

Combined 'Info Sheets' for the Flood maps in the Climate Just map tool (2018 update)

This provides a full description of all the indicators associated with flooding. These have been drawn from *'Present and future flood vulnerability, risk and disadvantage: A UK scale assessment'*, a 2017 report for the Joseph Rowntree Foundation published by Sayers and Partners LLP, the data from which has been incorporated into the 2018 update of the flood maps.

Item	Description
Reference	A1
Theme	Vulnerability
Hazard reference	Flood (Revised Data, 2017)
Characteristic	Susceptibility
Indicator	Age
Supporting Variable	Young children (% people under 5 years)
Assumption	Higher proportions of children under 5 years of age in an area indicate a higher vulnerability.
Evidence supporting the use of this supporting variable	<ul style="list-style-type: none"> • More information about children and social vulnerability, as well as what can be done to help, is available in the main site. http://www.climatejust.org.uk/messages/young-children-and-babies • Some of the specific evidence for this indicator includes: <ul style="list-style-type: none"> ○ Numerous studies have highlighted the association between flooding and increased mental health and behavioural problems in children (e.g. Mort et al., 2016). ○ Children’s stories of the impacts of the floods in Hull reveal the range of impacts which can affect younger children, including physical and mental health and the disruption of schooling and home-life (Mort et al., 2016).

Data Sources

ID	Indicator description	Source and provider	Date	Indicator processing details	Spatial Unit			
					Eng	Wales	Scot	NI
a1	Young children (% people under 5 years)	Census, ONS	2011	Census table 102. Number of people aged 0-4 years was divided by the population and multiplied by 100.	LSOA	LSOA	DZ	SOA

Office for National Statistics, 2011 Census: Aggregate data (England and Wales) [computer file]. UK Data Service Census Support. Downloaded from: <http://infuse.mimas.ac.uk>. This information is licensed under the terms of the Open Government Licence [<http://www.nationalarchives.gov.uk/doc/open-government-licence/version/2>].

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Further data for Scotland is available from <http://statistics.gov.scot/>

Based upon 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. Available [here](#)

References

Mort, M., Walker, M., Lloyd Williams, A., Bingley, A. and Howells, V. (2016) Final project report for 'Children, Young People and Flooding: Recovery and Resilience'. Lancaster University, Lancaster, UK.

Item	Description
Reference	A2
Theme	Vulnerability
Hazard reference	Flood (Revised Data, 2017)
Characteristic	Susceptibility
Indicator	Age
Supporting Variable	Older people (% people over 75 years)
Assumption	Higher proportions of people over 75 in an area indicate a higher vulnerability.
Evidence supporting the use of this supporting variable	<ul style="list-style-type: none"> • More information about older people and social vulnerability, as well as what can be done to help, is available in the main site. http://www.climatejust.org.uk/messages/older-people • Some of the specific evidence for this indicator includes: <ul style="list-style-type: none"> ○ The number of deaths caused by the 1953 'Big Flood' was highest among older people (Baxter, 2005), with people over 60 year olds accounting for 42% of resulting deaths in Essex (Vardoulakis and Heaviside, 2012). ○ Older people are less likely than other social groups to respond to flood warnings and may be more reluctant to leave their houses (Age UK, 2016), as well as having more limited physical mobility, making it difficult to use flood defence measures, such as putting up property level flood gates (Vardoulakis and Heaviside, 2012). ○ Tapsell et al. (2002) looked in detail at six case studies from across the UK; these showed that those over the age of 75 were more vulnerable to flooding.

Data Sources

ID	Indicator description	Source and provider	Date	Indicator processing details	Spatial Unit			
					Eng	Wales	Scot	NI
a2	Older people (% people over 75 years)	Census, ONS	2011	Census table 102. Number of people aged 75 years or more was divided by the population and multiplied by 100.	LSOA	LSOA	DZ	SOA

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Age UK (2016) Older people and power loss, floods and storms. Age UK.

Baxter, P. J. (2005) The east coast Big Flood, 31 January – 1 February: a summary of the human disaster. Philosophical Transactions of the Royal Society of London A: Mathematical, Physical and Engineering Sciences, 363, no. 1831 (2005): pp. 1293-1312.

Tapsell, S. M., Penning-Rowsell, E. C., Tunstall, S. M. and Wilson, T. L. (2002) Vulnerability to flooding: health and social dimensions, Flood risk in a changing climate. Papers of a Discussion Meeting organized and edited by D. Cox, J. Hunt, P. Mason, H. Wheater and P. Wolf. 15 July 2002, Vol 360, No. 1796, Philosophical Transactions of The Royal Society, Mathematical, Physical and Engineering Sciences pp. 1511-1525 - ISSN: 1364503X

Vardoulakis, S. and Heaviside, C. (2012) Health effects of climate change in the UK 2012. Health Protection Agency

Item	Description
Reference	C1
Theme	Vulnerability
Hazard reference	Flood (Revised Data, 2017)
Characteristic	Ability to Respond
Indicator	Crime
Supporting Variable	Crime
Assumption	Higher levels of crime in an area indicate a higher vulnerability. People living in areas with higher crime have a lower ability to respond to flood events and/or they be more severely affected.
Evidence supporting the use of this supporting variable	<ul style="list-style-type: none">• People living in areas with higher crime rates may be more wary of taking preventative measures against flooding and have extra security mechanisms on their houses such as

	<p>multiple locks on doors and windows; this can cause delays in evacuation and rescue attempts.</p> <ul style="list-style-type: none"> • People living in areas with higher crime rates may be more wary of taking preventative measures against flooding in case they are 'scams', and so may be more socially vulnerable than communities with lower crime rates. • Where crime rates are high, residents may hesitate to evacuate properties during floods for fear of looting. For example, during the 2014 floods on the Somerset Levels, it was reported that empty houses were being targeted by thieves taking domestic heating oil (The Independent, 2014).
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Data Sources

ID	Indicator description	Source and provider	Date	Indicator processing details	Spatial Unit			
					Eng	Wales	Scot	NI
c1	High levels of crime	Department of Communities and Local Government, Statistics for Wales, Scottish Government, NI Statistics and Research Agency	See next column	England: Indices of Deprivation 2015: Crime Domain: Crime Score (all crime); Scotland: SIMD Crime Score, 2012 Wales: SIMD Crime score, 2014; Northern Ireland: NIIMD Crime Score, 2010	LSOA	LSOA	DZ	SOA

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References

The Independent (2014) Somerset floods: Thieves target victims. Accessed: 24/10/2016. [Available at: <http://www.independent.co.uk/news/uk/crime/somerset-levels-thieves-cash-in-on-floods-misery-9103851.html>]

Item	Description
Reference	E1
Theme	Vulnerability
Hazard reference	Flood (Revised Data, 2017)
Characteristic	Community Support
Indicator	Direct flood experience
Supporting Variable	Number of properties within historical flood boundary
Assumption	Higher proportions of properties within the historical flood boundary within an area indicate a lower vulnerability. This is taken as an indicator of a community with more knowledge and support available given past experience and the likelihood of there being a higher level of activity by government and non-government organisations.
Evidence supporting the use of this supporting variable	<ul style="list-style-type: none"> • Those with experience of flooding are less vulnerable in subsequent events as they have more knowledge as to what to do and how to respond • Flood experience has often been shown to be a key factor in level of willingness to take preventative action against future floods, and also respond seriously to warnings (Tapsell <i>et al.</i>, 2005; McCarthy <i>et al.</i>, 2006; Tunstall <i>et al.</i>, 2006). • Fielding <i>et al.</i> (2007) found that there was a higher level of understanding of what the EA flood warning codes meant in households that had previously flooded. • This idea is characterised by the “prisoner of experience” phenomenon (e.g. Shaw <i>et al.</i>, 2005), whereby those without experience are less able to cope, and until people (unfortunately) have direct experience of flooding they are more vulnerable (although it may require homes to flooded several times before people are willing to act).

Data Sources

ID	Indicator description	Source and provider	Date	Indicator processing details	Spatial Unit			
					Eng	Wales	Scot	NI
e1	number of properties within historical flood boundary	EA, NRW, SEPA, NI Rivers Agency	Various	Based on query of property dataset and flood outline; limited to past 50 years when date information available	LSOA	LSOA	DZ	SOA

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Fielding, J., Burningham, K., Thrush, D. and Catt, R. (2007) Public responses to flood warnings. Environment Agency Science Report SC020116.

McCarthy, S., Parker, D. and Penning-Rowsell, E. (2006). Preconsultation social survey: Community based flood risk reduction options. Reach 4: Walton Bridge to Teddington. Enfield: Flood Hazard Research Centre, Middlesex University. Science Report: Improving Institutional and Social Responses to Flooding – Work Package 1 54

Shaw, J., Cudmore, S., Turner, D. and Collier, D. (2005) Improving flood warning awareness in low probability and medium-high consequence flood zones. Defra/Environment Agency Flood and coastal erosion risk management R&D Programme.

Tapsell, S., Burton, R., Oakes, S. and Parker, D. (2005) The social performance of flood warning communications technologies. Technical Report Environment Agency.

Tunstall, S., Tapsell, S., and Fernández-Bilbao, A. (2006) The Roadtesting Project. Objective 13. The damage-reducing effects of flood warnings: Results from new data collection. Defra/Environment Agency Project 2014: Development of economic appraisal methods for flood management and coastal erosion protection. Enfield: Flood Hazard Research Centre, Middlesex University.

Item	Description
Reference	F1 & F2
Theme	Vulnerability
Hazard reference	Flood (Revised Data, 2017)
Characteristic	Inability to Prepare, Respond and Recover
Indicator	Information Use
Supporting Variable	See table below
Assumption	<p>F1 Higher proportions of people born outside of the UK and Ireland in an area indicate a higher vulnerability since they are more likely to have difficulties understanding the English language compared to people born within the UK and Ireland. They are also likely to have less local knowledge and less familiarity with national and local services.</p> <p>F2 Higher proportions of people with low proficiency in English in an area indicate higher vulnerability.</p>
Evidence supporting the use of this supporting variable	<ul style="list-style-type: none"> People who cannot read, write and/or speak English or who are less proficient in English are more likely to have difficulty obtaining and using information and guidance provided to the general public (Lindley et al., 2011).

Data Sources

ID	Indicator description	Source and provider	Date	Indicator processing details	Spatial Unit			
					Eng	Wales	Scot	NI
f1	Recent arrivals to UK (% people with <1 yr residency coming from outside UK)	Census, ONS	2011	Census table QS801. Number of people within year of arrival 'Arrived 2010- 2011' divided by the total number of people and multiplied by 100.	LSOA	LSOA	DZ	SOA
f2	Level of proficiency in English	Census, ONS	2011	Census table QS205. Number of people 'Does not speak English at all' + 'Does not speak English well', divided by the total number of people and multiplied by 100.	LSOA	LSOA	DZ	SOA

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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.

Item	Description
Reference	H1
Theme	Vulnerability
Hazard reference	Flood (Revised Data, 2017)
Characteristic	Susceptibility
Indicator	Health
Supporting Variable	Disability / people in ill- health (% people whose day- to-day activities are limited)
Assumption	Higher proportions of people in poor health in an area indicate a higher vulnerability. The long-term sick are more vulnerable to the impacts of a flood as the experience can make their pre-existing condition worse either as a one-off 'hit', or due to accelerating its adverse trajectory.
Evidence supporting the use of this supporting variable	<ul style="list-style-type: none"> • More information about people in poor health and social vulnerability, as well as what can be done to help, is available in the main site. http://www.climatejust.org.uk/messages/people-poor-health • Some of the specific evidence for this indicator includes: <ul style="list-style-type: none"> ○ Flooding may restrict an individual's access to medicine, e.g. due to loss or damage or it being left behind in the context of an emergency (Age UK, 2016). ○ Flooding may prevent the use of complex home-based health care systems, for example home dialysis, due to direct flood damage or to loss of power (Klinger <i>et al.</i>, 2014). ○ Being flooded is stressful and mental health impacts can be serious. Recorded psychological stresses caused by flooding in the UK and OECD (e.g. Tapsell <i>et al.</i>, 2002) include: post-traumatic stress disorder, depression, anxiety and domestic violence (Pendlebury and Bates, 2015). A delayed increase in suicide rates has been observed following natural disasters, although the evidence of this after flood events is very limited (Kolves <i>et al.</i>, 2013). Many of these psychological effects last much longer (2+ years) than any adverse physical health effects (Tapsell <i>et al.</i>, 2002). While post-event stress is likely to affect everyone, those with existing mental health conditions are likely to suffer the most (Sims <i>et al.</i>, 2008; Waite <i>et al.</i>, 2017).

- Telephone connectivity and transport routes are often disrupted during flood events making it difficult for carers to contact and reach their patients that are receiving care at home (Age UK, 2016). This was a problem in Lancashire during the flooding in 2015 caused by Storm Desmond.

Data Sources

ID	Indicator description	Source and provider	Date	Indicator processing details	Spatial Unit			
					Eng	Wales	Scot	NI
h1	Disability / people in ill- health (% people whose day- to-day activities are limited)	Census, ONS	2011	Census table KS301. Number of people whose day to day activities are limited a lot + number of people whose day to day activities limited a little, divided by the total population and multiplied by 100.	LSOA	LSOA	DZ	SOA
h2	% households with at least one person with long term limiting illness	Census, ONS	2011	Census table KS106. Number of households with one or more persons with a long-term health problem or disability divided by the total number of households and multiplied by 100.	LSOA	LSOA	DZ	SOA

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Age UK (2016) Older people and power loss, floods and storms. Age UK.

Klinger, C., Landeg, O. and Murray, V. (2014) Power Outages, Extreme Events and Health: a Systematic Review of the Literature from 2011-2012. PLOS Currents Disasters.

Kolves, K., Kolves, K. E. and De Leo, D. (2013) Natural disasters and suicide behaviours: A systemic literature review. Journal of Affective Disorders, 146. 1-14.

Pendlebury, M. and Bates, G. (2015) Reducing adverse health impacts from flooding and flood risk: A review of the literature and development of questions for further research. National Flood Forum.

Tapsell, S. M., Penning-Rowsell, E. C., Tunstall, S. M. and Wilson, T. L. (2002) Vulnerability to flooding: health and social dimensions, Flood risk in a changing climate. Papers of a Discussion Meeting organized and edited by D. Cox, J. Hunt, P. Mason, H. Wheeler and P. Wolf. 15 July 2002, Vol 360, No. 1796, Philosophical Transactions of The Royal Society, Mathematical, Physical and Engineering Sciences pp. 1511-1525 - ISSN: 1364503X

Sims, R., Medd, W., Mort, M., Watson, N., Walker, G. and Twigger-Ross, C., (2008) Perspectives on resilience from households in Hull—response to Defra consultation on policy options for promoting property-level flood protection and resilience. Lancaster University.

Waite, T. D., Chaintarli, K., Beck, C., Bone, A., Amlôt, R., Kovats, S., Reacher, M., Armstrong, B., Leonardi, G., Rubin, J., and Oliver, I. (2017). The English national cohort study of flooding and health: cross-sectional analysis of mental health outcomes at year one. DOI: 10.1186/s12889-016-4000-2

Item	Description
Reference	H2
Theme	Vulnerability
Hazard reference	Flood (Revised Data, 2017)
Characteristic	Susceptibility
Indicator	Health
Supporting Variable	% households with at least one person with long term limiting illness
Assumption	Higher proportions of people in poor health in an area indicate a higher vulnerability. The long-term sick are more vulnerable to the impacts of a flood as the experience can make their pre-existing condition worse either as a one-off 'hit', or due to accelerating its adverse trajectory.
Evidence supporting the use of this supporting variable	<ul style="list-style-type: none"> • More information about people in poor health and social vulnerability, as well as what can be done to help, is available in the main site. http://www.climatejust.org.uk/messages/people-poor-health • Some of the specific evidence for this indicator includes: <ul style="list-style-type: none"> ○ Flooding may restrict an individual's access to medicine, e.g. due to loss or damage or it being left behind in the context of an emergency (Age UK, 2016). ○ Flooding may prevent the use of complex home-based health care systems, for example home dialysis, due to direct flood damage or to loss of power (Klinger <i>et al.</i>, 2014). ○ Being flooded is stressful and mental health impacts can be serious. Recorded psychological stresses caused by flooding in the UK and OECD (e.g. Tapsell <i>et al.</i>, 2002) include: post-traumatic stress disorder, depression, anxiety and domestic violence (Pendlebury and Bates, 2015). A delayed increase in suicide rates has been observed following natural disasters, although the evidence of this after flood events is very limited (Kolves <i>et al.</i>, 2013). Many of these psychological effects last much longer (2+ years) than any adverse physical health effects (Tapsell <i>et al.</i>, 2002). While post-event stress is likely to affect everyone, those with existing mental health conditions are likely to suffer the most (Sims <i>et al.</i>, 2008; Waite <i>et al.</i>, 2017).

- Telephone connectivity and transport routes are often disrupted during flood events making it difficult for carers to contact and reach their patients that are receiving care at home (Age UK, 2016). This was a problem in Lancashire during the flooding in 2015 caused by Storm Desmond.

Data Sources

ID	Indicator description	Source and provider	Date	Indicator processing details	Spatial Unit			
					Eng	Wales	Scot	NI
h1	Disability / people in ill- health (% people whose day- to-day activities are limited)	Census, ONS	2011	Census table KS301. Number of people whose day to day activities are limited a lot + number of people whose day to day activities limited a little, divided by the total population and multiplied by 100.	LSOA	LSOA	DZ	SOA
h2	% households with at least one person with long term limiting illness	Census, ONS	2011	Census table KS106. Number of households with one or more persons with a long-term health problem or disability divided by the total number of households and multiplied by 100.	LSOA	LSOA	DZ	SOA

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Waite, T. D., Chaintarli, K., Beck, C., Bone, A., Amlôt, R., Kovats, S., Reacher, M., Armstrong, B., Leonardi, G., Rubin, J., and Oliver, I. (2017). The English national cohort study of flooding and health: cross-sectional analysis of mental health outcomes at year one. DOI: 10.1186/s12889-016-4000-2

Item	Description
Reference	I1, I2, I3, I4 & I5
Theme	Vulnerability
Hazard reference	Flood (Revised Data, 2017)
Characteristic	Inability to Prepare, Respond and Recover
Indicator	Income
Supporting Variable	See table below
Assumption	Higher proportions of people on low incomes in an area indicate a higher vulnerability. Low income households are more vulnerable to flooding due to the effect of low income on people’s ability to adapt (to prepare for events, respond to them when they occur and recover from them afterwards).
Evidence supporting the use of this supporting variable	<ul style="list-style-type: none"> • More information about people on low incomes and social vulnerability, as well as what can be done to help, is available in the main site. http://www.climatejust.org.uk/messages/people-low-incomes • Some of the specific evidence for this indicator includes: <ul style="list-style-type: none"> ○ Low income households are less likely to have the capacity to fully prepare for future floods (through insurance and property level measures). ○ Low income households are less likely to own their own home. Housing tenure together with low income may restrict people’s ability to make modifications to the home they do not own (Fielding and Burningham, 2005). ○ A lack of savings restricts the ability of households to respond immediately to flood damage, e.g. through spending on repairs and replacements that would kick-start a recovery process. (Tapsell <i>et al.</i>, 2002) ○ Disruption of transport systems by flood events is likely to particularly affect people who depend upon (rather than choose to use) public transport to get to their place of work or to access other services (for example, public transport is typically more used by low income households).

Data Sources

ID	Indicator description	Source and provider	Date	Indicator processing details	Spatial Unit			
					Eng	Wales	Scot	NI
i1	Unemployed (% unemployed)	Census, ONS	2011	KS501, % Unemployed in population aged 16 -74	LSOA	LSOA	DZ	SOA
i2	Long-term unemployed (% who are LTU or who have never worked)	Census, ONS	2011	Census table KS611. Number of people aged 16- 74 'never worked and long- term unemployed' divided by the total number of people aged 16-74 and multiplied by 100.	LSOA	LSOA	DZ	SOA
i3	Low income occupations (% in routine or semi-routine occupations)	Census, ONS	2011	Census table KS611. Number of people aged 16- 74 in routine occupations + number of people in semi- routine occupations divided by all people aged 16 to 74 and multiplied by 100	LSOA	LSOA	DZ	SOA
i4	Households with dependent children and no adults in employment (%)	Census, ONS	2011	Census table KS106. Number of households 'No adults in employment in household: With dependent children' divided by the total number of households and multiplied by 100.	LSOA	LSOA	DZ	SOA
i5	People income deprived (%)	ONS, National Records of Scotland, Northern Ireland Department for Communities	2010	England: IMD; Average Weekly Household Net Income Estimate (equivalised after housing costs); Scotland: SIMD Income index, i.e. "percentage of people income deprived"; Wales: As England; Northern Ireland: NIIMD 2010	LSOA	LSOA	DZ	SOA

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Item	Description
Reference	K1
Theme	Vulnerability
Hazard reference	Flood (Revised Data, 2017)
Characteristic	Inability to Prepare and Respond
Indicator	Local Knowledge
Supporting Variable	New migrants from outside the local area
Assumption	Higher proportions of people who are new to an area indicate a higher vulnerability. They have a lower ability to adapt (to prepare for events and respond to them) because they may be less aware that their new community has a flood risk issue and have less knowledge about what to do if affected.
Evidence supporting the use of this supporting variable	<ul style="list-style-type: none"> • More information about the issues faced by people who are new to an area, as well as what can be done to help, is available in the main site. http://www.climatejust.org.uk/messages/people-who-have-lived-area-short-time • Communities where population turnover is high may be less aware of the likelihood of being affected by events like floods, how to respond and where to seek support (Penning-Rowsell <i>et al.</i>, 1986). • People who have recently moved into an area may lack awareness of local flood risk provided through family and community clues. Blaikie <i>et al.</i> (1994) states that lack of knowledge and information is one of the most important underlying reasons for vulnerability (Werritty <i>et al.</i>, 2007). • People living in rural areas tend to have more knowledge of local flood risk compared to urban areas, not least (but not exclusively) because they have longer residence times (Penning-Rowsell <i>et al.</i>, 1986).

Data Sources

ID	Indicator description	Source	Date	Indicator processing details	Spatial Unit			
					Eng	Wales	Scot	NI
k1	New migrants from outside the local area	Census, ONS	2011	Census table UKMIG001. Number of people who 'Lived elsewhere one year ago outside the area but within 'associated area" + 'Lived elsewhere one year ago outside the 'associated area' but within the UK' (where associated area is the next level up in the census geography hierarchy, i.e. local authority in this case), divided by the total number of residents and multiplied by 100.	MSOA ¹	MSOA	DZ	SOA

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¹ MSOA level results are sampled to neighbourhood by picking the value from the MSOA that the neighbourhood lies in. A neighbourhood lies entirely within 1 MSOA and do not t cross MSOA boundaries.

Item	Description
Reference	L1
Theme	Vulnerability
Hazard reference	Flood (Revised Data, 2017)
Characteristic	Community Support
Indicator	Housing Characteristics
Supporting Variable	% caravan or other mobile or temporary structures
Assumption	Higher proportions of households living in caravan or other mobile or temporary structures in an area indicate a higher vulnerability. Poor quality housing provide more limited protection against flood waters than structurally competent buildings
Evidence supporting the use of this supporting variable	<ul style="list-style-type: none"> • Flood waters can devastate homes in caravan or other mobile/temporary structures, and even place life at risk. • Response to flood warnings is also likely to be lower in these properties as residents are less likely to be able to move their possessions to a place of safety (Thrush <i>et al.</i>, 2005). • Caravans are considered in project appraisals as moveable in times of flood and therefore do not benefit from having any damage avoided as counted against the costs of flood defences (Penning-Rowse <i>et al.</i>, 2013). Hence within the standard assessment of damages caravans rarely feature. Residents of caravans are also more likely to have a limited knowledge of the local area (McEwen <i>et al.</i>, 2002).

Data Sources

ID	Indicator description	Source and provider	Date	Indicator processing details	Spatial Unit			
					Eng	Wales	Scot	NI
I1	% caravan or other mobile or temporary structures in all households	Census, ONS	2011	Census table KS401. 'All household spaces: Caravan or other mobile or temporary structure' divided by the total number of households and multiplied by 100.	LSOA	LSOA	DZ	SOA

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Item	Description
Reference	M1, M2 & M3
Theme	Vulnerability
Hazard reference	Flood (Revised Data, 2017)
Characteristic	Ability to Respond and Ability to Recover
Indicator	Physical mobility
Supporting Variable	Disability (M1), People living in medical and care establishments (M2), Availability of private transport (M3)
Assumption	Higher proportions of people with low personal, physical mobility in an area indicate a higher vulnerability. Limited physical mobility creates a number of practical challenges in preparing for, responding to and recovering from a flood. This means that impacts tend to be greater.
Evidence supporting the use of this supporting variable	<p>More information about people with low physical mobility and social vulnerability, as well as what can be done to help, is available in the main site. http://www.climatejust.org.uk/messages/people-low-personal-mobility</p> <ul style="list-style-type: none"> Someone with a disability will require a higher amount of resources and planning for them to reach the same level of wellbeing as someone without that disability and this should be reflected in disaster

management and evacuation plans (Cabinet Office, 2013).

- People with reduced mobility may be more reliant on others to assist them for example during evacuation either from their own homes or from serviced accommodation such as care homes. Disruption caused by a flood may prevent carers reaching those they care for and may leave assistance tools such as electronic lifts unusable.
- Where individuals are normally able to help themselves, any loss of power or internal flooding may severely reduce their capacity to do so.

Data Sources

ID	Indicator description	Source and provider	Date	Indicator processing details	Spatial Unit			
					Eng	Wales	Scot	NI
m1	High levels of disability (% of population who are disabled)	Census, ONS	2011	% with 'activities limited a lot'	LSOA	LSOA	DZ	SOA
m2	% people living in medical and care establishments	Census, ONS	2011	Census table QS421SC. Number of people in 'Medical and care establishments' divided by the total population and multiplied by 100.	LSOA	LSOA	DZ	SOA
m3	Lack of private transport (% households with no car or van)	Census, ONS	2011	Census table KS404SC. Number of households where 'Number of cars or vans in household: No cars or vans' divided by the total number of households and multiplied by 100.	LSOA	LSOA	DZ	SOA

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Item	Description
Reference	N1-3
Theme	Vulnerability
Hazard reference	Flood (Revised Data, 2017)
Characteristic	Community Support
Indicator	Social networks
Supporting Variable	N1 - % single-pensioner households N2 - % lone-parent households with dependent children N3 - % children of primary school age (4-11) in the population
Assumption	Higher proportions of people in an area who are socially isolated indicate a higher vulnerability. Socially isolated people are more vulnerable to flooding due to being less likely to ask for assistance. They are less likely to benefit from community knowledge, community activities and community responses. Similarly social cohesion may be less strong as a whole.
Evidence supporting the use of this supporting variable	<ul style="list-style-type: none"> • More information about people who are socially isolated and social vulnerability, as well as what can be done to help, is available in the main site. http://www.climatejust.org.uk/messages/people-who-are-socially-isolated • People with weaker social networks; <ul style="list-style-type: none"> ○ Struggle to maintain continuity of treatment in relation to physical or mental health treatments (WHO, 2013). Where social networks are relatively good there is evidence of a better response to emergency situations and quicker recovery (Preston <i>et al.</i>, 2014). ○ Face practical difficulties in responding to a flood where children are dependent on them as there is less direct within-the-family support (Tapsell <i>et al.</i>, 2002). ○ Adults who live alone (including those with dependent children) are more likely to struggle to take action when receiving a flood warning, for example it may be physically impossible to move furniture or other items, and they will also feel more uncertain and anxious with no-one to confide in (Thrush <i>et al.</i>, 2005). ○ Face difficulties in accessing short-term alternative accommodation from family and friends, and so are more likely to need to use public shelters in the event of an evacuation (Scawthorn <i>et al.</i>, 2006), but also may be less likely to know about the existence and location of such services.

- Informal networks are much reduced or even absent during a flood (Tapsell *et al.*, 2002; Penning-Rowell and Tapsell, 2002)
- People with pre-school age children can become socially isolated. However, those with school age children tend to have better local social networks (Corcoran *et al.*, 2010) and in many cases locally-focused charities reduce the social isolation of individuals (Kazmierczak *et al.*, 2015; Leisure Futures, 2011).
- Connections have been made between a lack of social or community networks and other factors which increase social vulnerability. For example, this is also linked to areas with highly transient populations, with residents less likely to have access to family or friends nearby (Zsomboky *et al.*, 2011). Individuals that are more likely to feel socially isolated include single parents, lone pensioners and new arrivals to an area.

Data Sources

ID	Indicator description	Source and provider	Date	Indicator processing details	Spatial Unit			
					Eng	Wales	Scot	NI
n1	% single-pensioner households	Census, ONS	2011	Census table QS113. Number of households 'One-person household: Aged 65 and over' divided by the total number of households and multiplied by 100.	LSOA	LSOA	DZ	SOA
n2	% lone-parent households with dependent children	Census, ONS	2011	Census table QS113. Number of households of lone parent with one or more dependent children divided by the total number of households and multiplied by 100.	LSOA	LSOA	DZ	SOA
n3	% children of primary school age (4-11) in the population	Census, ONS	2011	Census table QS103. Number of people aged '4- 11 years' divided by the total population and multiplied by 100.	LSOA	LSOA	DZ	SOA

Note: Data are reported and mapped at Local Authority level to avoid identifying any particular community services.

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Item	Description
Reference	T1 and T2
Theme	Vulnerability
Hazard reference	Flood (Revised Data, 2017)
Characteristic	Ability to Prepare
Indicator	Property Tenure
Supporting Variable	Private Renters (T1) and Social Renters (T2)
Assumption	<p>Higher proportions of people renting their homes in an area indicate a higher vulnerability. Tenants are more vulnerable to flooding because they have less ability than home owners to adapt their homes. As a result they may be less prepared.</p> <p>However, it should be noted that social tenants may be able to benefit from adaptations that are put in place by social landlords as part of wider measures. The two measures can be viewed separately if this is the case in your area.</p>
Evidence supporting the use of this supporting variable	<ul style="list-style-type: none"> • More information about people renting their homes and social vulnerability, as well as what can be done to help, is available in the main site. http://www.climatejust.org.uk/messages/tenants-0 • Social housing tenants may encounter difficulties in preparing for and responding to flooding due to their living arrangements and because they are likely to have a low income. • Tenants are often not allowed to make physical alterations to their properties, and leaseholders may be disinclined to as they may not feel the additional expense of making those changes is worthwhile given that they do not own the freehold. Landlords of social housing may be more inclined to make these alterations, but little quantified evidence exists. • Where tenants are permitted to make physical alterations to their dwellings, there is little incentive to do so. This may be because: <ul style="list-style-type: none"> I. Tenancies are often short, with limited security of tenure so these residents are likely to be less aware of the flood risk in their neighbourhoods; II. Tenants are generally less well-off than homeowners (The Poverty Site, 2014), and therefore cannot afford to install meaningful physical risk reducing measures. III. Tenants are less likely than homeowners to speak English as their first language and so may not be easily able to access information on flood risk and preparedness.
Data Sources	

ID	Indicator description	Source and provider	Date	Indicator processing details	Spatial Unit			
					Eng	Wales	Scot	NI
t1	Recent arrivals to UK (% people with <1 yr residency coming from outside UK)	Census, ONS	2011	Census table QS801. Number of people within year of arrival 'Arrived 2010- 2011' divided by the total number of people and multiplied by 100.	LSOA	LSOA	DZ	SOA
t2	Level of proficiency in English	Census, ONS	2011	Census table QS205. Number of people 'Does not speak English at all' + 'Does not speak English well', divided by the total number of people and multiplied by 100.	LSOA	LSOA	DZ	SOA

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Item	Description
Theme	Neighbourhood Flood Vulnerability Index (NFVI)
Hazard reference	Flood (Revised data, 2017)
Definition	<p>The new Neighbourhood Flood Vulnerability Index (NFVI) provides insight into the social vulnerability of a neighbourhood should a flood occur. The NFVI combines five characteristics of vulnerability:</p> <ul style="list-style-type: none"> • 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. <p>The map tool contains maps for each of the above characteristics. The characteristics layers are made up of indicators like Age and Health (which are mapped separately) and a series of supporting variables, each of which has its own information sheet. Map categories are given according to 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. See the technical guide for more information.</p>
References	<p>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. Available here</p>

Item	Description
Theme	Social Flood Risk Index (SFRI)
Hazard reference	Flood (Revised data, 2017)
Definition	<p>The level of social flood risk (SFRI) at a neighbourhood scale is a measure of geographic flood disadvantage (i.e. where social vulnerability and exposure to flooding coincide).</p> <p>The SFRI is a relative index and has no defined units. 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. Social flood risk maps are provided for two flood themes:</p> <ul style="list-style-type: none"> • pluvial (surface water) flooding • coastal and fluvial flooding combined. <p>Social flood risk maps cover three different scenarios:</p> <ul style="list-style-type: none"> • 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. <p>Social flood risk is given as two different measures for each neighbourhood:</p> <ul style="list-style-type: none"> • 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.
<p>References</p> <p>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. Available here</p>	

Item	Description
Reference	S1, S2, S3 & S4
Theme	Vulnerability
Hazard reference	Flood (Revised Data, 2017)
Characteristic	Community Support
Indicator	Service availability
Supporting Variable	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
Assumption	Higher proportions of services at risk of flooding at a level of 1:75 or greater within an area indicate a higher vulnerability. A community is likely to see greater overall impacts if its local services are also affected by flooding, e.g. leading to difficulties accessing emergency or health services.
Evidence supporting the use of this supporting variable	<ul style="list-style-type: none"> • Various studies, including by the National Flood Forum, highlight the link between the degree of support provided by institutional (such as the police, the fire brigade, ambulances and local authority social care) and community support networks and the vulnerability of the individuals in those communities. Higher levels of post-flood institutional support can accelerate the pace of recovery². • Emergency services will aim to target the most vulnerable households in assistance efforts but the ability to do this effectively relies on the flood resilience of these services themselves. During the 2010 flood in Cockermouth, Cumbria, the police station itself was flooded which hampered the coordination of the relief effort and therefore increasingly the vulnerability of the population to the flood (BBC, 2010). • If a school floods, children are often temporarily transferred to other schools which may be some distance away while the original school is restored. This adds to family disruption and dislocation, increasing their vulnerability³. • The location of services that should remain accessible throughout a flood event, such as GP surgeries, is very important, especially as they can be essential in relief plans (Kazmierczak and Kenny, 2011). • If care or nursing homes are flooded, highly vulnerable residents must be evacuated and

² <http://www.nationalfloodforum.org.uk/flood-recovery-and-empowering-grassroots-communities/> Accessed Oct 2016

³ <http://www.nationalfloodforum.org.uk/flood-recovery-and-empowering-grassroots-communities/> Accessed Oct 2016

suitable placements for them have to be found. If a care home or hospital is in a flood prone area, it is also likely that many of its employees will also live in the flood risk area, or will have to travel through a flooded area. Additionally, care homes will also often take in vulnerable residents who have been evacuated from their own homes. This system is severely hampered if the care home itself is flooded (Donovan, 2014).

Data Sources

ID	Indicator description	Source and provider	Date	Indicator processing details	Spatial Unit			
					Eng	Wales	Scot	NI
s1	% of emergency services exposed to flooding	CCRA, Sayers et al, 2015	2011	Based on query of sites against hazard data to identify proportion of sites at risk of flooding 1:75 or greater	LA	LA	LA	LA
s2	% no. of care homes exposed to flooding	CCRA, Sayers et al, 2015	2011	Based on query of sites against hazard data to identify proportion of sites at risk of flooding 1:75 or greater	LA	LA	LA	LA
s3	% no. of GP surgeries exposed to flooding	CCRA, Sayers et al, 2015	2011	Based on query of sites against hazard data to identify proportion of sites at risk of flooding 1:75 or greater	LA	LA	LA	LA
s4	% no. of schools exposed to flooding	CCRA, Sayers et al, 2015	2011	Based on query of sites against hazard data to identify proportion of sites at risk of flooding 1:75 or greater	LA	LA	LA	LA

Office for National Statistics, 2011 Census: Aggregate data (England and Wales) [computer file]. UK Data Service Census Support. Downloaded from: <http://infuse.mimas.ac.uk>. This information is licensed under the terms of the Open Government Licence [<http://www.nationalarchives.gov.uk/doc/open-government-licence/version/2>].

Office for National Statistics, 2011 Census: Digitised Boundary Data (England and Wales) [computer file England_Isoa_2011_clipped.shp and Wales_Isoa_2011_clipped.shp]. UK Data Service Census Support. Downloaded from: borders.ukdataservice.ac.uk Downloaded 10-06-14.

Scotland boundaries (Data Zones) Downloaded from: gov.scot/Topics/Statistics/sns/BoundMap Downloaded 5-11-14.

Further data for Scotland is available from <http://statistics.gov.scot/>

Based upon 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. Available [here](#)

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