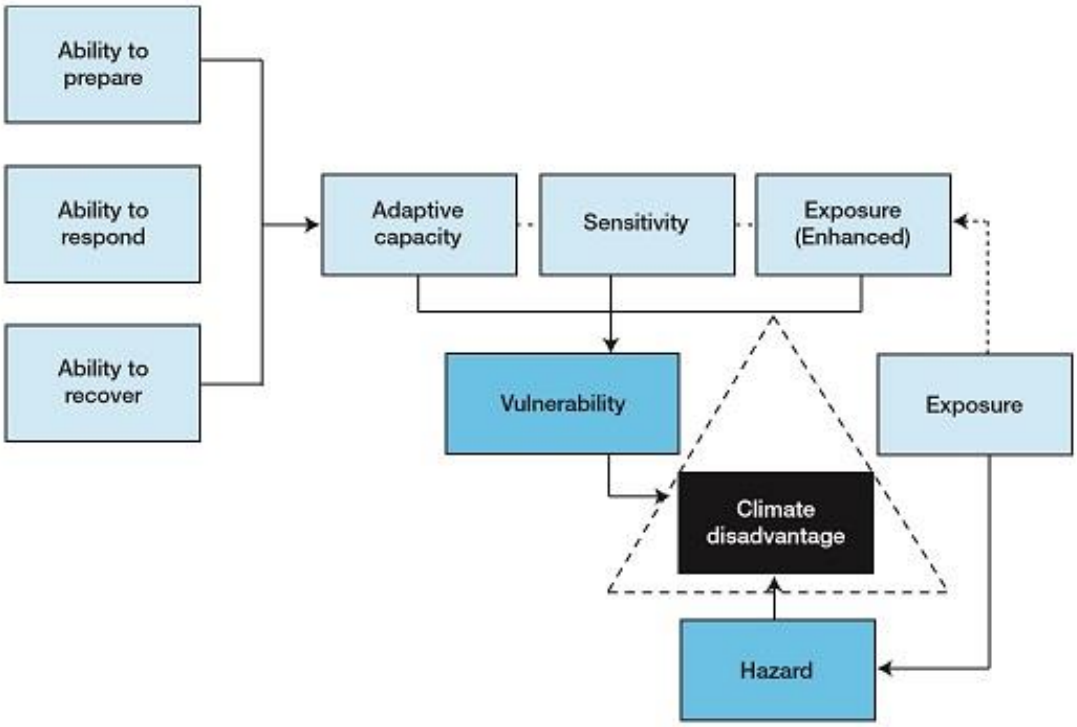
This guide is split into seven sections:

1. Overview of the conceptual frameworks and methodologies
2. Key terminology and what it means
3. Lists of indicators and metrics
4. Notes on calculating indices and mapping categories
5. Spreadsheet contents
6. Using spreadsheets to create maps

1. Overview of the conceptual frameworks and methodologies

The *Climate change, justice and vulnerability* (Lindley et al., 2011) project explored how climate change may differentially impact people's health and well-being across the UK. The project used the context of heat- and flood-related events as its basis.

A variety of personal, environmental and social factors affect how far an individual is able to respond to stresses placed on wellbeing. As a result there are personal, environmental and social factors which explain how people can be affected differently when exposed to the same event. The data on heat vulnerability[6] use this framework and account for these factors. Disadvantage in terms of high temperatures can be estimated and mapped through the combination of representations of hazard-exposure and socio-spatial vulnerability (see Figures 1a and 1b).



[5] Sayers, P.B., Horritt, M., Penning Rowsell, E., and Fieth, J. (2017). Present and future flood vulnerability, risk and disadvantage: A UK scale assessment. A report for the Joseph Rowntree Foundation published by Sayers and Partners LLP.

[6] Users interested to access the coarser scale data of flood vulnerability and disadvantage in England for 2011 developed using the original framework can access our archived maps and related explanation.

Figure 1a: Conceptual framework for assessing socio-spatial vulnerability and climate disadvantage (heat and original flood data).[11]

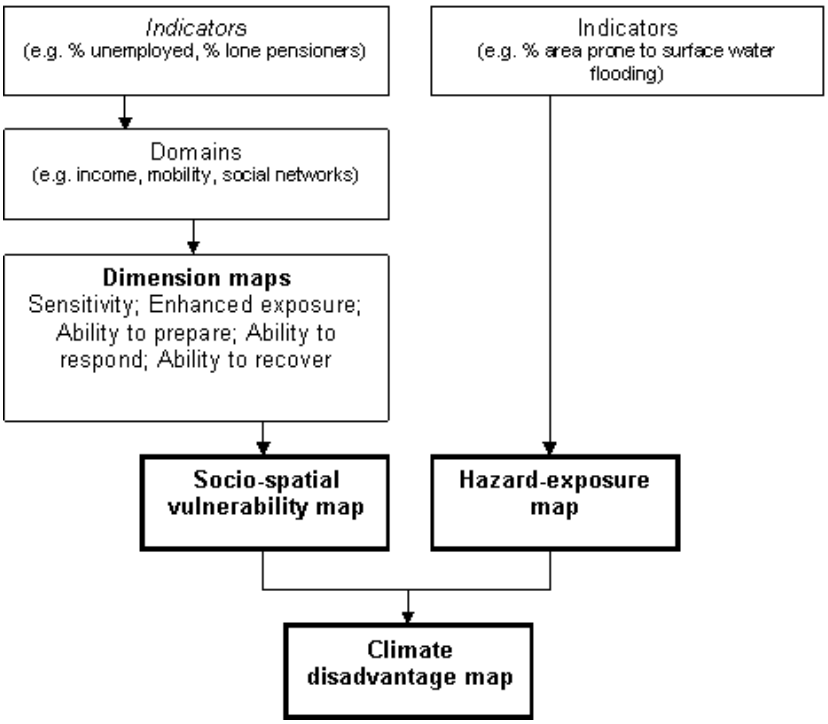


Figure 1b: The relationship between different datasets available in this resource (heat and original flood data): Climate disadvantage as a measure of socio-spatial vulnerability and hazard-exposure.

Later work for the Joseph Rowntree Foundation by Sayer's et al (2017) entitled *Present and future flood vulnerability, risk and disadvantage: A UK scale assessment* has developed a new framework for assessing social vulnerability and current and future flood disadvantage (Figure 2a and 2b). Present and future flood vulnerability, risk and disadvantage analysis provides an estimate of present-day flood risk across the UK based on an assessment of the flood hazard, exposure and vulnerability. These estimates of future risks, through to the 2080s, then account for the influences of both endogenous (internal) and exogenous (external) drivers of change.

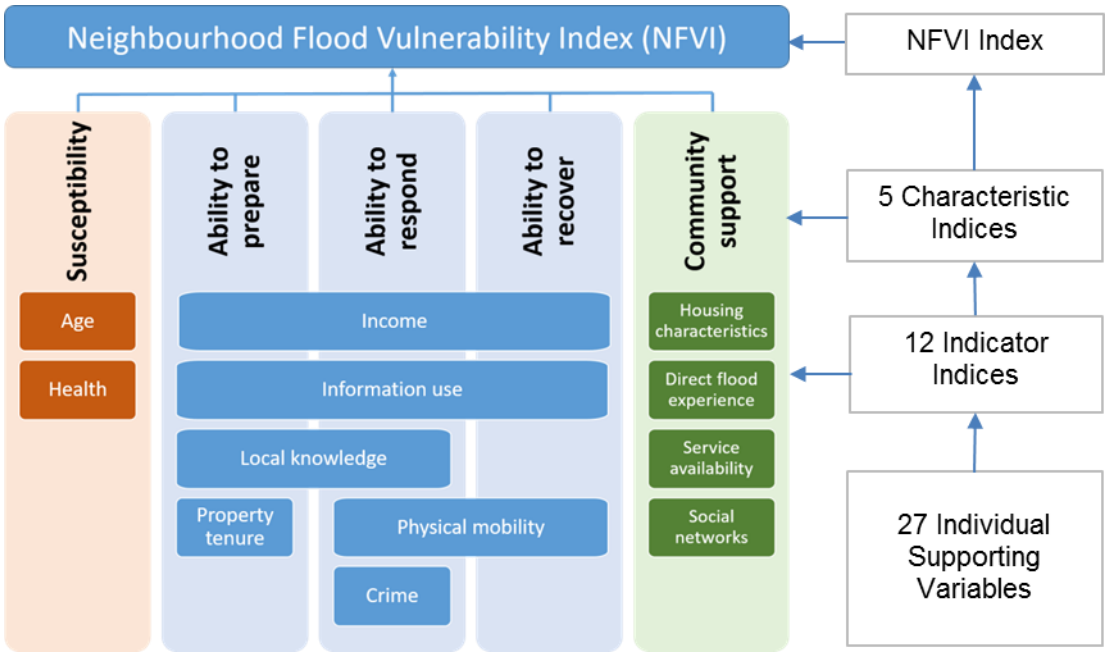
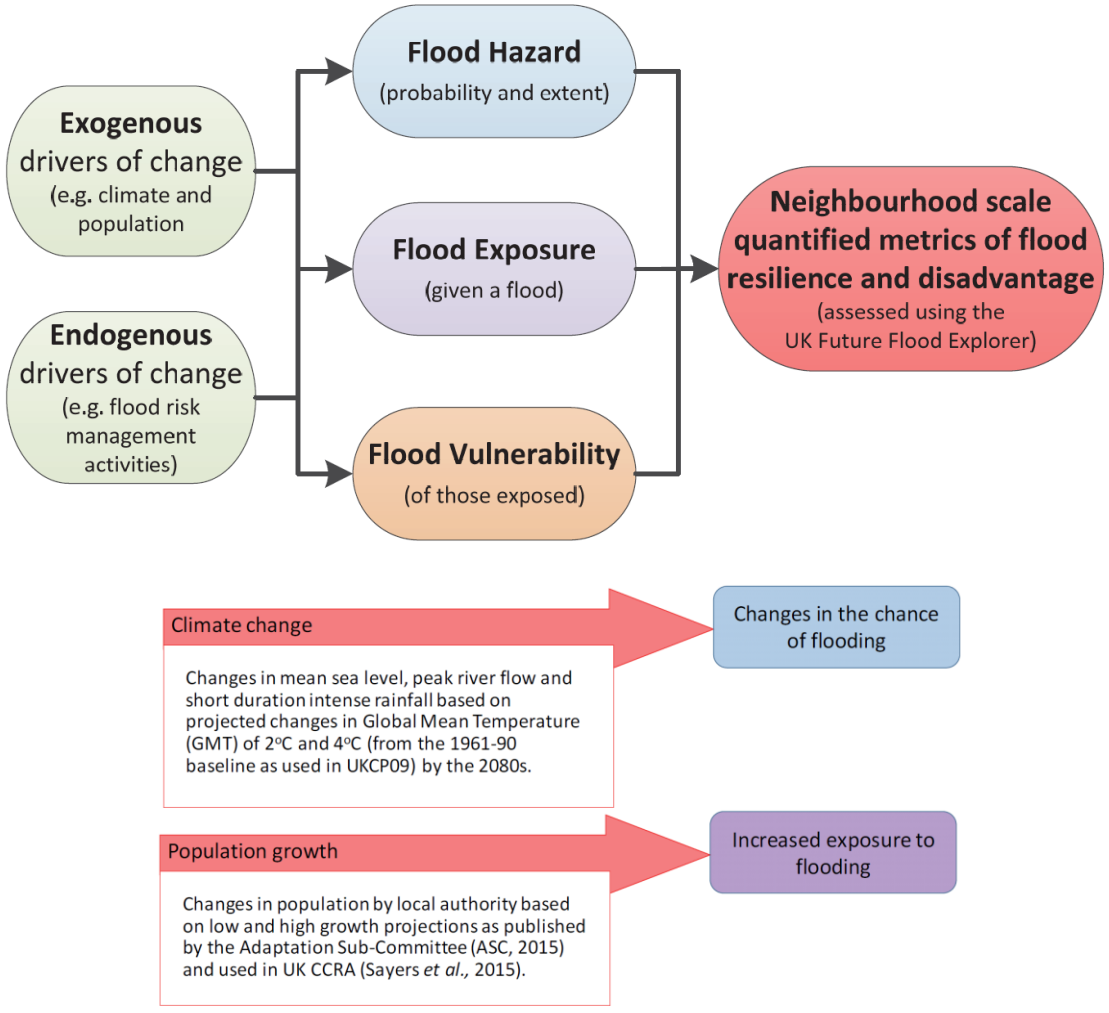


Figure 2a: The structure of social vulnerability according to the new Neighbourhood Flood Vulnerability Index (NFVI).



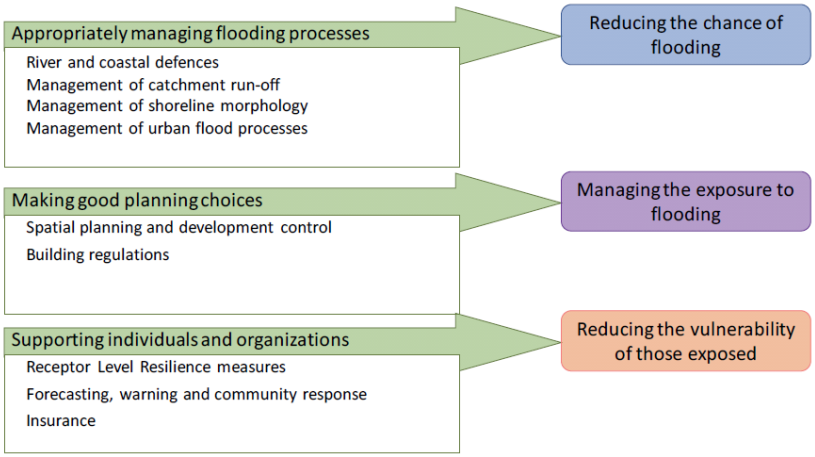


Figure 2b: New framework for assessing current and future flood disadvantage (top) considering exogenous (external) (middle) and endogenous (internal) (bottom) drivers. Further explanation is given in section 2.

Two measures are contained in the Climate Just Map Tool. They are:

- the Neighbourhood Flood Vulnerability Index NFVI and its components (Figure 2a) measuring social vulnerability to flooding; and
- the Social Flood Risk Index (SFRI) for river and coastal flooding combined and for surface water flooding. The index is provided for the present day and two future scenarios. It is presented as a population-weighted measure (group) and an average measure (individual). It is based on the framework in Figure 2b (see section 2)

2. Key terminology and what it means

Flood-related data

The meanings of terms used in the new framework are outlined below with additional information provided in a separate guide and, where appropriate, supporting appendices.

The new **Neighbourhood Flood Vulnerability Index (NFVI)** provides insight into the social vulnerability of a neighbourhood should a flood occur. It estimates how far individuals may experience a loss in well-being if exposed to a flood as well as their ability to prepare, respond and recover from a flood (without significant emergency support from the authorities). A neighbourhood is defined by census geographies (i.e. Lower Super Outputs Areas (LSOAs) in England and Wales and Data Zones (DZs) in Scotland.

The NFVI combines five characteristics of vulnerability:

- **Susceptibility** - describing the predisposition of an individual to experience a loss of well-being when exposed to a flood. It is widely evidenced that the dominant characteristics that influence susceptibility to harm relate to the age (the old and very young) and health of the individuals exposed.
- **Ability to prepare** - reflecting the actions taken by an individual during normal conditions (i.e. in the absence of a forecast or actual flood) that are likely to reduce the harm they suffer when a future flood occurs. Although an area of continued research, an individual's ability to prepare is influenced by their income, capacity to act, local knowledge and property tenure.
- **Ability to respond** – reflecting the underlying reasons why some individuals act more effectively in the run up to and during a flood. Although this is an area of continued research, there is broad agreement that an individual's ability to respond is influenced

by their income, capacity to access and use formal and informal information, local knowledge and physical mobility.
- **Ability to recover** – reflecting the degree to which an individual can aid their own recovery is influenced by several factors, particularly their income, capacity to use information, and physical mobility. Many flood events have highlighted the length of time it can take for individuals and communities to recover from a flood.
- **Community support** – recognising how the availability and quality of services provided by health and emergency services as well as broader care and social services influence the severity of harm caused by a flood . A formal representation of community cohesion and its influence on flood vulnerability is not available. However, the following are considered to gauge the nature of this support: housing characteristics; the collective experience of past floods; the likely availability of community services in a flood (including emergency service provides, schools, GPs, care homes); and the social networks that exist.

More detail on the flood vulnerability NFVI metric is provided in:
- Section 3 of this document.
- Appendix B (Sayers et al., 2017)
- a dedicated document on the vulnerability indicators Sayers at el 2017 - Present and future flood vulnerability risk and disadvantage - NFVI and Vulnerability Indicators'.

The new **Social Flood Risk Index (SFRI)** provides insight into the flood disadvantage of a neighbourhood should a flood occur. It is a measure of where social vulnerability and exposure to flooding coincide. As with the NFVI, a neighbourhood is defined by census geographies (i.e. Lower Super Outputs Areas (LSOAs) in England and Wales and Data Zones (DZs) in Scotland. Social flood risk is given as two different measures for each neighbourhood:

- **Neighbourhood scale - a 'group' measure** which incorporates the chance of flooding occurring in the floodplain (accounting for defences), the number of people living within the floodplain and the overall social vulnerability of the neighbourhood. High positive scores identify neighbourhoods where large numbers of the most vulnerable people are exposed to flooding.
- **Individual scale - an 'average' measure** which incorporates the chance of flooding occurring in the floodplain (accounting for defences) and the overall social vulnerability of the neighbourhood. The measure generates a 'per person' risk estimate. It helps to identify neighbourhoods where the vulnerability of those exposed is high (even when in reality only a few people may be exposed). It is calculated by dividing the SFRI group measure by the floodplain population.

The SFRI is a relative index and has no defined units. However, to make the scores easier to interpret, they have been allocated categories of relative risk (see section 3). The greater the value for a neighbourhood, the higher the level of social flood risk, with all values above the UK mean being of concern, i.e. due to at least some people living in the flood plain in neighbourhoods with above average social vulnerability. Higher levels of risk occur where high numbers of people live in the floodplain in a neighbourhood with high social vulnerability. High negative values are a result of high numbers of people living in the floodplain in a neighbourhood with low social vulnerability (below the UK mean). Neighbourhoods where no-one lives in the floodplain have a value of zero.

Social flood risk maps are provided for two flood themes:

- **pluvial (surface water) flooding**

- **coastal and fluvial flooding combined**

Social flood risk maps cover three different scenarios:

- **Present day**
- **2050s 2 degrees** rise in Global Mean Temperature (GMT) (from the 1961-90 baseline as used in the latest UK climate change projections (UKCP09)
- **2050s 4 degrees** rise in GMT assuming a continuation in current levels of adaptation and high population growth.

Some of the **underpinning terminology** for the new framework of flood vulnerability and disadvantage (Figure 2b) is as follows (also see the list of metrics in Section 3 of this document):

Flood hazard **(fluvial (river), coastal and surface water (pluvial) flooding)**

- **Probability** is defined here as the annual exceedance probability of a flood to any depth
- **Spatial resolution** - The underlying spatial resolution of the flood hazard data varies across the UK and ranges from 2m-50m (depending upon flood source and location).
    - *Fluvial flooding* – the resolution used is 50m in England and Wales and 5-20m for Scotland.
    - *Coastal flooding* – the resolution used is 50m in England and Wales and 5m for Scotland.
    - *Surface water flooding* – the resolution used is 2m in England and Wales and 5m for Scotland.

- **More detail on flood hazards** is provided in Appendix B (Sayers et al., 2017)

Flood Exposure

The number of people that may be flooded during a given flood event and subject to a potential loss of well-being. Exposure data used is based on residential point datasets (resolution of a single property). This does not however imply the results are credible at these scales. The concept of the 'neighbourhood' is therefore used as an aggregation of flood hazard and exposure with census based vulnerability data. Neighbourhoods correspond to Lower-level Super Output Areas (LSOAs) for England and Wales, Super Output Areas (SOAs) for Northern Ireland, and Data Zones (DZs) for Scotland. There are 42,619 neighbourhoods in the UK. The average population in each of these areas varies by country: 1600 in England, 760 in Scotland, 1600 in Wales and 2000 in Northern Ireland. This represents an evolution of the previous assessments of flood disadvantage for England and Wales (Lindley et al., 2011[7], based upon Middle Layer Super Output Areas, MSOAs) and maintains the resolution of previous studies in Scotland (Kazmierczak et al., 2015).[8]

- **More detail on flood exposure** is provided in Appendix B (Sayers et al., 2017) also see the list of metrics in section 3.

[7] Lindley, S., O'Neill, J., Kandeh, J., Lawson, N., Christian, R. and O'Neill, M. (2011). Climate change, justice and vulnerability. A report published by Joseph Rowntree Foundation, York.
[8] Kazmierczak, A., Cavan, G., Connelly, A. and Lindley, S. (2015). Mapping Flood Disadvantage in Scotland 2015. The Scottish Government.

Future Scenarios

The UK Future Flood Explorer (FFE)[9] was used to assess present day flood risks (for a range of metrics) and the change in risk given a range of influences (such as climate change, population growth and adaptation), including actions to manage the probability of flooding as well as those that influence exposure and vulnerability). Although scenarios were run for a range of time periods, the Climate Just resource only contains data for the 2050s scenarios.

Exogenous future change

Two drivers of change, outside of FRM policy, are considered to influence future flood risk:
1 Climate change
2. Population growth
3. Demographic change

Climate change

Two climate projections are considered, a 2ºC and 4ºC rise in Global Mean Temperature (GMT) by the 2080s (from the 1961-90 baseline as used in UKCP09). For each projection, consideration is given to changes in mean sea level, peak fluvial flows and short duration rainfall, all of which act to change the probability of flooding.

Population growth

The Office for National Statistics (ONS) produce population projections for England, Wales, Scotland and Northern Ireland to 2100, with sub-national population projections to 2037 (ONS, 2014).

Demographic change (Age profile)

Growing numbers of elderly people, and the increasing number of under 5 year olds projected to occur from around the 2040s, could have a significant influence on overall vulnerability and the number of elderly and very young people that may be at risk.

Endogenous future change

Actions taken to directly control or strongly influence future flood risk increasingly include a broad range of responses. This ‘whole system’ approach is reflected here through eight individual adaptation measures (**Error! Reference source not found.**4).

[9] Sayers et al (2016). The analysis of future flood risk in the UK using the Future Flood Explorer (FFE). Proceedings of Floodrisk2016. Paul Sayers, Matt Horritt, Edmund Penning-Rowsell, Andrew McKenzie and David Thompson. E3S Web Conf., 7 (2016) 21005. DOI: /10.1051/e3sconf/20160721005

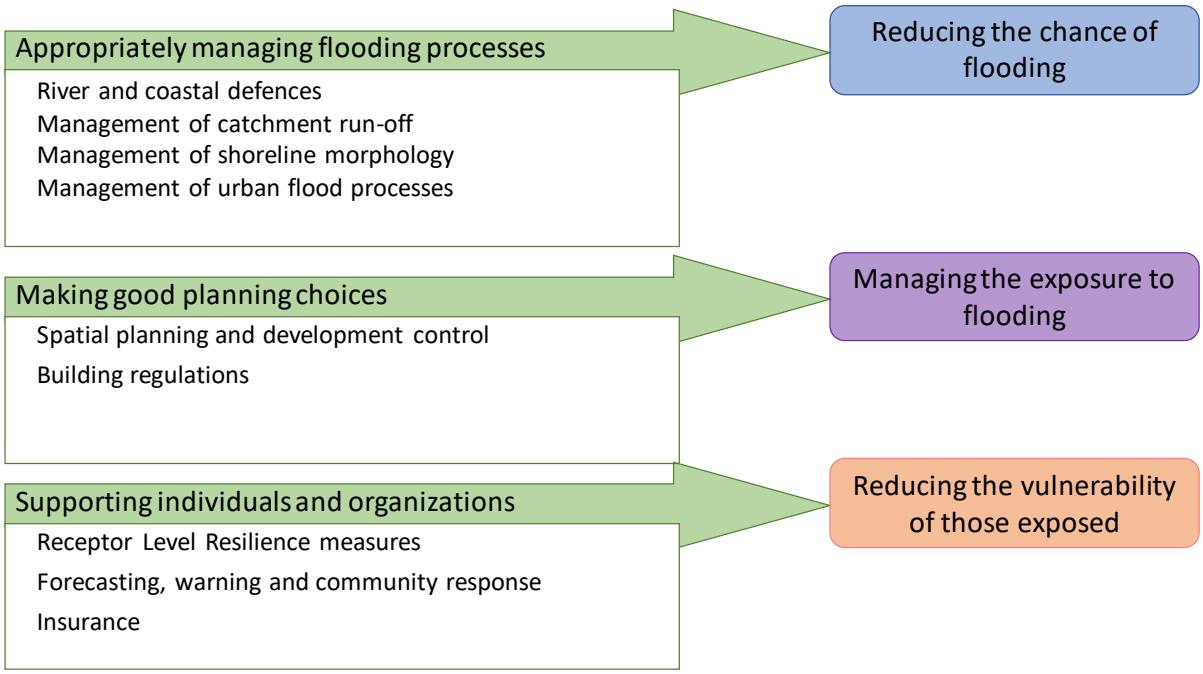


Figure 3: Endogenous change: Adaptation measures considered as part of a continuation of current levels of adaptation.

Heat-related data – England only

Socio-spatial vulnerability to heat ('vulnerability'[10])–Socio-spatial vulnerability considers how the characteristics of people and places can affect the chance of the people within any particular neighbourhood to be negatively affected by an event, irrespective of whether they come into contact with one. The term is used to represent the quantitative assessment and associated mapping of vulnerability as previously defined. Socio-spatial vulnerability has five dimensions related to the personal, environmental and social factors governing differential impacts:

- **Sensitivity** – factors which describe personal biophysical characteristics such as age and health. These affect people's underlying susceptibility to health-related outcomes of high temperature events.
- **Enhanced exposure** – factors which describe aspects of the physical environment, such as the proportion of green space or housing characteristics, which tend to accentuate or mitigate the severity of heat events.
- **Ability to prepare** – social factors that describe the extent to which people within a neighbourhood are able to prepare for heat waves, such as due to income and the ease with which living environments can be modified.
- **Ability to respond** – social factors that enable people within a neighbourhood to immediately respond to heat waves such as income, community networks and personal mobility.
- **Ability to recover** – social factors that enable people within a neighbourhood to recover from heat waves) such as income, mobility and social networks.
- **Climate disadvantage**- Refers to the combination of measures of vulnerability and measures of potential exposure, i.e. to take account of the likelihood of being affected by an event like a heat-wave.

[10] The term vulnerability is used to represent socio-spatial vulnerability in the remainder of this document, given that socio-spatial vulnerability is the quantified and mapped interpretation of vulnerability based on the Lindley et al 2011 definition.

For heat-related hazard, the adaptive capacity measures operate over a relatively short time scale. The ability to prepare for heat-related events refers to the average capacity of individuals within neighbourhoods (Middle Super Outputs Areas (MSOAs) of around 7,800 people in 2011) to take precautions, the ability to respond refers to the average capacity of individuals within neighbourhoods (MSOAs) to avoid getting heat stress during an event and the ability to recover refers to the average capacity of individuals within neighbourhoods (MSOAs) to be able to obtain help in the event of getting heat-stress.

The maps of **heat disadvantage** show how heat-related social vulnerability combines with the potential for exposure to heat-related events. They account for both the likelihood of coming into contact with high temperatures and also the severity of negative impacts on the health and wellbeing of local communities that could occur as a result of that contact. There are eight combinations of maps bringing together two representations of social vulnerability (population-weighted and average) and four representations of heat-related hazard (see below). They show the result of an equally-weighted combination of neighbourhood-level scores for:

- Socio-spatial heat vulnerability – a map of where negative social impacts are more likely. There are two types of maps both of which are represented over a 25km grid. The first shows a population-weighted representation of vulnerability and the second shows average heat-related vulnerability for each 25km grid cell across England.
- High temperature hazard-exposure – a map of where high temperatures are more likely. This map uses a 25km grid over England. There are four measures of high temperature hazard-exposure and therefore four maps. They are: mean summer maximum temperature in the 2050s; change in mean summer maximum temperature from the climate baseline to the 2050s; change in the temperature of the warmest day from the climate baseline to the 2050s; and change in the temperature of the warmest night from the climate baseline to the 2050s.

The maps are shown by 25km grid cell, conforming to climate scenario outputs from UKCP09.[11] In line with UKCP09 guidance, maps are provided for three scenarios and three probability levels. The maps for the central (50th percentile) estimate of the medium scenario for mean summer maximum temperature in the 2050s are a recommended starting point.

3. Lists of indicators and metrics

Flood-related data

Table 1 lists the series of quantified expressions of exposure, vulnerability and risk which have been used for the calculation of social flood vulnerability (through the NFVI) and flood disadvantage (through the SFRI). Please note that only the two main metrics identified in Section 1 are available through the Climate Just resource. Section 4 provides more detailed information about each of the metrics.

Metric	Insight provided

[11] http://ukclimateprojections.metoffice.gov.uk/21678

Exposure metrics	
Floodplain population (FP)	The scale of the potential exposure within a neighbourhood in the absence of defences.
Expected Annual Probability of flooding: Individual (EAI)	An individual's annual 'average' exposure to flooding, taking account of defences. Athough not representative of any specific individual this provides a means of comparing the 'average' exposure between neighbourhoods.
Number of People Exposed to Frequent Flooding (PEFf)	The number of people exposed to flooding more frequently than 1:75 years, on average.
Vulnerability metrics	
Neighbourhood Flood Vulnerability Index (NFVI)	The propensity of those living in a neighbourhood to suffer a loss of well-being should a flood occur.
Susceptibility Index	A characteristic of the NFVI reflecting the predisposition of an individual to experience a loss of well-being when exposed to a flood.
Ability to Prepare Index	A characteristic of the NFVI reflecting the actions taken by an individual during normal conditions (i.e. in the absence of a forecast or actual flood) that are likely to reduce the harm they suffer when a future flood occurs.
Ability to Respond Index	A characteristic of the NFVI reflecting the underlying reasons why some individuals act more effectively in the run up to and during a flood.
Ability to Recover Index	A characteristic of the NFVI reflecting the degree to which an individual can aid their own recovery.
Community support Index	A characteristic of the NFVI reflecting how the availability and quality of services provided by health and emergency services as well as broader care and social services influence the severity of harm caused by a flood.
Indicator Indices	12 composite indicators contributing to the characteristics of the NFVI (age; health; income; information use; local knowledge; property tenure; physical mobility; crime; housing characteristics; direct flood experience; service availability; social networks.
Supporting Variable layers	27 composite indicators which contribute to the indicator layers (see section 4)
Risk metrics	
Expected Annual Damages (EAD) - Residential only	The annual 'average' direct economic damages, in monetary terms, taking account of defences.
Expected Annual Damage: Individual (EADi)	The average (economic) risk faced by an individual living within the floodplain. Although not representative of the risk faced by any specific individual this provides a means of comparing risks between neighbourhoods.
Relative Economic Pain (REP)	The 'relative pain' of the economic risks faced by those exposed to flooding (expressed as the ratio between uninsured economic damages and household income).
Social Flood Risk Index (SFRI)	The level of social flood risk (a combination of exposure, vulnerability and probability of flooding), at a neighbourhood scale (SFRI) and as an individual 'average' (iSFRI).

*Table 1: Vulnerability and risk metrics used to measure social flood vulnerability and risk. Metrics available in the map tool are shown **in bold.***

Heat-related data

The five different vulnerability dimensions (each of which are mapped) are represented by a number of indicators within domain groups. Domains for heat related vulnerability are shown in Table 2 below (for the list of individual indicators, see the 'indicators-metadata' worksheet of the related spreadsheet and section 4[12]). Indicators and domains have been selected following a review of the literature published on vulnerability. This particularly draws on findings from work in the UK but also considers key evidence from elsewhere, where relevant. The methodology is subject to some limitations – these are explained in the Lindley et al (2011)

[12] Add link to metadata sheet- check with SL which is latest version

report (page 11/12)[13] and also in a separate document in the map tool, including with recommendations for how to overcome the limitations at the local level. See section 4 for the full list of metrics.

Dimension	Domain	Explanation
Sensitivity Index	Age	The old and young are more physically susceptible to harm
	Health	Those with pre-existing illnesses are more susceptible to harm
Enhanced exposure Index	Physical Environment	Amount of build up/non-built up areas
	Physical Geography	Physical location, e.g. cooler temperatures at higher elevations
	Housing Characteristics	Types of buildings (e.g. high rise dwellings)
Ability to Prepare Index	Income	e.g. ability to obtain property-level solutions
	Tenure	e.g. ability to modify living environment
	Information use	e.g. ability to access and use information
Ability to Respond Index	Income	e.g. ability to use property level (and other) solutions
	Information use	e.g. ability to respond to warnings.
	Social networks	Personal and community networks
	Mobility	e.g. general personal and household mobility
	Crime	e.g. ability to deploy property level solutions
	General accessibility	Extent of relatively physical isolation
	General infrastructure	e.g. availability of potential cool spaces, e.g. local shops and general community cohesion
Ability to Recover Index	Information use	e.g. ability to access and use information
	Social networks	Personal and community networks
	Mobility	e.g. general personal and household mobility
	Service access	e.g. availability and accessibility of GPs and hospitals

*Table 2: Domains associated with heat socio-spatial vulnerability. Metrics available in the map tool are shown **in bold.***

4. Notes on calculating indices and mapping categories

Flood-related data

Approach to calculating the Neighbourhood Flood Vulnerability Index (NFVI)

The Neighbourhood Flood Vulnerability Index (NFVI) is determined through a three-stage process as outlined in Figure 3 and described below.

[13] Add link to http://www.jrf.org.uk/sites/files/jrf/climate-change-social-vulnerability-full.pdf

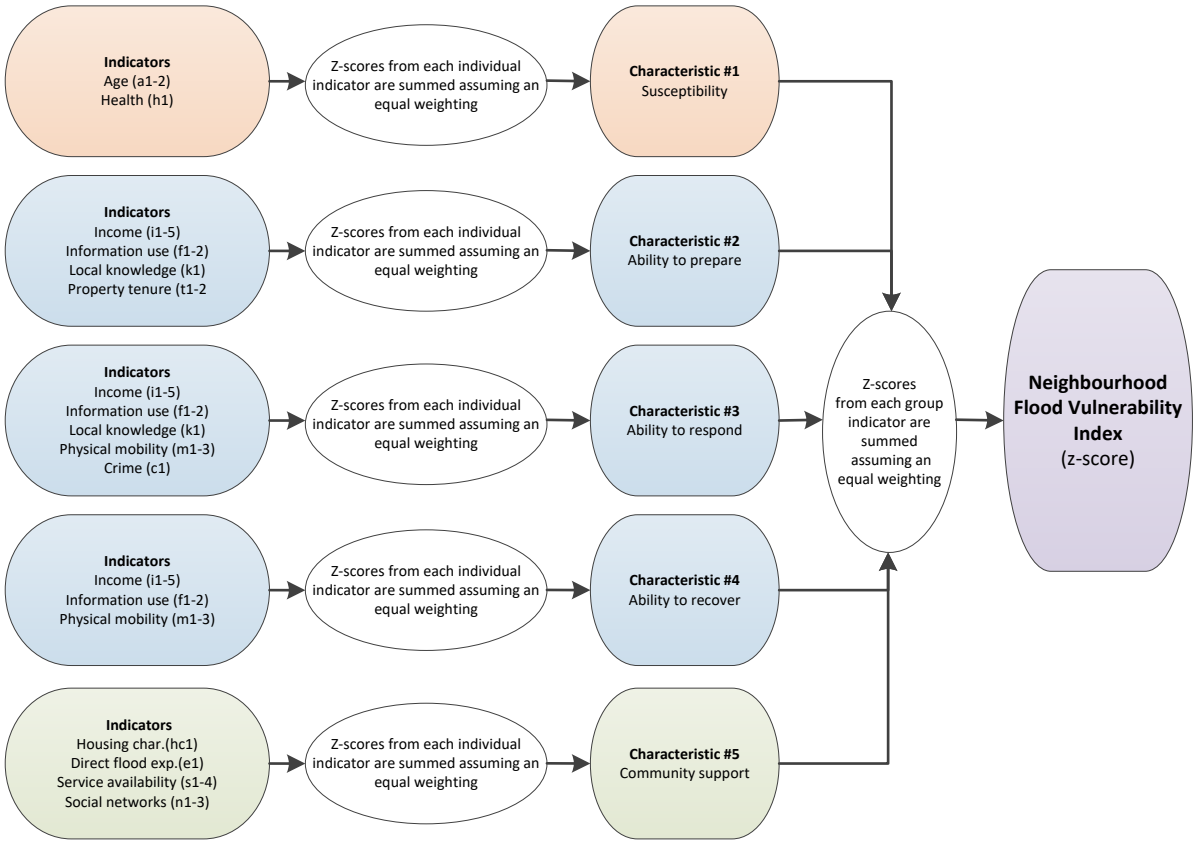


Figure 3 The process used to calculate the NFVI

Stage 1: Determine the z-score for Supporting variables

Each indicator ('age' etc as described in the previous section) is normalised to a z score. The z score is derived by subtracting the mean value and dividing by the standard deviation. If an indicator is already in the form of a rank (e.g. as is the Index of Multiple Deprivation, IMD), the equivalent z score is determined by assuming the rank is drawn from a normal distribution and calculating the number of standard deviations from the mean associated with that rank. This is done so that each indicator has the same numerical parameters, rather than its original numbers (which might be a %, a number, a rank, a fraction, etc.), and to enable them to be compared and combined on the "same playing field".

Stage 2: Determine the z-score for each characteristic

Z scores for the supporting variables that contribute to each characteristic (Susceptibility, Ability to Prepare, Respond and Recover, and Community Support) are combined based upon the assumption of equal weighting (Table 3). The only exception is the individual indicator associated with 'direct flood experience' (e1). In this case the weighting is negative as it acts to reduce the relative vulnerability of one neighbourhood compared to another.

The resulting values for each characteristic are then themselves transformed into a z score.

Stage 3: Determine the NFVI

For each neighbourhood, the z scores derived for each Indicator are summed with equal weighting. The final z score is calculated based on these results and used as the NFVI (Figure 4).

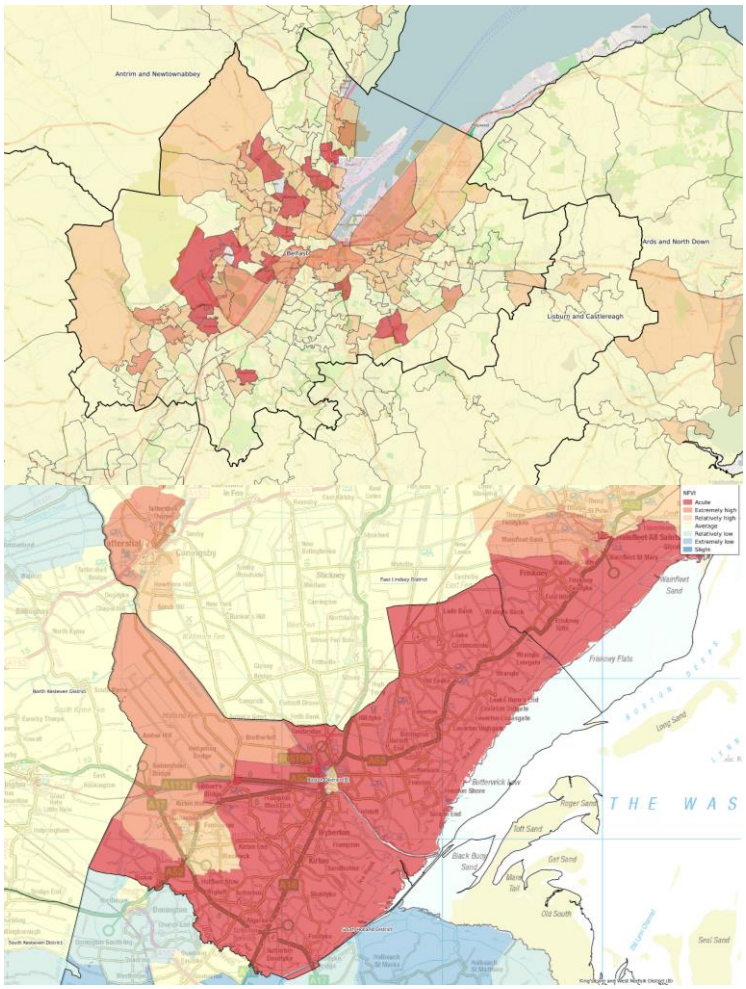


Figure 4 Example Neighbourhood Flood Vulnerability Index Maps Top: Belfast, Bottom: Boston.

Approach to estimating other flood related metrics

Data and methods used to estimate other flood metrics are summarised in Table 4.

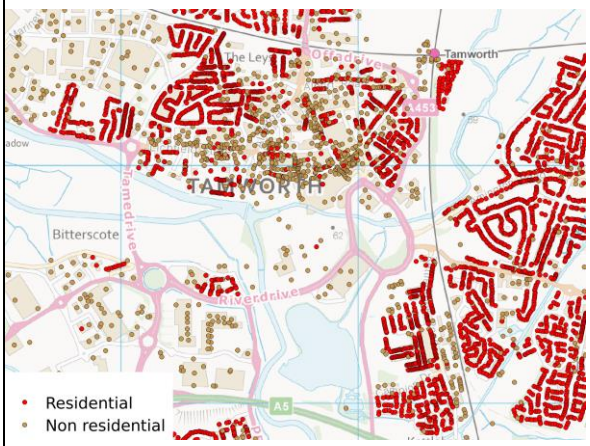
Table 3: Indicator weighting

Neighbourhood Flood Vulnerability: Weighting of individual indicators							
	Individual indicator	Weighted contribution to each characteristic					Relative weighting in NFVI
		Suscept.	Ability to prepare	Ability to respond	Ability to recover	Community support	
Age							**0.11**
a1	Young children (% people under 5 years)	0.25					0.05
a2	Older people (% people over 75 years)	0.25					0.05
Health							**0.11**
h1	Disability / people in ill- health (% people whose day- to-day activities are limited)	0.25					0.05
h2	% households with at least one person with long term limiting illness	0.25					0.05
Income							**0.31**
i1	Unemployed (% unemployed)		0.10	0.08	0.10		0.06
i2	Long-term unemployed (% who are LTU or who have never worked)		0.10	0.08	0.10		0.06
i3	Low income occupations (% in routine or semi- routine occupations)		0.10	0.08	0.10		0.06
i4	Households with dependent children and no adults in employment (%)		0.10	0.08	0.10		0.06
i5	People income deprived (%)		0.10	0.08	0.10		0.06
Information use							**0.12**
f1	Recent arrivals to UK (% people with <1 year residency coming from outside UK)		0.10	0.08	0.10		0.06
f2	Level of proficiency in English		0.10	0.08	0.10		0.06
Local knowledge							**0.04**
k1	New migrants from outside the local area		0.10	0.08			0.04
Tenure							**0.04**
t1	Private renters (% Households)		0.10				0.02
t2	Social renters (% Households renting from Social or Council landlords)		0.10				0.02
Physical mobility							**0.12**
m1	High levels of disability (% of population who are disabled)			0.08	0.10		0.04
m2	% people living in medical and care establishments			0.08	0.10		0.04
m3	Lack of private transport (% households with no car or van)			0.08	0.10		0.04
Crime							**0.02**
c1	High levels of crime			0.08			0.02
Housing characteristics							**0.02**
hc1	Caravan or other mobile or temporary structures in all households (%)					0.11	0.02
Direct flood experience							**-0.02**
e1	Properties exposed to significantly flood risk (% of homes in floodplain)					-0.11	-0.02
Service availability							**0.10**
s1	Emergency services exposed to flooding (%)					0.11	0.02
s2	Care homes exposed to flooding (%)					0.11	0.02
s3	GP surgeries exposed to flooding (%)					0.11	0.02
s4	Schools exposed to flooding (%)					0.11	0.02
Social networks (non-flood)							**0.02**
n1	Single-pensioner households (%)					0.11	0.02
n2	Lone-parent households with dependent children (%)					0.11	0.02
n3	Children of primary school age (4-11) in the population (%)					-0.11	-0.02

Table 4: Data and methods used in the estimation of flood metrics used in Sayers et al., 2017. For more information see the separate technical guide. The document also considers other notes and caveats.

Metric	Meaning	Data, Method and Notes
Exposure metrics		
Floodplain population (FP):	This is an estimate of the number of people living (not working) within the floodplain within a given neighbourhood	The estimate is made by combining the average occupancy rate of a household within a given neighbourhood and the number of residential properties that would be exposed to flooding with a return period of 1:1000 years or more frequent (in the absence of defences, where they exist). This metric also considers the number of people in areas exposed to surface water flooding with a return period of 1:1000 years or more frequent, even though these areas are not in what are traditionally thought of as floodplains. Note: This metric does not change with climate change. This is because the floodplain extent, defined by the present day 1:1000-year return period flood, is assumed to remain unchanged in the future (although flood probability within the floodplain does change). This is not a true representation, as floodplains are likely to extend further (in the absence of defences) with climate change, but is considered reasonable given the most significant impact of climate change on surface water and fluvial floods is likely to be the change in probability of flooding. At the coast this assumption is more challengeable under more extreme sea level rise assumptions (beyond those considered here) and was explored in the CCRA (Sayers et al., 2015a)[14]. This metric does, however, change with population growth.
Expected annual probability of flooding: Individual (EAI):	EAI is used to provide a people-focused annual 'average' exposure to flooding.	Calculated by combining the spatial variation in the annual probability of flooding to any depth with the location of individual residential properties and neighbourhood average occupancy rate. *Note*: EAI is calculated at a neighbourhood level and is an average value for those living within the 1:1000-year floodplain (or surface water equivalent) within that neighbourhood and is not associated with a specific individual.
Number of People Exposed to Frequent Flooding (PEFf):	This metric focuses on the number of people exposed to flooding more frequently than 1:75 years (on average).	A focus on expected values alone (*e.g.* EAI above) can mask important differences in the profile of the risk faced between neighbourhoods. For example, an area with many people exposed to very infrequent flooding would yield the same estimate of EAI as an area where only a few people are exposed to frequent flooding. To enable a valid comparison between areas the PEFf is expressed as an average value per head of those living within areas exposed to a probability of flooding of 1:1000 or greater (and within the aggregation area of interest). *Note*: To quantify exposure to flooding, only those living on ground floor or basement properties are considered in England and Wales; for Scotland, all properties are included; for Northern Ireland ground floor properties only are included, and additional multiple properties within the same building footprint are not counted. These differences in the treatment of properties stem from the different data sets used in each country. No distinction is made between those living in a basement flat and those living on the ground in terms of exposure. It is however assumed that basement properties suffer more economic damage (by a factor of 1.5 owing to likely greater impact of a flood on household inventory items. Estimates are based on residential property data (based upon national point datasets) together with locally representative household occupancy rates (from census data) The location of a single residential property is taken from national

[14] Sayers, P. B., Horritt, M. S., Penning-Rowsell, E. and Mckenzie, A. (2015a). Climate Change Risk Assessment 2017: Projections of future flood risk in the UK. Pages 125. Sayers and Partners LLP report for the Committee on Climate Change.

		receptor datasets, namely: • England and Wales: National Receptor Dataset (NRD) – Dated 29/10/14. • Scotland: Scottish Property Dataset (SPD) – Dated 29/01/2015. These supporting datasets identify individual residential property footprints and provide information on the likely number of households at ground floor within a given footprint (Figure 5). Information on the percentage of properties with a basement within a given neighbourhood is taken from the 2001 Census. Note: There are known errors associated with these datasets (see Sayers et al., 2015c – Appendix G) but they are assumed here to be fit for purpose in the context of residential property locations.  *Figure 5 National receptor datasets are used to identify the location of residential properties. Contains OS data © Crown copyright and database right (2016)*
Vulnerability metrics		
Neighbourhood Flood Vulnerability Index (NFVI):	Used to provide insight into the social vulnerability of a neighbourhood should a flood occur	The NFVI combines the five characteristics of vulnerability based upon a subset of twelve 'vulnerability indicators' and 27 supporting variables. These are summarised in Figure 3 and Table 3 together with the associated process of weighting. Note: Social vulnerability can be extremely localised, to a specific street, household or individual. Analysis at such a localised scale is not practical in the context of this study (although possible in principle). The concept of the 'neighbourhood' is therefore used as a small, but aggregated, spatial unit for assessing socio-economic factors.
Risk metrics		
Expected Annual Damages (EAD):	This provides the conventional view of risk that estimates the Expected Annual Damages in national economic terms	The assessment of EAD used here combines the annual probability of a residential property being flooded and the associated direct economic damages to residential properties with an uplift of 1.5 applied to the proportion of properties with basements (as determined through the 2005 census data). Note: The focus is on economic loss to the UK and not the financial loss that may be incurred by an individual. Wider social impacts (such as monetisation of mental health impacts) are also excluded. No consideration is given here to indirect damages (such as the consequential costs on the public purse of supporting short- and long-term recovery) or wider impacts, such as the valuation of the health impacts (physical and mental).
Expected Annual Damage: Individual (EADi)	This provides an estimate of the average (economic) risk faced by an individual living within the floodplain with a	Although not representative of the risk faced by any specific individual, this provides a valid means of comparing risks between areas

	given neighbourhood.	
Relative Economic Pain (REP)	In recognition of the varying coping capacity between more affluent and lower income households, this metric captures the relationship between uninsured economic damages and household income.	The REP is used to express the 'relative pain' of a risk and is defined here as: REP = (1- insurance penetration) x Expected Annual Damages (direct residential) per household within the floodplain / Average income per household within the neighbourhood. *Note*: As previously noted (see EAD), the damages calculated here are economic losses, whereas the impact of flooding on uninsured households is related to the financial losses. The REP metric should therefore not be viewed as directly representing the impact on household finances, but is nevertheless a useful metric relating losses to income and insurance take-up. No consideration is given to issues of excess, deductibles or exclusions (including uninsured impacts, such as long-term physical or mental health that may be associated with a flood). In assessing the REP, household income is taken from the appropriate census data sources for each constituent county. These are generally available at a larger spatial scale than the census areas used in this study (e.g. MSOA for England and Wales rather than LSOA), and are therefore sampled down to the appropriate scale.
Social Flood Risk Index (Group)	Used to identify those areas where the largest number of the most vulnerable people are exposed to frequent flooding.	The SFRI therefore directly supports an understanding of Geographic Flood Disadvantage and is estimated at both a neighbourhood scale and as an individual 'average' as follows: SFRI = Expected Annual Probability of Flooding: Individual (EAI) x Number of people within the floodplain (FP) x Neighbourhood Flood Vulnerability Index (NFVI).
Social Flood Risk Index (Individual)	Helps identify those neighbourhoods where the vulnerability of those exposed is high	Social flood risk index: Individual (iSFRI) helps identify those neighbourhoods where the vulnerability of those exposed is high (even when only a few people may be exposed) and is calculated simply by dividing the SFRI by the floodplain population, to give: SFRI Individual = Expected Annual Probability of Flooding: Individual (EAI) x Neighbourhood Flood Vulnerability Index (NFVI).

Heat-related data

Approach to calculating the Socio-Spatial Heat Vulnerability Index

In order to calculate the dimension indices of sensitivity, enhanced exposure, ability to prepare, respond and recover, the indicators included in the spreadsheet available in the map tool underwent the following processes:

- Standardisation. This was done to avoid 'comparing apples and pears', i.e. to provide a uniform scale for all indicators. Zscore standardisation was used for the national dataset of 6791 MSOAs, which resulted in the mean=0 and standard deviation=1 for all indicators. For the standardised indicators, values above the English mean are positive (denoting above average vulnerability), and values below English mean are negative (denoting below average vulnerability). The further the original value was from the English mean, the more extreme the positive and negative values of zscores.
- Reversing. Zscores of some of the indicators were multiplied by -1, in order to reflect the fact that high original values of the selected indicator were sometimes a measure of low vulnerability. For example, high income is associated with low vulnerability; thus, the values of Zscore of this indicator had to be multiplied by -1 to convert positive values to negative and negative values to positive. Where possible the original data associated with indicators were modified to better represent the vulnerability factor being measured. For example, the Census indicator % of people providing unpaid care (KS301) was converted to the % of

people *not* providing unpaid care since higher proportions of unpaid carers is assumed to reduce vulnerability through being an indicator of better social networks in an area. The original indicator could have been left in its original form and the indicator multiplied by -1. However in this case it was possible to easily produce an indicator of vulnerability from the original data.

- Weighting. The indicators were equally weighted within domains in order to achieve equal weighting for the domains in indices. For example, if there were 4 indicators within a domain, each of them had a weighting of 0.25; if there were 5 indicators, each of them would have a weight of 0.2, etc.

To calculate the indices of sensitivity, enhanced exposure, ability to prepare, respond and recover, the relevant standardised and weighted indicators were added together, following the formulas included in the accompanying spreadsheet (worksheet 'indices – metadata'[15]). The resultant indices were standardised again (in order to achieve the same scale).

The vulnerability indices were calculated by summarising equally weighted indices of sensitivity, enhanced exposure, ability to prepare, ability to respond and ability to recover, and then standardised.

The indicators of hazard exposure were also standardised. The disadvantage indices were calculated by adding the zscore of heat vulnerability and zscore of relevant hazard exposure indicator, and then standardised. Heat disadvantage therefor shows the standardised sum of socio-spatial heat vulnerability and potential exposure to high temperatures.

Mapping categories

Mapping categories for social vulnerability are given according to scores (z scores) in the index with Acute indicating areas where social vulnerability is highest in a UK context: Acute, Very High, Relatively High; Average (UK mean); Relatively Low, Very Low and Slight. The mapping categories for heat and flood vulnerability are identical but with variations in the colour scheme for easy identification (Table 5).

The SFRI is a relative index and has no defined units. The mapping categories for the Social Flood Risk Index measure of flood disadvantage are shown in Table 6. They differ from the published report as they differentiate neighbourhoods with no exposed population from neighbourhoods which have some exposed populations (i.e. people living in the floodplain). The greater the value for a neighbourhood, the higher the level of social flood risk. High levels of risk occur where high numbers of people live in the floodplain in a neighbourhood with high social vulnerability. High negative values are a result of high numbers of people living in the floodplain in a neighbourhood with low social vulnerability. Neighbourhoods where no-one lives in the floodplain have a value of zero.

Table 5: Classification scheme for all standardised indices

Index score	**Label**
≥ 2.5	Acute
1.5 – 2.5	Extremely high
0.5 – 1.5	Relatively high
-0.5 – 0.5	Average
-1.5 - -0.5	Relatively low
-2.5 - - 1.5	Extremely low
≤ - 2.5	Slight

[15] Add link – check latest version with SL

Table 6: Classification scheme for SFRI

Index score	Label
0	No exposed population
<0	Exposed, NFVI below the UK mean
>0 to +5	Low
+5 to +12.5	Moderate
+12.5 to +25	High
+25 to +50	Very high
+50 to +100	Acute
>100	Extreme

5. The contents of the spreadsheets and spreadsheet metadata

The spreadsheets found in the data download tab contain metadata about each of the datasets used to generate the indicator layers.

These are:

- Neighbourhood Flood Vulnerability Index and Social Flood Risk Index
- LA summary
- Socio-spatial heat vulnerability indicators
- Socio-spatial heat vulnerability indices

These can be used to trace back to the original sources of data. Raw and standardised data are provided which can be used to construct local interpretations of the data, for an explanation of how to do this see section 4. They can also be used to generate local and regional averages with which to compare particular neighbourhoods. The spreadsheet also provides the weighting basis for the calculation of the indices. These can modified, e.g. to replace specific indicators with updated/local data representing the same factor of interest. A look up table is used to assist interpretation of the excel columns in each of the spreadsheets (reproduced below). Data can be mapped through joining the Census zone unique identifier in the spreadsheet to the unique identifiers in Census zone geographical data. This will produce map outputs which are equivalent to the maps in the Climate Just map tool[16].

NFVI and SFRI indicators

The following information explains the contents of the spreadsheet. It reproduces the contents of the Readme tab provided with the download spreadsheet table. Shapefile versions of the data are also provided for use in GIS.

Geographical Unit Information

Column Name	Long name
CODE	Lower Super Output Area or Data Zone Code (Unique Identifier)
NAME	Name of area
COUNTRY	Country

[16] Add link to map tool home page http://climatejust.cc.demo.faelix.net/map

Neighbourhood Flood Vulnerability Index (NFVI) Data

Column Name	Long Name
NVFI	Neighbourhood Flood Vulnerability Index (NFVI)

Neighbourhood Flood Vulnerability Index (NFVI) Characteristics Data

Column Name	Long Name
NVFI_SUS	NFVI - Susceptibility Index (Characteristics)
NVFI_PRP	NFVI - Ability to Prepare Index (Characteristics)
NVFI_RES	NFVI - Ability to Respond Index (Characteristics)
NVFI_REC	NFVI - Ability to Recover Index (Characteristics)
NVFI_COM	NFVI -Community Support Index (Characteristics)

Neighbourhood Flood Vulnerability Index (NFVI) Composite Indicator Data

Column Name	Long Name
AGE	Age composite Indicator
HEALTH	Health composite Indicator
INCOME	Income composite Indicator
INFO	Information use composite Indicator
LOC_KNOW	Local knowledge composite Indicator
TENURE	Property tenure composite Indicator
MOBILITY	Mobility composite Indicator
CRIME	Crime composite Indicator
HOUSE_TYP	Housing characteristics composite Indicator
FLOOD_EXP	Flood experience composite Indicator
SERVICE	Service availability composite Indicator
SOC_NET	Social networks composite Indicator

Neighbourhood Flood Vulnerability Index (NFVI) Supporting Variable Data

Column Name	Long Name
a1	Young children (% people under 5 years)
a2	Older people (% people over 75 years)
h1	Disability / people in ill- health (% people whose day- to-day activities are limited)
h2	% households with at least one person with long term limiting illness
i1	Unemployed (% unemployed)
i2	Long-term unemployed (% who are LTU or who have never worked)
i3	Low income occupations (% in routine or semi- routine occupations)
i4	Households with dependent children and no adults in employment (%)
i5	People income deprived (%)
f1	Recent arrivals to UK (% people with <1 yr residency coming from outside UK)
f2	Level of proficiency in English
k1	New migrants from outside the local area
t1	Private renters (% Households)
t2	Social renters (% Households renting from Social or Council landlords)

m1	High levels of disability (% of population who are disabled)
m2	% people living in medical and care establishments
m3	Lack of private transport (% households with no car or van)
c1	High levels of crime (index)
l1	% caravan or other mobile or temporary structures in all households
e1	number of properties within historical flood boundary
s1	% of emergency services exposed to flooding
s2	% no. of care homes exposed to flooding
s3	% no. of GP surgeries exposed to flooding
s4	% no. of schools exposed to flooding
n1	% single-pensioner households
n2	% lone-parent households with dependent children
n3	% children of primary school age (4-11) in the population

Social Flood Risk Index (SFRI) Data

Column Name	Long Name
SFRIPFCG	Social Flood Risk Index (SFRI): Present Day, Fluvial & Coastal, Group (SFRI)
SFRIPFCI	Social Flood Risk Index (SFRI): Present Day, Fluvial & Coastal, Individual (iSFRI)
SFRI2FCG	Social Flood Risk Index (SFRI): Two degrees Future Scenario, Fluvial & Coastal, Group (SFRI)
SFRI2FCI	Social Flood Risk Index (SFRI): Two degrees Future Scenario, Fluvial & Coastal, Individual (iSFRI)
SFRI4FCG	Social Flood Risk Index (SFRI): Four degrees Future Scenario, Fluvial & Coastal, Group (SFRI)
SFRI4FCI	Social Flood Risk Index (SFRI): Four degrees Future Scenario, Fluvial & Coastal, Individual (iSFRI)
SFRIPSWG	Social Flood Risk Index (SFRI): Present Day, Surface Water, Group (SFRI)
SFRIPSWI	Social Flood Risk Index (SFRI): Present Day, Surface Water, Individual (iSFRI)
SFRI2SWG	Social Flood Risk Index (SFRI): Two degrees Future Scenario, Surface Water, Group (SFRI)
SFRI2SWI	Social Flood Risk Index (SFRI): Two degrees Future Scenario, Surface Water, Individual (iSFRI)
SFRI4SWG	Social Flood Risk Index (SFRI): Four degrees Future Scenario, Surface Water, Group (SFRI)
SFRI4SWI	Social Flood Risk Index (SFRI): Four degrees Future Scenario, Surface Water, Individual (iSFRI)

Socio-spatial heat vulnerability indicators – individual indicators contained in the socio-spatial vulnerability to heat indices.

Note that the following tables include the original updated (2011) flood data and heat data. For heat socio-spatial vulnerability data you should ignore the “flood only” columns. They are retained in this guide for the purposes of explaining data in the original documentation. Note that all detail relating to flood disadvantage data have been removed.

Geographical Unit Information

Column Name	Long name
MSOA11CD	Middle Super Output Area Code (Unique Identifier)
MSOA11NM	Middle Super Output Area Name

Colour codes

Both flood and heat
Flood only
Heat only

Socio-spatial vulnerability to heat indicator information

Column Name	Long name
S_1	% children < 5 years old
S_3	% people > 75 years old
S_4	% people with long term ill-health/disability (activities limited a little/ a lot)
S_7	% households with at least one person with long term ill-health/disability (activities limited a little or a lot)
AT0_1	% unemployed
AT0_2	% in low income occupations (routine & semi-routine)
AT0_3	% long term unemployed / never worked
AT0_4	% households with no adults in employment and dependent children
AT0_9	Average weekly household net income estimate (equivalised after housing costs) (Pounds)
AT0_10	% all pensioner households
AT0_11	% households rented from social landlords
AT0_12	% households rented from private landlords
AT0_17	% born outside UK and Ireland
AT0_24	*Flood experience (% area associated with past events)**
AT0_25	*Insurance availability (% area with 1 in 75 chance of flooding)**
AT0_26	% people with <1 yr residency coming from outside UK
AT1_1	% unemployed
AT1_2	% in low income occupations (routine & semi-routine)
AT1_3	% long term unemployed / never worked
AT1_4	% households with no adults in employment and dependent children
AT1_9	Average weekly household net income estimate (equivalised after housing costs) (Pounds)
AT1_10	% all pensioner households
AT1_13	% born outside UK and Ireland
AT1_20	*Flood experience (% area associated with past events)**
AT1_21	*Insurance availability (% area with 1 in 75 chance of flooding)**
AT1_23	% single pensioner households
AT1_26	% lone parent household with dependent children
AT1_28	% people who do not provide unpaid care

AT1_29	% disabled (activities limited a lot)
AT1_30	% households with no car
AT1_33	Crime score (IMD)
AT1_35	% area not road
AT1_36	Density of retail units (count /km2)
AT1_37	% change in number of local VAT-based units
AT1_39	% people with <1 yr residency coming from outside UK
AT1_40	% home workers
AT2_1	% unemployed
AT2_2	% in low income occupations (routine & semi-routine)
AT2_3	% long term unemployed / never worked
AT2_4	% households with no adults in employment and dependent children
AT2_9	Average weekly household net income estimate (Pounds)
AT2_10	% all pensioner households
AT2_12	% born outside UK and Ireland
AT2_16	*Insurance availability (% area with 1 in 75 chance of flooding)**
AT2_18	% single pensioner households
AT2_21	% lone parent household with dependent children
AT2_23	% people who do not provide unpaid care
AT2_24	% disabled (activities limited a lot)
AT2_25	% households with no car
AT2_27	Travel time to nearest GP by walk/public transport (mins - representative time)
AT2_30	% of at risk population (no car) outside of 15 minutes by walk/public transport to nearest GP
AT2_32	Number of GPs within 15 minutes by walk/public transport
AT2_33	Number of GPs within 15 minutes by car
AT2_36	Travel time to nearest hospital by walk/public transport (mins - representative time)
AT2_38	Travel time to nearest hospital by car (mins - representative time)
AT2_39	% of at risk population outside of 30 minutes by walk/PT to nearest hospital
AT2_41	Number of hospitals within 30 minutes by walk/public transport
AT2_42	Number of hospitals within 30 minutes by car
AT2_53	*Change in median house price 2004-09 (Pounds)**
AT2_55	% people with <1 yr residency coming from outside UK
AT2_50	*% home workers**
E_1	% area not green space
E_2	Area of domestic buildings per area of domestic gardens (m2 per m2)
E_3	% area not blue space
E_4	Distance to coast (m)
E_6	Elevation (m)
E_9	*% households with the lowest floor level: Basement or semi-basement**
E_10	*% households with the lowest floor level: ground floor**
E_11	% households with the lowest floor level: fifth floor or higher

*Note: * These data are part of the former socio-spatial flood vulnerability data (2011), now superseded by the NVFI and SFRI (2017).*

Socio-spatial vulnerability indices socio-spatial vulnerability to flood and socio-spatial vulnerability to heat indices.

Geographical Unit Information

Column Name	Long name
MSOA11CD	Middle Super Output Area Code (Unique Identifier)
MSOA11NM	Middle Super Output Area Name

Colour codes

Both flood and heat
Flood only
Heat only

Socio-spatial vulnerability index information

Column Name	Long name
ZSENS_IND	Sensitivity
ZF_PREP_IN	*Ability to prepare – flood**
ZF_RESP_IN	*Ability to respond – flood**
ZF_REC_IND	*Ability to recover – flood**
ZF_EXP_IND	*Enhanced exposure – flood**
ZH_PREP_IN	Ability to prepare – heat
ZH_RESP_IN	Ability to respond – heat
ZH_REC_IND	Ability to recover – heat
ZH_EXP_IND	Enhanced exposure – heat
ZF_VULN_IN	*Socio-spatial vulnerability index – flood**
ZH_VULN_IN	Socio-spatial vulnerability index – heat

*Note: * these data are now superseded by the SVFI.*

Flood disadvantage - flood disadvantage indices.

Geographical Unit Information

Column Name	Long name
MSOA11CD	Middle Super Output Area Code (Unique Identifier)
MSOA11NM	Middle Super Output Area Name

LA summary sheet

Flood data: The Local Authority summary sheet is a tabular summary of the mapped NFVI and SFRI data.

Heat data: The Local Authority summary sheet is a tabular summary of the mapped socio-spatial heat vulnerability dimensions. It also contains socio-spatial flood vulnerability dimensions, exposure and disadvantage for each LA by MOSA (now superseded by the NFVI and SFRI). For more information click here (FAQ's).

6. Using spreadsheets to create your maps

The data is provided in spreadsheet format from the data download tab in the map tool as a list of Census areas and their associated attributes. Attributes are available for the NFVI, the SFRI and socio-spatial heat vulnerability. On opening of the spreadsheets look at the 'Read Me' tab for an explanation of what is contained in the data set. The 'look up' tab provides more information about each of the columns of data, with a short explanation of the meanings of the column titles in each case (e.g. the unique codes for each Census unit). For example, the unique codes for the socio-spatial heat vulnerability data are provided in the field (column) called MSOA11CD. Here the unique code for the 2011 MSOA Census Unit for 'Kingston upon Hull 008' is 'E02002659'. If you do not have your own copy of the administrative boundaries you can download 2011 Census boundary data from data.gov.uk

- Scotland – Data Zones, 2011
- England and Wales – Lower Super Output Areas (LSOA), 2011 & Middle Super Output Area (MSOA), 2011

If you have your own GIS software such as ArcGIS or MapInfo you can 'join' the data to your own map layers yourself. However, the site provides shapefile format GIS files which are suitable for mapping. The shapefiles contain the same unique codes for Census units, e.g. for the socio-spatial heat vulnerability data this is the spreadsheet field (column) called MSOA11CD. This unique code can be used to join data from the attribute file to the shapefile. Data can be matched in several ways however; it is recommended that this is done within a GIS package using an attribute join (e.g. ArcGIS, QGIS or MapInfo). Once the data are joined the attributes can be mapped. This is not necessary if using the GIS shapefiles which are available to download directly.

Once the datasets have been joined, users can choose which indicators to show on one map.

If you do not have this proprietary software we recommend that you download the free QGIS software instead that can use the shp file format. Depending on the GIS package, you may need to export the downloaded spreadsheet to a text (e.g. CSV) file before it can be joined.