INFO SHEETS - COMBINED

Introduction

Central to the Climate Just website is an understanding of the social impacts of climate change with a focus specifically upon the impacts in disadvantaged communities. It aims to help local authorities and their partners working in other sectors to develop the skills, knowledge and expertise necessary to adapt to the impacts of climate change.

The map tool is a key element of this work and is designed as a platform to display spatial data and provide information to improve understanding of climate change issues in neighbourhoods across the UK, to facilitate adaptation planning and decision-making, and support the spatial targeting of adaptation responses. While not all data resources and supporting materials are available for the whole of the UK, new data for flooding have been added in 2018 which extend the focus from England.

The spatial data and information included in the portal help to build the evidence base available to decision makers and other stakeholders when developing climate change adaptation plans and strategies. The map tool is for all stakeholders, including community members, to visualise vulnerability, exposure and climate hazards within a particular location, thus raising awareness, aiding decision-making and facilitating community and stakeholder participation in formulating appropriate adaptation responses.

What does this document contain?

This document contains all of the 'info' notes that are attached to the majority of the map layers in the map tool. The majority of the map layers come with a hyperlink to additional 'info' notes that explain what that mapped dataset shows. Some of the ‘info’ notes contain a theme and description (e.g. for hazard data). The more detailed ‘info’ notes include the following sections:

For Flood-related *Neighbourhood Flood Vulnerability Index* supporting variables

- Item
- Reference
- Theme
- Hazard reference
- Characteristic
- Indicator
- Supporting Variable
- Assumption
- Evidence supporting the use of this supporting variable
- Data Sources
- References

For Heat-related *socio-spatial vulnerability* indicators

- Theme
- Hazard reference
- Dimension
- Domain
- Indicator
- Assumption
- Confidence level
- Guidance for the use of this indicator
- Data Source

'Info' sheets are also provided for:

- Neighbourhood Flood Vulnerability Index
- Social Flood Risk Index
- Social-spatial heat vulnerability dimensions
- Heat disadvantage
- Heat Hazard

Neighbourhood Flood Vulnerability Index supporting variables

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	• 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:
	  ○ 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].

Office for National Statistics, 2011 Census: Digitised Boundary Data (England and Wales) [computer file England_lsoa_2011_clipped.shp and Wales_lsoa_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

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	• 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: ○ The number of deaths caused by the 1953 'Big Flood' was highest among older people (Baxter, 2005), with people over 60 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 UK case studies; these showed that people over 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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Office for National Statistics, 2011 Census: Digitised Boundary Data (England and Wales) [computer file England_lsoa_2011_clipped.shp and Wales_lsoa_2011_clipped.shp]. UK Data Service Census Support. Downloaded from: borders.ukdataservice.ac.uk Downloaded 10-06-14.
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References

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 & Eng. Sciences, 363: 1831, 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	• 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 multiple locks on doors and windows; this can cause delays in evacuation and rescue attempts. • 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).

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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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	• 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 *et al.*, 2005; McCarthy *et al.*, 2006; Tunstall *et al.*, 2006). • Fielding *et al.* (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 *et al.*, 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	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. F2 Higher proportions of people with low proficiency in English in an area indicate higher vulnerability.
Evidence supporting the use of this supporting variable	• 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 & 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

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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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	• 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: ○ 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 *et al.*, 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 *et al.*, 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 *et al.*, 2013). Many of these psychological effects last much longer (2+ years) than any adverse physical health effects (Tapsell *et al.*, 2002). While post-event stress is likely to affect everyone, those with existing mental health conditions are likely to suffer the most (Sims *et al.*, 2008; Waite *et al.*, 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

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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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. 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
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	• 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: ○ 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 *et al.*, 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 *et al.*, 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 *et al.*, 2013). Many of these psychological effects last much longer (2+ years) than any adverse physical health effects (Tapsell *et al.*, 2002). While post-event stress is likely to affect everyone, those with existing mental health conditions are likely to suffer the most (Sims *et al.*, 2008; Waite *et al.*, 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 from Storm Desmond.

Data Sources

ID	Indicator description	Source and provider	Date	Indicator processing details	Spatial Unit			
					Eng	Wales	Scot	NI
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.
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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. 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
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	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	• 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: ○ 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 *et al.*, 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	• 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 *et al.*, 1986). • People who have recently moved into an area may lack awareness of local flood risk provided through family and community clues. Blaikie *et al.* (1994) states that lack of knowledge and information is one of the most important underlying reasons for vulnerability (Werritty *et al.*, 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 *et al.*, 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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Further data for Scotland is available from http://statistics.gov.scot/

[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.

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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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	• 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 *et al.*, 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-Rowsell *et al.*, 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 *et al.*, 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	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 • 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	• 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;
	  ○ 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 *et al.*, 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 *et al.*, 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 *et al.*, 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 *et al.*, 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-Rowsell 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 (Zsamboky *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	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. 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.
Evidence supporting the use of this supporting variable	• 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: 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
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	• 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 recovery[2]. • 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 vulnerability[3]. • 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 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).

[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

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

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Kazmierczak, A. and Kenny, C. (2011) Risk of flooding to infrastructure in Greater Manchester. Manchester: The University of Manchester.

Other Flood-related data: *Neighbourhood Flood Vulnerability Index* & *Social Flood Risk Index*

Item	Description
Theme	Neighbourhood Flood Vulnerability Index (NFVI)
Hazard reference	Flood (Revised data, 2017)
Definition	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: • **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. 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.

References

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

Item	Description
Theme	Social Flood Risk Index (SFRI)
Hazard reference	Flood (Revised data, 2017)
Definition	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). 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: • **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. 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.

References

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

Heat *socio-spatial vulnerability* indicators

Item	Description
Reference	AT0_1, AT1_1, AT2_1
Theme	Vulnerability
Hazard reference	Heat
Dimension	Ability to Prepare, Respond and Recover
Domain	Income
Indicator	**Unemployment (% working population unemployed)**
Assumption	Higher proportions of unemployed people in an area indicate a higher vulnerability because of their likelihood to be on lower incomes relative to other people.
Confidence level	High
Guidance for the use of this indicator	Unemployment is a recognised proxy indicator of financial deprivation; indeed, the unemployed are nearly twice as likely to experience persistent poverty compared to the population as a whole. Adaptation should address the needs of people who have lower incomes. This is because a lack of financial resources may restrict people's access to some ways of preparing for, responding to and recovering from hazard events. A range of actions appropriate to tackling these difficulties is given in our dedicated pages on this topic. Unemployment is commonly used as a measure of vulnerability[4]. For example, unemployment or irregular employment may reduce the opportunities for obtaining insurance. Unemployment is linked to other social characteristics, such as being in social or privately rented housing and a greater tendency to have poor physical and mental health. Although unemployment is taken as an indicator of a tendency towards high vulnerability, it may reduce vulnerability in some cases. For example, unemployed people may benefit from being able to respond quickly to events like heat-waves and potentially getting assistance through social housing. Additional, more refined, data may be available at the local level.
Data Source	Census, 2011, KS501, % Unemployed in population aged 16 -74 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]. UK Data Service Census Support. Downloaded from: http://edina.ac.uk/census

4 Twigger-Ross, C and Orr, P (2012) The UK Climate Change Risk Assessment 2012 Evidence Report Project

D.4.2.1 Release 7 Annex B: Social Vulnerability to Climate Change Impacts

Item	Description
Reference	AT0_2, AT1_2, AT2_2
Theme	Vulnerability
Hazard reference	Heat
Dimension	Ability to Prepare, Respond and Recover
Domain	Income
Indicator	**Low income occupations (% in routine or semi-routine occupations)**
Assumption	Higher proportions of people employed in routine and semi-routine jobs in an area indicate a higher vulnerability because of their likelihood to be on lower incomes relative to other people.
Confidence level	High
Guidance for the use of this indicator	All other things being equal, people working in routine or semi-routine occupations tend to be on lower incomes compared to those in other occupational groups. Therefore this indicator is used as a proxy for low incomes. Average levels of wealth for households headed by people working in routine occupations has been estimated to be only 14% of those of working in employment classified as 'large employer or higher managerial'[5]. Adaptation should address their needs because a lack of financial resources may restrict people's access to some ways of preparing for, responding to and recovering from hazard events. A range of actions appropriate to tackling these difficulties is given in our dedicated pages on this topic. People working in routine and semi-routine occupations may also be vulnerable for other reasons, such as higher exposure to hazards due to the characteristics of their jobs or increased sensitivity due to being more likely to be in ill-health. Some actions might be targeted through employers – so-called inward looking adaptation which can be part of a wider drive to improve working conditions – or through trades associations, clubs or societies. Measures can include training, provision of appropriate equipment and clothing, improving working environments, consideration of accessibility issues (e.g. during extreme weather) and broader awareness raising. Additional, more refined, data may be available at the local level.
Data Source	Census, 2011, KS611, % people in routine and semi-routine occupations 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]. UK Data Service Census Support. Downloaded from: http://edina.ac.uk/census

5 Office for National Statistics Wealth and Assets Survey 2006-8, cited in the Marmot Review (2010, p77)

Item	Description
Reference	AT0_3, AT1_3, AT2_3
Theme	Vulnerability
Hazard reference	Heat
Dimension	Ability to Prepare, Respond and Recover
Domain	Income
Indicator	**Long-term unemployed (% who are LTU or who have never worked)**
Assumption	Higher proportions of people in an area who are long-term unemployed or who have never worked indicate a higher vulnerability because of their likelihood to be on lower incomes relative to other people.
Confidence level	High
Guidance for the use of this indicator	Unemployment is a recognised indicator of financial deprivation (see Unemployment info). The challenges facing the unemployed are heightened in terms of the long-term unemployed. Therefore this indicator is used as a proxy for low incomes. Average levels of wealth for households headed by people who are long-term unemployed or who have never worked are just 3% of those of working in employment classified as 'large employer or higher managerial'[6]. Adaptation should address the needs of people who have lower incomes. This is because a lack of financial resources may restrict people's access to some ways of preparing for, responding to and recovering from hazard events. A range of actions appropriate to tackling these difficulties is given in our dedicated pages on this topic. Although unemployment is taken as an indicator of a tendency towards high vulnerability, it may reduce vulnerability in some cases. For example, unemployed people may benefit from being able to respond quickly to events like heat-waves and potentially getting assistance through social housing. Additional, more refined, data may be available at the local level.
Data Source	Census, 2011, KS611, % people who never worked + % people in long-term unemployment 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]. UK Data Service Census Support. Downloaded from: http://edina.ac.uk/census

6 Office for National Statistics Wealth and Assets Survey 2006-8, cited in the Marmot Review (2010, p77)

Item	Description
Reference	AT0_4, AT1_4, AT2_4
Theme	Vulnerability
Hazard reference	Heat
Dimension	Ability to Prepare, Respond and Recover
Domain	Income
Indicator	**Households with dependent children and no adults in employment (%)**
Assumption	Higher proportions of unemployed people with dependent children in an area indicate a higher vulnerability because of their likelihood to be on lower incomes relative to other people.
Confidence level	High
Guidance for the use of this indicator	Unemployment is a recognised indicator of financial deprivation (see Unemployment Info) and is commonly used as a measure of vulnerability. The indicator is therefore used as a proxy for low incomes. Adaptation should address the needs of people who have lower incomes. This is because a lack of financial resources may restrict people's access to some ways of preparing for, responding to and recovering from hazard events. When people who are unemployed have additional caring responsibilities, it may place further stresses upon them. Despite having additional financial support, compared with unemployed people without dependents, it may be insufficient to fully compensate for the additional financial burdens required to effectively prepare for, respond to and recover from events like heat-waves. Additional, more refined, data may be available at the local level.
Data Source	Census, 2011, KS106, % households with no adults in employment and dependent children 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]. UK Data Service Census Support. Downloaded from: http://edina.ac.uk/census

Item	Description
Reference	AT0_9, AT1_9, AT2_9
Theme	Vulnerability
Hazard reference	Heat
Dimension	Ability to Prepare, Respond and Recover
Domain	Income
Indicator	**Weekly household income estimate (Pounds)**
Assumption	Lower mean weekly household incomes in an area indicate a higher vulnerability.
Confidence level	High
Guidance for the use of this indicator	People on low incomes are less able to prepare for, respond to and recover from extreme weather events, for example due to struggling to afford home insurance. See our dedicated pages on this topic for more information on actions associated with this group. The mapped indicator shows weekly incomes from low to high. It is therefore important to note that in contrast with most other indicators in the portal where higher values represent higher vulnerability, higher values for this indicator indicate lower vulnerability. Additional, more refined, data may be available at the local level.
Data Source	Office of National Statistics 2007-2008, Income: Model-Based Estimates at MSOA Level Office for National Statistics, 2011 Census: Digitised Boundary Data (England and Wales) [computer file]. UK Data Service Census Support. Downloaded from: http://edina.ac.uk/census

Item	Description
Reference	AT0_10, AT1_10, AT2_10
Theme	Vulnerability
Hazard reference	Heat
Dimension	Ability to Prepare, Respond and Recover
Domain	Income
Indicator	**All pensioner households**
Assumption	All pensioner households tend to have lower incomes compared to other – particularly working – households and this indicates a higher vulnerability.
Confidence level	Medium
Guidance for the use of this indicator	This indicator is used as a proxy for low incomes. Adaptation should address their needs because a lack of financial resources may restrict people's access to some ways of preparing for, responding to and recovering from hazard events. A range of actions appropriate to tackling these difficulties is given in our dedicated pages on this topic. This indicator has a medium level of confidence as there is a very high variability in incomes within the pensioner group. Furthermore, there is some evidence that all pensioner households tend to have proportionally higher incomes than single pensioner households, particularly compared to single female pensioners. Therefore users may wish to review the data layer showing patterns with single pensioner households, which for the purposes of this mapping work, is used as a proxy indicator of social networks. Additional, more refined, data may be available at the local level.
Data Source	Census 2011, QS113, % all pensioner households 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]. UK Data Service Census Support. Downloaded from: http://edina.ac.uk/census

Item	Description
Reference	AT0_11
Theme	Vulnerability
Hazard reference	Heat
Dimension	Ability to Prepare
Domain	Tenure
Indicator	**Social renters (% Households renting from Social or Council landlords)**
Assumption	Higher proportions of social renters in an area indicate a higher vulnerability as renters have a lower ability to adapt their homes.
Confidence level	High
Guidance for the use of this indicator	Social renters are less able to prepare for extreme weather events, for example due to inability to modify their homes to prepare for hot weather. See our dedicated pages on this topic for more information and for actions associated with this group. Additional, more refined, data may be available at the local level.
Data Source	Census 2011, KS402, % households social rented: council (rented from local authority) + % households social rented: other 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]. UK Data Service Census Support. Downloaded from: http://edina.ac.uk/census

Item	Description
Reference	AT0_12
Theme	Vulnerability
Hazard reference	Heat
Dimension	Ability to Prepare
Domain	Tenure
Indicator	**Private renters (% Households)**
Assumption	Higher proportions of private renters in an area indicate a higher vulnerability as renters have a lower ability to adapt their homes.
Confidence level	High
Guidance for the use of this indicator	Private renters are less able to prepare for extreme weather events, for example due to inability to modify their homes to prepare for hot weather. See our dedicated pages on this topic for more information and for actions associated with this group. Additional, more refined, data may be available at the local level.
Data Source	Census 2011, KS402, % households Private Rented; Private Landlord or Letting Agency + % households Private Rented; Other 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]. UK Data Service Census Support. Downloaded from: http://edina.ac.uk/census

Item	Description
Reference	AT0_13, AT1_12, AT2_12
Theme	Vulnerability
Hazard reference	Heat
Dimension	Ability to Prepare, Ability to Respond, Ability to Recover
Domain	Information use - language
Indicator	**Born outside UK/Ireland (%)**
Assumption	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.
Confidence level	Medium
Guidance for the use of this indicator	People born outside of the UK and Ireland are less able to prepare for, respond to and recover from extreme weather events than other people. All other things being equal, people in this group are more likely to have difficulty obtaining and using information and guidance provided to the general public. However, some within this group may have English as their mother tongue and/or have no difficulties understanding the English language. Note that the indicator source was selected to allow a more direct comparison with the equivalent 2001 indicator. An improved indicator (QS205EW) 'Proficiency in English' has been made available for the first time in 2011.
Data Source	Census 2011, KS204, % Born outside UK and Ireland 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]. UK Data Service Census Support. Downloaded from: http://edina.ac.uk/census

Item	Description
Reference	AT0_26_AT1_39_AT2_53
Theme	Vulnerability
Hazard reference	Heat
Dimension	Ability to Prepare, Ability to Respond, Ability to Recover
Domain	Information use - language
Indicator	**Recent arrivals to UK (% arrived in UK less than a year ago)**
Assumption	Higher proportions of people recently arrived from outside the UK in an area indicate a higher vulnerability.
Confidence level	Medium
Guidance for the use of this indicator	People recently arrived from outside of the UK are less able to prepare for, respond to and recover from extreme weather events than other people. They are more likely to have difficulty obtaining and using information and guidance provided to the general public. However, some within this group may have English as their mother tongue and/or have no difficulties understanding the English language. They are also likely to have less local knowledge and less familiarity with national and local services. Note that the indicator source was selected to allow a more direct comparison with the equivalent 2001 indicator. An improved indicator (QS205EW) 'Proficiency in English' has been made available for the first time in 2011.
Data Source	Census 2011, QS801, % people with <1 yr residency coming from outside UK 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]. UK Data Service Census Support. Downloaded from: http://edina.ac.uk/census

Item	Description
Reference	AT1_23, AT2_18
Theme	Vulnerability
Hazard reference	Heat
Dimension	Ability to Respond and Ability to Respond
Domain	Social networks
Indicator	**Single pensioner households (%)**
Assumption	Areas with higher proportions of single pensioner householders are more likely to have socially isolated people and therefore higher social vulnerability compared to areas with lower proportions of single pensioner households.
Confidence level	Medium
Guidance for the use of this indicator	Adaptation needs to address the specific challenges associated with places with a higher proportion of single pensioner households (as is measured by this indicator), but more specifically places where communities are likely to have socially isolated individuals with poor social networks. However, it is also important to develop actions to target places where there may be fewer single pensioner households but where individuals might still be socially or physically isolated, perhaps within areas which otherwise have low social vulnerability. Responses in places with high concentrations of single pensioner households may differ from those in places with low concentrations, for example, if there are more intermediary organisations or networks such as community organisations who can work with older people with particular needs. See the separate message on social isolation for more evidence and possible responses. Additional, more refined, data on older people, their relative sensitivities and other characteristics which tend to make them more or less vulnerable may be available at the local level.
Data Source	Census, 2011, QS113, % Single pensioner household 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]. UK Data Service Census Support. Downloaded from: http://edina.ac.uk/census

Item	Description
Reference	AT1_26, AT2_21
Theme	Vulnerability
Hazard reference	Heat
Dimension	Adaptive capacity: Ability to respond and ability to recover
Domain	Social networks
Indicator	**% lone parent households with dependent children**
Assumption	A higher proportion of lone parents with dependent children is assumed to be a proxy indicator of higher vulnerability as a result of potential isolation.
Confidence level	Low – this is a proxy measure and its suitability is open to debate.
Guidance for the use of this indicator	Adaptation needs to address the specific challenges associated with places with a higher proportion of lone parents with dependent children (as is measured by this indicator), but more specifically places where communities are likely to include socially isolated people who have poor social networks. The use of this indicator as a proxy for social networks and the assumption that higher proportions of lone parents with dependent children may result in more potential for isolation is open to debate. There is conflicting evidence which points to both the potential for stronger networks and also the chance for higher rates of isolation within this group. Although this indicator is used as a proxy measure of networks, considering the distributions of lone parents with dependent children may be helpful as an indicator of other vulnerability factors since this also points to greater responsibilities which may reduce their capacity for responding to extreme events relative to other groups. Other measures of social networks for people with young children may be available from internal data sources or from local organisations working with vulnerable people.
Data Source	Census, 2011, % Lone parent households with dependent children 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]. UK Data Service Census Support. Downloaded from: http://edina.ac.uk/census

Item	Description
Reference	AT1_28, AT2_23
Theme	Vulnerability
Hazard reference	Heat
Dimension	Ability to Respond and Ability to Recover
Domain	Social networks
Indicator	**Lack of carers (% people not providing unpaid care)**
Assumption	Areas with higher proportions of unpaid carers – i.e. communities where more people provide a caring role outside of formal employment - are assumed to be associated with more extensive social networks compared to areas with higher proportions.
Confidence level	Low
Guidance for the use of this indicator	Adaptation needs to address the specific challenges associated with places with poorer social networks. There is evidence that the process of providing care helps to extend social networks and enhance wider 'social capital'[7] for both the carers and those being cared for. In turn, social capital has been shown to be connected to health benefits in both individuals and also wider communities. However, the use of this indicator as a proxy for social networks is open to debate. Higher proportions of unpaid caring can be indicative of higher proportions of ill-health in an area. Furthermore, there is evidence that unpaid carers themselves tend to have less good health compared to the health of people not providing unpaid care. It could also be argued that in some cases unpaid carers might be more isolated than other people as a result of the demands of their caring duties. They may face specific challenges when faced with extreme events. The low level of confidence in this particular indicator is also influenced by unpaid carers encompassing a very broad group. The indicator does not differentiate types of carers, who they care for and on what basis or level of paid care provision. More detailed local datasets may be available to help refine this indicator in the context of particular local circumstances.
Data Source	Census, 2011, KS301, % people who not provide unpaid care (original data subtracted from 100%) 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]. UK Data Service Census Support. Downloaded from: http://edina.ac.uk/census

7 Putnam et al (1993:167) define social capital as those "features of social organization, such as trust, norms, and networks that can improve the efficiency of society by facilitating coordinated actions". Putnam RD, Leonardi R, Nanenetti R (1993). Making democracy work: civic traditions in modern Italy. Princeton, NJ, Princeton University Press.

Item	Description
Reference	AT1_29, AT2_24
Theme	Vulnerability
Hazard reference	Heat
Dimension	Ability to Respond
Domain	Mobility
Indicator	**Disability (% people whose day-to-day activities are limited a lot)**
Assumption	Areas with larger proportions of people whose day-to-day activities are limited a lot are more likely to be communities with mobility problems and therefore have higher social vulnerability compared with communities with lower proportions of people whose day-to-day activities are limited a lot.
Confidence level	High
Guidance for the use of this indicator	Adaptation needs to address the specific challenges associated with places with a higher proportion of people whose day-to-day-activities are limited a lot (as is measured by this indicator). However, it is also important to develop actions to support people with disability-related mobility problems more generally, perhaps within areas which otherwise have low social vulnerability.
Data Source	Census, 2011, KS301, % of people whose day to day activities are limited a lot 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]. UK Data Service Census Support. Downloaded from: http://edina.ac.uk/census

Item	Description
Reference	AT1_30, AT2_25
Theme	Vulnerability
Hazard reference	Heat
Dimension	Ability to Respond and Ability to Recover
Domain	Mobility
Indicator	**Lack of private transport (% households with no car or van)**
Assumption	Areas with higher proportions of households which have no private transport are more likely to be communities with mobility problems and therefore have higher social vulnerability compared with communities with lower proportions of households with no private transport.
Confidence level	High
Guidance for the use of this indicator	Adaptation needs to address the specific challenges associated with places with a higher proportion of households with no private transport. This may restrict people's ability to respond during events like heatwaves and to assist dependents, for example. Furthermore, they may be particularly affected during disruptions to public transport services. It is also important to consider how householders with no private transport might be supported more generally, perhaps within areas which otherwise have low social vulnerability. For example, this may be through community-based solutions, such as help with organizing car sharing and dedicated transport during extreme events. Additional, more refined, data may be available at the local level.
Data Source	Census, 2011, KS404, % households with no car 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]. UK Data Service Census Support. Downloaded from: http://edina.ac.uk/census

Item	Description
Reference	AT1_33
Theme	Vulnerability
Hazard reference	Heat
Dimension	Ability to Respond
Domain	Crime
Indicator	**Index of Multiple Deprivation crime score**
Assumption	People living in areas with higher rates of crime may be more reluctant to take preventative measures in reaction to warnings of extreme events and therefore have higher social vulnerability compared with communities with lower crime rates.
Confidence level	Medium
Guidance for the use of this indicator	Adaptation needs to address the specific challenges associated with places where people may be reluctant to take preventative measures during, or immediately prior to, events like heat-waves. For example, if there is a fear of crime in an area people may feel less able to leave windows open at night during heat-wave events. Fear of crime was found to be one of the major factors explaining why some people were more negatively affected than others in the 1995 heat-wave in Chicago, for example.[8] This is a proxy indicator which has been given a medium confidence rating. It is uncertain because the factor of interest is fear of crime which may not necessarily correspond to the reality of crime rates in an area. It is also recognised that there are different types of crime, not all of which will have the same impact on individual and community perceptions. Nevertheless, measures which address reasons for people not feeling able to respond to warnings may be an important consideration when working towards more resilient communities. Additional and finer scale indicators are available through the Index of Multiple Deprivation and crime statistics datasets. Further sources of information may also be available at a local level.
Data Source	Office of National Statistics, The English Indices of Deprivation 2010: Crime Domain. Recalculated from 2001 LSOA spatial units (2010 data) by area-weighted averages for 2011 MSOAs. The index is created by the Social Disadvantage Research Centre at the Department of Social Policy and Social Work at the University of Oxford Office for National Statistics, 2011 Census: Digitised Boundary Data (England and Wales) [computer file]. UK Data Service Census Support. Downloaded from: http://edina.ac.uk/census

8 Klinenberg, E. (2002) Heatwave: A Social Autopsy of Disaster in Chicago. Chicago, IL: University of Chicago Press

Item	Description
Reference	AT1_35
Theme	Vulnerability
Hazard reference	Heat
Dimension	Ability to Respond
Domain	General accessibility
Indicator	**Low road density (% area not road)**
Assumption	People living in area with lower road density have lower general accessibility and therefore higher social vulnerability compared with communities with higher road density.
Confidence level	Medium
Guidance for the use of this indicator	Adaptation needs to address the specific challenges associated with places with relatively poor accessibility and where people may not be able to respond as quickly in an emergency as in other areas with better general accessibility. Road density is only a proxy indicator for accessibility. Alternative local datasets may be available to help refine this indicator.
Data Source	Land Use Statistics (Generalised Land Use Database - GLUD) 2005 Office for National Statistics and Communities and Local Government. Indicator calculated by subtracting area of road from 100% and recalculating for 2011 Census boundaries using an area-weighted averaging approach. Office for National Statistics, 2011 Census: Digitised Boundary Data (England and Wales) [computer file]. UK Data Service Census Support. Downloaded from: http://edina.ac.uk/census

Item	Description
Reference	AT1_36
Theme	Vulnerability
Hazard reference	Heat
Dimension	Ability to Respond
Domain	General infrastructure
Indicator	**Density of retail units**
Assumption	Shops and other community-related infrastructure can act as informal refuges during extreme events. People living in areas with lower densities of infrastructure which might perform this function are assumed to have higher vulnerability compared to people living in places with higher densities. The mapped indicator shows densities from low to high. It is therefore important to note that in contrast with most other indicators in the portal where higher values represent higher vulnerability, higher values for this indicator indicate lower vulnerability.
Confidence level	High
Guidance for the use of this indicator	Community resilience can be enhanced in areas where retail and other community infrastructure is available, however informally, as places of potential refuge. For example, any air conditioned space can provide an informal refuge during heat-wave events as well as a source of wider assistance. For example, an analysis of the 1995 Chicago heat-wave identified cases where people combined visits to the grocery store with the opportunity to cool down.[9] All other things being equal, adaptive capacity in areas with a lower density of community and commercial facilities can be expected to be lower compared to areas where the density is higher, even where spaces are not air conditioned. Nevertheless, it should also be noted that other individual and neighbourhood characteristics may influence the extent to which people are able to take advantage of these opportunities, e.g. due to restrictions on personal mobility or fear of crime. Particular measures may be needed to address the specific challenges associated with places where these opportunities are limited. There may be opportunities to formalise arrangements in some areas. For example, heatwave planning in parts of Greece involves formalised arrangements with owners of air conditioned spaces which are not fully accessible to the wider public. Additional sources of information may also be available at a local level, e.g. lists of public buildings which may be air conditioned or which could act as possible cool spaces relative to flats in high-rise buildings, for example.
Data Source	Office for National Statistics (ONS) Business Registers Unit (BRU). VAT-based enterprises. 2011. Local Units by Broad Industry Group: Urban/Rural. Number of enterprises divided by the area of MSOA. High number = low vulnerability Office for National Statistics, 2011 Census: Digitised Boundary Data (England and Wales) [computer file]. UK Data Service Census Support. Downloaded from: http://edina.ac.uk/census

[9] Klinenberg, E. (2002) Heatwave: A Social Autopsy of Disaster in Chicago. Chicago, IL: University of Chicago Press

Item	Description
Reference	AT1_37
Theme	Vulnerability
Hazard reference	Heat
Dimension	Ability to Respond
Domain	General infrastructure
Indicator	**% change in the number of enterprises**
Assumption	Shops and other community-related infrastructure can act as informal refuges during extreme events. People living in areas with declining levels of infrastructure which might perform this function are assumed to have higher vulnerability compared to people living in places where infrastructure is not declining. Declining neighbourhoods are also indicative of other sources of community vulnerability. The mapped indicator shows positive to negative change. Higher positive values for this indicator indicate lower vulnerability in contrast with many of the other indicators in this portal.
Confidence level	High
Guidance for the use of this indicator	An analysis of the 1995 Chicago heatwave event found that neighbourhood decline helped to explain differences in mortality rates.[10] Community resilience can be enhanced in areas where retail and other community infrastructure is increasing and eroded where this infrastructure is being lost. Indeed, the loss of such infrastructure can be an indicator of wider community decline. For more information, also see the 'Density of retail units' indicator Info. Additional sources of information may also be available at a local level.
Data Source	Office for National Statistics (ONS) Business Registers Unit (BRU). VAT-based enterprises. 2009-11. Local Units by Broad Industry Group: Urban/Rural. Number of enterprises divided by the area of MSOA. High number = low vulnerability Office for National Statistics, 2011 Census: Digitised Boundary Data (England and Wales) [computer file]. UK Data Service Census Support. Downloaded from: http://edina.ac.uk/census

[10] Klinenberg, E. (2002) Heatwave: A Social Autopsy of Disaster in Chicago. Chicago, IL: University of Chicago Press

Item	Description
Reference	AT2_55
Theme	Vulnerability
Hazard reference	Heat
Dimension	Ability to Recover
Domain	Mobility
Indicator	**Working away from home (% not working at home)**
Assumption	Areas with higher proportions of people working away from home are more likely to be communities with relatively slow responses to heat-waves (or associated warnings) compared with communities where there are higher proportions of home workers.
Confidence level	Medium
Guidance for the use of this indicator	Adaptation needs to address the specific challenges associated with places where high proportions of people may be away from home during hazardous events. This may restrict people's ability to respond during events like heatwaves and to assist dependents, for example. There may also be greater challenges in supporting dependents affected by heatwaves.
Data Source	Census, 2011, QS701, % not home workers. indicator calculated by subtracting home workers from 100% 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]. UK Data Service Census Support. Downloaded from: http://edina.ac.uk/census

Item	Description
Reference	AT2_27
Theme	Vulnerability
Hazard reference	Heat
Dimension	Ability to Recover
Domain	Service access
Indicator	**Travel time to nearest GP by walking/public transport**
Assumption	People living in areas with higher travel time to the nearest GP by foot or by public transport are assumed to be more socially vulnerable since communities have a lower access to medical help during heat-wave events.
Confidence level	High
Guidance for the use of this indicator	This is one of several similar indicators which account for the relative accessibility of medical services in a local area. Specific measures may be helpful in areas with low accessibility to services in order to support people potentially affected by heat-wave events. Alternative measures at finer spatial scales may be available through the SHAPE and Public Health Outcomes Framework tools.
Data Source	Office for National Statistics (ONS) Accessibility statistics 2010. Recalculated from 2001 MSOA spatial units (2010 data) by area-weighted averages for 2011 MSOAs. Office for National Statistics, 2011 Census: Digitised Boundary Data (England and Wales) [computer file]. UK Data Service Census Support. Downloaded from: http://edina.ac.uk/census

Item	Description
Reference	AT2_30
Theme	Vulnerability
Hazard reference	Heat
Dimension	Ability to Recover
Domain	Service access
Indicator	**% of at risk population (no car) outside of 15 minutes by walking/public transport to nearest GP**
Assumption	Areas with higher proportions of people with no private transport living more than 15 minutes away from the nearest GP by foot or public transport are assumed to be more socially vulnerable since communities have a lower access to medical help during heatwave events.
Confidence level	High
Guidance for the use of this indicator	This is one of several similar indicators which account for the relative accessibility of medical services in a local area. Specific measures may be helpful in areas with low accessibility to services in order to support people potentially affected by heat-wave events. Alternative measures at finer spatial scales may be available through the SHAPE and Public Health Outcomes Framework tools.
Data Source	Office for National Statistics (ONS) Accessibility statistics 2010. Recalculated from 2001 MSOA spatial units (2010 data) by area-weighted averages for 2011 MSOAs. Office for National Statistics, 2011 Census: Digitised Boundary Data (England and Wales) [computer file]. UK Data Service Census Support. Downloaded from: http://edina.ac.uk/census

Item	Description
Reference	AT2_32
Theme	Vulnerability
Hazard reference	Heat
Dimension	Ability to Recover
Domain	Service access
Indicator	**Number of GPs within 15 minutes by walking/public transport**
Assumption	Areas with lower numbers of GPs within 15 minutes travel by foot or public transport are assumed to be more socially vulnerable since communities have a lower access to medical help during heat-wave events. The mapped indicator shows the number from low to high. It is therefore important to note that in contrast with most other indicators in the portal where higher values represent higher vulnerability, higher values for this indicator indicate lower vulnerability.
Confidence level	High
Guidance for the use of this indicator	This is one of several similar indicators which account for the relative accessibility of medical services in a local area. Specific measures may be helpful in areas with low accessibility to services in order to support people potentially affected by heat-wave events. Alternative measures at finer spatial scales may be available through the SHAPE and Public Health Outcomes Framework tools.
Data Source	Office for National Statistics (ONS) Accessibility statistics 2010. Recalculated from 2001 MSOA spatial units (2010 data) by area-weighted averages for 2011 MSOAs. Office for National Statistics, 2011 Census: Digitised Boundary Data (England and Wales) [computer file]. UK Data Service Census Support. Downloaded from: http://edina.ac.uk/census

Item	Description
Reference	AT2_33
Theme	Vulnerability
Hazard reference	Heat
Dimension	Ability to Recover
Domain	Service access
Indicator	**Number of GPs within 15 minutes by car**
Assumption	Areas with lower numbers of GPs within 15 minutes travel by car are assumed to be more socially vulnerable since communities have a lower access to medical help during heat-wave events. The mapped indicator shows the number from low to high. It is therefore important to note that in contrast with most other indicators in the portal where higher values represent higher vulnerability, higher values for this indicator indicate lower vulnerability.
Confidence level	High
Guidance for the use of this indicator	This is one of several similar indicators which account for the relative accessibility of medical services in a local area. Specific measures may be helpful in areas with low accessibility to services in order to support people potentially affected by heat-wave events. Alternative measures at finer spatial scales may be available through the SHAPE and Public Health Outcomes Framework tools.
Data Source	Office for National Statistics (ONS) Accessibility statistics 2010. Recalculated from 2001 MSOA spatial units (2010 data) by area-weighted averages for 2011 MSOAs. Office for National Statistics, 2011 Census: Digitised Boundary Data (England and Wales) [computer file]. UK Data Service Census Support. Downloaded from: http://edina.ac.uk/census

Item	Description
Reference	AT2_38
Theme	Vulnerability
Hazard reference	Heat
Dimension	Ability to Recover
Domain	Service access
Indicator	**Travel time to nearest hospital by walking/public transport**
Assumption	Areas with higher travel times to the nearest hospital are assumed to be more socially vulnerable since communities have a lower access to medical help during heatwave events.
Confidence level	High
Guidance for the use of this indicator	This is one of several similar indicators which account for the relative accessibility of medical services in a local area. Specific measures may be helpful in areas with low accessibility to services in order to support people potentially affected by heat-wave events. Alternative measures at finer spatial scales may be available through the SHAPE and Public Health Outcomes Framework tools.
Data Source	Office for National Statistics (ONS) Accessibility statistics 2010. Recalculated from 2001 MSOA spatial units (2010 data) by area-weighted averages for 2011 MSOAs. Office for National Statistics, 2011 Census: Digitised Boundary Data (England and Wales) [computer file]. UK Data Service Census Support. Downloaded from: http://edina.ac.uk/census

Item	Description
Reference	AT2_39
Theme	Vulnerability
Hazard reference	Heat
Dimension	Ability to Recover
Domain	Service access
Indicator	**% of at risk population (no car) outside of 30 minutes by walking/public transport to nearest hospital**
Assumption	Areas with higher proportions of people with no private transport living more than 30 minutes away from the nearest hospital by foot or public transport are assumed to be more socially vulnerable since communities have a lower access to medical help during heat-wave events.
Confidence level	High
Guidance for the use of this indicator	This is one of several similar indicators which account for the relative accessibility of medical services in a local area. Specific measures may be helpful in areas with low accessibility to services in order to support people potentially affected by heat-wave events. Alternative measures at finer spatial scales may be available through the SHAPE and Public Health Outcomes Framework tools.
Data Source	Office for National Statistics (ONS) Accessibility statistics 2010. Recalculated from 2001 MSOA spatial units (2010 data) by area-weighted averages for 2011 MSOAs. Office for National Statistics, 2011 Census: Digitised Boundary Data (England and Wales) [computer file]. UK Data Service Census Support. Downloaded from: http://edina.ac.uk/census

Item	Description
Reference	AT2_41
Theme	Vulnerability
Hazard reference	Heat
Dimension	Ability to Recover
Domain	Service access
Indicator	**Number of hospitals within 30 minutes by walking/public transport**
Assumption	Areas with lower numbers of hospitals within 30 minutes travel by foot or public transport are assumed to be more socially vulnerable since communities have a lower access to medical help during heatwave events. The mapped indicator shows the number from low to high. It is therefore important to note that in contrast with most other indicators in the portal where higher values represent higher vulnerability, higher values for this indicator indicate lower vulnerability.
Confidence level	High
Guidance for the use of this indicator	This is one of several similar indicators which account for the relative accessibility of medical services in a local area. Specific measures may be helpful in areas with low accessibility to services in order to support people potentially affected by heat-wave events. Alternative measures at finer spatial scales may be available through the SHAPE and Public Health Outcomes Framework tools.
Data Source	Office for National Statistics (ONS) Accessibility statistics 2010. Recalculated from 2001 MSOA spatial units (2010 data) by area-weighted averages for 2011 MSOAs. Office for National Statistics, 2011 Census: Digitised Boundary Data (England and Wales) [computer file]. UK Data Service Census Support. Downloaded from: http://edina.ac.uk/census

Item	Description
Reference	AT2_42
Theme	Vulnerability
Hazard reference	Heat
Dimension	Ability to Recover
Domain	Service access
Indicator	**Number of hospitals within 30 minutes by car**
Assumption	Areas with lower numbers of hospitals within 30 minutes travel by car are assumed to be more socially vulnerable since communities have a lower access to medical help during heat-wave events. The mapped indicator shows the number from low to high. It is therefore important to note that in contrast with most other indicators in the portal where higher values represent higher vulnerability, higher values for this indicator indicate lower vulnerability.
Confidence level	High
Guidance for the use of this indicator	This is one of several similar indicators which account for the relative accessibility of medical services in a local area. Specific measures may be helpful in areas with low accessibility to services in order to support people potentially affected by heat-wave events. Alternative measures at finer spatial scales may be available through the SHAPE and Public Health Outcomes Framework tools.
Data Source	Office for National Statistics (ONS) Accessibility statistics 2010. Recalculated from 2001 MSOA spatial units (2010 data) by area-weighted averages for 2011 MSOAs. Office for National Statistics, 2011 Census: Digitised Boundary Data (England and Wales) [computer file]. UK Data Service Census Support. Downloaded from: http://edina.ac.uk/census

Item	Description
Reference	E_1
Theme	Vulnerability
Hazard reference	Heat
Dimension	Enhanced Exposure
Domain	Physical Environment
Indicator	**Built up area (% area not greenspace)**
Assumption	The more built up an area, the more likely it is that heat-wave and hot weather impacts are more severe.
Confidence level	High
Guidance for the use of this indicator	This indicator accounts for the additional impact that local environments can have during events like heat-waves. In this case, areas with higher proportions of green space can be assumed to have better drainage and cooling functions compared to areas with lower proportions of greenspace. More information about this indicator is available in the adapting buildings and greenspace messages, including actions which can be taken to respond. Additional, more refined, data may be available at the local level, e.g. through data agreements with the Ordnance Survey.
Data Source	Land Use Statistics (Generalised Land Use Database - GLUD) 2005 Office for National Statistics and Communities and Local Government. Indicator calculated by subtracting the area of greenspace from 100%. Recalculated from 2001 MSOA spatial units by area-weighted averages for 2011 MSOAs. Office for National Statistics, 2011 Census: Digitised Boundary Data (England and Wales) [computer file]. UK Data Service Census Support. Downloaded from: http://edina.ac.uk/census

Item	Description
Reference	E_2
Theme	Vulnerability
Hazard reference	Heat
Dimension	Enhanced Exposure
Domain	Physical Environment
Indicator	**Lack of domestic gardens (area of buildings/domestic gardens)**
Assumption	The higher the ratio of domestic buildings relative to domestic gardens, the more likely it is that heat-wave impacts are more severe.
Confidence level	Medium
Guidance for the use of this indicator	This indicator accounts for the additional impact that local environments can have during events like heat-waves. Gardens can provide better drainage and a cooling function. Therefore areas where housing tends to have relatively small gardens are more likely to see severe impacts compared with areas where housing tends to be associated with relatively large gardens. There is some uncertainty since cooling and drainage functions are strongly affected by the way that property owners develop their gardens. Background information relevant to this indicator is available in the adapting buildings and green space messages in the main portal, including actions which can be taken to respond. Additional, more refined, data may be available at the local level, e.g. through data agreements with the Ordnance Survey.
Data Source	Land Use Statistics (Generalised Land Use Database - GLUD) 2005 Office for National Statistics and Communities and Local Government. Indicator calculated by dividing the area of domestic buildings by area of gardens. Recalculated from 2001 MSOA spatial units by area-weighted averages for 2011 MSOAs. Office for National Statistics, 2011 Census: Digitised Boundary Data (England and Wales) [computer file]. UK Data Service Census Support. Downloaded from: http://edina.ac.uk/census

Item	Description
Reference	E_3
Theme	Vulnerability
Hazard reference	Heat
Dimension	Enhanced Exposure
Domain	Physical Environment
Indicator	**Built up area (% area not bluespace)**
Assumption	The more built up an area, the more likely it is that heat-wave impacts are more severe.
Confidence level	High
Guidance for the use of this indicator	This indicator accounts for the additional impact that local environments can have during heat-waves, in this case where a greater proportion of land area associated with water bodies, such as lakes, provides a cooling function. More information about this indicator is available in the adapting buildings message in the main portal, including actions which can be taken to respond. Additional, more refined, data may be available at the local level, e.g. through data agreements with the Ordnance Survey.
Data Source	Land Use Statistics (Generalised Land Use Database - GLUD) 2005 Office for National Statistics and Communities and Local Government. Indicator calculated by subtracting the area of greenspace from 100%. Recalculated from 2001 MSOA spatial units by area-weighted averages for 2011 MSOAs. Office for National Statistics, 2011 Census: Digitised Boundary Data (England and Wales) [computer file]. UK Data Service Census Support. Downloaded from: http://edina.ac.uk/census

Item	Description
Reference	E_4
Theme	Vulnerability
Hazard reference	Heat
Dimension	Enhanced Exposure
Domain	Physical Geography
Indicator	**Distance to coast**
Assumption	The closer an area is to the coast, the more likely it is to be cooler relative to areas inland.
Confidence level	Medium
Guidance for the use of this indicator	This indicator accounts for the additional impact that physical location can have during events like heat-waves. All other things being equal, coastal areas are more likely to be cooler compared to inland areas due to the effects of onshore breezes. Additional, more refined, data may be available at the local level, e.g. through data agreements with the Ordnance Survey.
Data Source	2011 MSOA population weighted centroids and UK boundary line Office for National Statistics, 2011 Census: Digitised Boundary Data (England and Wales) [computer file]. UK Data Service Census Support. Downloaded from: http://edina.ac.uk/census

Item	Description
Reference	E_11
Theme	Vulnerability
Hazard reference	Heat
Dimension	Enhanced Exposure
Domain	Housing Characteristics
Indicator	**High rise homes (% households with lowest floor 5th floor or above)**
Assumption	The higher the proportion of dwellings at 5th floor or above in an area, the more likely its residents are to be affected by high temperatures during heat-waves.
Confidence level	Medium
Guidance for the use of this indicator	This indicator accounts for the additional impact that housing characteristics can have during heat-waves. Houses in the upper levels of tower blocks are more likely to be affected by heat-waves than some other types of accommodation. Background information relevant to this indicator is available in the adapting buildings section of the main portal, including actions which can be taken to respond. There is some uncertainty with this indicator since data are only available for 2001. Additional, more refined, data may be available at the local level, e.g. property level data through data agreements with the Ordnance Survey.
Data Source	Census, 2001, Office for National Statistics, 2001 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 Office for National Statistics, 2011 Census: Digitised Boundary Data (England and Wales) [computer file]. UK Data Service Census Support. Downloaded from: http://edina.ac.uk/census

Item	Description
Reference	S1
Theme	Vulnerability
Hazard reference	Heat
Dimension	Sensitivity
Domain	Age
Indicator	**Young children (% people under 5 years)**
Assumption	Higher proportions of children under 5 in an area indicate a higher vulnerability.
Confidence level	High
Guidance for the use of this indicator	This indicator shows areas which have an above average proportion of young children in the population and therefore where the population is more sensitive to the impacts of heat-related hazards. Young children can be affected anywhere that high temperatures occur. However, there is a case for particular targeting of areas: where there are more children exposed; where the characteristics of areas increase exposure; or where children have other characteristics affecting sensitivity or exposure, such as ill-health or disabilities. General advice and guidance can also be delivered through pre-schooling, nurseries and doctor's surgeries to reach parents, carers and, using appropriate means, children themselves. Advice needs to recognise both that there is a higher chance of being affected and also that children are less able to adapt their own behaviour and so may not recognise the dangers of hot temperatures. Additional, more refined, data on children, their relative sensitivities and other characteristics which tend to make them more or less vulnerable may be available at the local level. Also consider data available in the SHAPE and Public Health Outcomes Framework tools.
Data Source and Acknowledgements	Census 2011, KS102, % 0-4 years. 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]. UK Data Service Census Support. Downloaded from: http://edina.ac.uk/census

Item	Description
Reference	S3
Theme	Vulnerability
Hazard reference	Heat
Dimension	Sensitivity
Domain	Age
Indicator	**Older people (% people over 75 years)**
Assumption	Higher proportions of people over 75 in an area indicate a higher vulnerability.
Confidence level	High
Guidance for the use of this indicator	Adaptation needs to address the specific challenges associated with places with a high density of older people (as is measured by this indicator) and also places where there may be fewer older people but where they may be socially or physically isolated, perhaps within areas which otherwise have low social vulnerability. Responses in places with high concentrations of older people may differ from those in places with low concentrations, for example, if there are more community organisations, facilities and networks in such areas to support action. These may be used to disseminate good practice and promote appropriate self-help alongside responses delivered through social services. Government guidance is available to specifically target this group, e.g. as part of the heatwave and cold weather plans. Adaptation needs to take account of the growing trend towards further concentrations of older populations in the future. Additional, more refined, data on older people, their relative sensitivities and other characteristics which tend to make them more or less vulnerable may be available at the local level. Also consider data available in the SHAPE and Public Health Outcomes Framework tools. See the separate message on older people for more evidence and possible responses.
Data Source	Census, 2011, KS102, % 75 yrs and older 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]. UK Data Service Census Support. Downloaded from: http://edina.ac.uk/census

Item	Description
Reference	S7
Theme	Vulnerability
Hazard reference	Heat
Dimension	Sensitivity
Domain	Health
Indicator	**Households containing at least one person in ill-health**
Assumption	Higher proportions of households containing at least one person in ill-health indicate a higher vulnerability.
Confidence level	High
Guidance for the use of this indicator	Adaptation needs to address the specific challenges associated with places with a high density of people in ill-health (as is measured by this indicator) and also places where there may be fewer people in ill-health but where they may be socially or physically isolated, perhaps within areas which otherwise have low social vulnerability. Responses may need to be targeted differently to take account of this, working with existing health and social care service providers and also voluntary and community sector organisations who may support these groups. More information about this indicator is available in the poor health message in the main portal, including actions which can be taken to respond. Additional, more refined, health data may be available at the local level, as well as from tools such as SHAPE and the Public Health Outcomes Framework tools.
Data Source	Census, 2011, KS106, One Person in Household with a Long-Term Health Problem or Disability; With/No Dependent Children 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]. UK Data Service Census Support. Downloaded from: http://edina.ac.uk/census

Item	Description
Reference	S4
Theme	Vulnerability
Hazard reference	Heat
Dimension	Sensitivity
Domain	Health
Indicator	**People in ill-health (% people whose day-to-day activities are limited)**
Assumption	Higher proportions of people in ill-health in an area indicate a higher vulnerability.
Confidence level	High
Guidance for the use of this indicator	Adaptation needs to address the specific challenges associated with places with a high density of people in ill-health (as is measured by this indicator) and also places where there may be fewer people in ill-health but where they may be socially or physically isolated, perhaps within areas which otherwise have low social vulnerability. Responses may need to be targeted differently to take account of this, working with existing health and social care service providers and also voluntary and community sector organisations who may support these groups. More information about this indicator is available in the poor health message in the main portal, including actions which can be taken to respond. Additional, more refined, health data may be available at the local level, as well as from tools such as SHAPE and the Public Health Outcomes Framework tools.
Data Source	Census, 2011, KS301, sum of two indicators: (% of people whose day to day activities are limited a lot) + (% of people day to day activities limited a little) 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]. UK Data Service Census Support. Downloaded from: http://edina.ac.uk/census

Other Heat-related datasets

Data theme	Description
Heat disadvantage	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. 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 is a recommended starting point. More information is available in the ClimateJust user guide, the main report[11], UKCP09[12] and the list of limitations. Acknowledgements: See indicator information for relevant data acknowledgements for the inputs to this dataset. UK Climate Projections 2009, Crown copyright.UKCP09 data show 50th, 90th and 10th percentile estimates for each climate metric for the low (L50), medium (M50) and high (H50) emissions scenarios. Population-weighted centre-points of neighbourhoods (MSOAs) areas have been used to allocate neighbourhood-based data to the appropriate 25km grid cell.

11 Lindley, S. J., O'Neill, J., Kandeh, J., Lawson, N., Christian, R. & O'Neill M. (2011) "Climate change, justice and vulnerability", Joseph Rowntree Foundation Report, York

12 http://ukclimateprojections.metoffice.gov.uk/21708

Heat disadvantage (Population weighted vulnerability and mean summer maximum temperature 2050s)	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. This map shows the result of an equally-weighted combination of neighbourhood-level scores over a 25km grid for: • population-weighted socio-spatial heat vulnerability • heat hazard-exposure according to mean summer maximum temperature[13] in the 2050s The maps are shown by 25km grid cell, conforming to climate scenario outputs from UKCP09. 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. More information is available in the ClimateJust user guide, the main report[14] , UKCP09[15] and the list of limitations. Acknowledgements: See indicator information for relevant data acknowledgements for the inputs to this dataset. UK Climate Projections 2009, Crown copyright.UKCP09 data show 50th, 90th and 10th percentile estimates for each climate metric for the low (L50), medium (M50) and high (H50) emissions scenarios. Population-weighted centre-points of neighbourhoods (MSOAs) areas have been used to allocate neighbourhood-based data to the appropriate 25km grid cell.

13 http://ukclimateprojections.metoffice.gov.uk/21813

14 Lindley, S. J., O'Neill, J., Kandeh, J., Lawson, N., Christian, R. & O'Neill M. (2011) "Climate change, justice and vulnerability", Joseph Rowntree Foundation Report, York

15 http://ukclimateprojections.metoffice.gov.uk/21708

Heat disadvantage (Population weighted vulnerability and mean summer maximum temperature 2050s) Medium Emissions scenario 50th percentile (Recommended)	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. This map shows the result of an equally-weighted combination of neighbourhood-level scores over a 25km grid for: • population-weighted socio-spatial heat vulnerability • heat hazard-exposure according to mean summer maximum temperature in the 2050s (**medium emissions scenario, 50th percentile**) The maps are shown by 25km grid cell, conforming to climate scenario outputs from UKCP09. **These maps for the central (50th percentile) estimate of the medium scenario for mean summer maximum temperature in the 2050s are a recommended starting point**. **However, users are encouraged to review maps for other probability levels and emissions scenarios in line with UKCP09 guidance. Maps are provided for three scenarios and three probability levels.** More information is available in the ClimateJust user guide, the main report16, UKCP0917 and the list of limitations. Acknowledgements: See indicator information for relevant data acknowledgements for the inputs to this dataset. UK Climate Projections 2009, Crown copyright.UKCP09 data show 50th, 90th and 10th percentile estimates for each climate metric for the low (L50), medium (M50) and high (H50) emissions scenarios. Population-weighted centre-points of neighbourhoods (MSOAs) areas have been used to allocate neighbourhood-based data to the appropriate 25km grid cell.

16 Lindley, S. J., O'Neill, J., Kandeh, J., Lawson, N., Christian, R. & O'Neill M. (2011) "Climate change, justice and vulnerability", Joseph Rowntree Foundation Report, York

17 http://ukclimateprojections.metoffice.gov.uk/21708

Heat hazard-exposure	The maps of heat hazard-exposure broadly show where there is likely to be a greater chance of coming into contact with heat-related events. There are four representations of heat-related hazard and therefore four sets of 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. 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. More information is available in the ClimateJust user guide, the main report[18] and list of limitations. This is an imperfect representation of the likelihood of people and communities coming into contact with heat-waves. Users should also note that people in different parts of the country are already used to different temperatures so heat health warning thresholds are different according to where you are located[19]. More information and data are available from the UKCP09 website[20]. Acknowledgements: See indicator information for relevant data acknowledgements for the inputs to this dataset. UK Climate Projections 2009, Crown copyright.UKCP09 data show 50th, 90th and 10th percentile estimates for each climate metric for the low (L50), medium (M50) and high (H50) emissions scenarios. Population-weighted centre-points of neighbourhoods (MSOAs) areas have been used to allocate neighbourhood-based data to the appropriate 25km grid cell.

18 Lindley, S. J., O'Neill, J., Kandeh, J., Lawson, N., Christian, R. & O'Neill M. (2011) "Climate change, justice and vulnerability", Joseph Rowntree Foundation Report, York

19 Public Health England. 2013. The heat-wave plan for England 2013. Available at: https://www.gov.uk/government/publications/heat-wave-plan-for-england-2013

20 http://ukclimateprojections.metoffice.gov.uk/21708

Heat hazard-exposure (Mean summer maximum temperature 2050s)	The maps of heat hazard-exposure broadly show where there is likely to be a greater chance of coming into contact with heat-related events. This set of maps shows mean summer maximum temperature in the 2050s. The maps are shown by 25km grid cell, conforming to climate scenario outputs from UKCP09. 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. More information is available in the ClimateJust user guide, the main report[21] and list of limitations. This is an imperfect representation of the likelihood of people and communities coming into contact with heat-waves. Users should also note that people in different parts of the country are already used to different temperatures so heat health warning thresholds are different according to where you are located[22]. More information and data are available from the UKCP09 website[23]. Acknowledgements: See indicator information for relevant data acknowledgements for the inputs to this dataset. UK Climate Projections 2009, Crown copyright.UKCP09 data show 50th, 90th and 10th percentile estimates for each climate metric for the low (L50), medium (M50) and high (H50) emissions scenarios. Population-weighted centre-points of neighbourhoods (MSOAs) areas have been used to allocate neighbourhood-based data to the appropriate 25km grid cell.
Heat hazard-exposure (Change in mean summer maximum temperature baseline to 2050s)	The maps of heat hazard-exposure broadly show where there is likely to be a greater chance of coming into contact with heat-related events. This set of maps shows change in mean summer maximum temperature from the climate baseline to the 2050s. The maps are shown by 25km grid cell, conforming to climate scenario outputs from UKCP09. 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. More information is available in the ClimateJust user guide, the main report and list of limitations. This is an imperfect representation of the likelihood of people and communities coming into contact with heat-waves. Users should also note that people in different parts of the country are already used to different temperatures so heat health warning thresholds are different according to where you are located. More information and data are available from the UKCP09 website. Acknowledgements: See indicator information for relevant data acknowledgements for the inputs to this dataset. UK Climate Projections 2009, Crown copyright.UKCP09 data show 50th, 90th and 10th percentile estimates for each climate metric for the low (L50), medium (M50) and high (H50) emissions scenarios. Population-weighted centre-points of neighbourhoods (MSOAs) areas have been used to allocate neighbourhood-based data to the appropriate 25km grid cell.

21 Lindley, S. J., O'Neill, J., Kandeh, J., Lawson, N., Christian, R. & O'Neill M. (2011) "Climate change, justice and vulnerability", Joseph Rowntree Foundation Report, York

22 Public Health England. 2013. The heat-wave plan for England 2013. Available at: https://www.gov.uk/government/publications/heat-wave-plan-for-england-2013

23 http://ukclimateprojections.metoffice.gov.uk/21708

Heat hazard-exposure (Change in the temperature of the warmest day baseline to 2050s)	The maps of heat hazard-exposure broadly show where there is likely to be a greater chance of coming into contact with heat-related events. This set of maps shows change in the temperature of the warmest day from the climate baseline to the 2050s. The maps are shown by 25km grid cell, conforming to climate scenario outputs from UKCP09. 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. More information is available in the ClimateJust user guide, the main report[24] and list of limitations. This is an imperfect representation of the likelihood of people and communities coming into contact with heat-waves. Users should also note that people in different parts of the country are already used to different temperatures so heat health warning thresholds are different according to where you are located[25]. More information and data are available from the UKCP09 website[26]. Acknowledgements: See indicator information for relevant data acknowledgements for the inputs to this dataset. UK Climate Projections 2009, Crown copyright.UKCP09 data show 50th, 90th and 10th percentile estimates for each climate metric for the low (L50), medium (M50) and high (H50) emissions scenarios. Population-weighted centre-points of neighbourhoods (MSOAs) areas have been used to allocate neighbourhood-based data to the appropriate 25km grid cell.
Heat hazard-exposure (Change in the temperature of the warmest night baseline to 2050s)	The maps of heat hazard-exposure broadly show where there is likely to be a greater chance of coming into contact with heat-related events. This set of maps shows 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. 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. More information is available in the ClimateJust user guide, the main report and list of limitations. This is an imperfect representation of the likelihood of people and communities coming into contact with heat-waves. Users should also note that people in different parts of the country are already used to different temperatures so heat health warning thresholds are different according to where you are located. More information and data are available from the UKCP09 website. Acknowledgements: See indicator information for relevant data acknowledgements for the inputs to this dataset. UK Climate Projections 2009, Crown copyright.UKCP09 data show 50th, 90th and 10th percentile estimates for each climate metric for the low (L50), medium (M50) and high (H50) emissions scenarios. Population-weighted centre-points of neighbourhoods (MSOAs) areas have been used to allocate neighbourhood-based data to the appropriate 25km grid cell.

24 Lindley, S. J., O'Neill, J., Kandeh, J., Lawson, N., Christian, R. & O'Neill M. (2011) "Climate change, justice and vulnerability", Joseph Rowntree Foundation Report, York

25 Public Health England. 2013. The heat-wave plan for England 2013. Available at: https://www.gov.uk/government/publications/heat-wave-plan-for-england-2013

26 http://ukclimateprojections.metoffice.gov.uk/21708

Heat socio-spatial vulnerability	Heat socio-spatial vulnerability refers to mapped social vulnerability with respect to heat-related hazard. The map shows how the personal, social and environmental factors which help to explain uneven impacts on people and communities come together in particular neighbourhoods. It shows where negative social impacts are more likely. This information can then be combined with the likelihood of events occurring to understand how this social vulnerability and potential for negative impacts translates into disadvantage. The heat socio-spatial vulnerability map shows the result of an equally-weighted combination of neighbourhood-level scores for indicators within each of the five dimensions of socio-spatial vulnerability for each neighbourhood: • Sensitivity • Enhanced Exposure • (In)ability to Prepare • (In)ability to Respond • (In)ability to Recover Neighbourhood mapping uses Middle Super Output Areas (MSOAs) from the UK Census, 2011. More information is available in the ClimateJust user guide and list of limitations. This area-based representation provides only a broad, national-scale indication of local patterns and users are strongly encouraged to build on this starting point with finer scale geographical data and other local data holdings. Acknowledgements: See indicator information for relevant data acknowledgements for the inputs to this dataset. Mapping is based on Office for National Statistics, 2011 Census: Digitised Boundary Data (England and Wales) [computer file]. UK Data Service Census Support. Downloaded from: http://edina.ac.uk/census
Sensitivity	Sensitivity refers to personal biophysical characteristics which affect the likelihood that a heat wave event will have negative health and welfare impacts. For example, older people tend to be more susceptible to the effects of high temperatures. The map shows the result of an equally-weighted combination of neighbourhood-level scores for indicators within the two domains associated with Sensitivity: • Age • Health Neighbourhood mapping uses Middle Super Output Areas (MSOAs) from the UK Census, 2011. More information is available in the ClimateJust user guide and list of limitations. This area-based representation provides only a broad, national-scale indication of local patterns and users are strongly encouraged to build on this starting point with finer scale data and local data holdings. Acknowledgements: See indicator information for relevant data acknowledgements for this dataset. Mapping is based on Office for National Statistics, 2011 Census: Digitised Boundary Data (England and Wales) [computer file]. UK Data Service Census Support. Downloaded from: http://edina.ac.uk/census

Enhanced Exposure (heat)	Enhanced exposure refers to aspects of the physical environment, such as the availability of green space or housing characteristics, which tend to accentuate or offset the severity of heat wave events. The map shows the result of an equally-weighted combination of neighbourhood-level scores for indicators within the domains associated with enhanced exposure with respect to heat: • Physical environment • Physical geography • Building characteristics Neighbourhood mapping uses Middle Super Output Areas (MSOAs) from the UK Census, 2011. More information is available in the ClimateJust user guide and list of limitations. This area-based representation provides only a broad, national-scale indication of local patterns and users are strongly encouraged to build on this starting point with finer scale geographical data and other local data holdings. Acknowledgements: See indicator information for relevant data acknowledgements for this dataset. Mapping is based on Office for National Statistics, 2011 Census: Digitised Boundary Data (England and Wales) [computer file]. UK Data Service Census Support. Downloaded from: http://edina.ac.uk/census
Ability to prepare (heat)	A person's or community's ability to prepare for climate and extreme weather events is governed primarily by social factors. With respect to heat this includes factors such as income and tenure. The map shows the result of an equally-weighted combination of neighbourhood-level scores for indicators within the domains associated with respect to heat: • Income • Tenure • Information use – language Neighbourhood mapping uses Middle Super Output Areas (MSOAs) from the UK Census, 2011. More information is available in the ClimateJust user guide and list of limitations. This area-based representation provides only a broad, national-scale indication of local patterns and users are strongly encouraged to build on this starting point with finer scale geographical data and other local data holdings. Acknowledgements: See indicator information for relevant data acknowledgements for this dataset. Mapping is based on Office for National Statistics, 2011 Census: Digitised Boundary Data (England and Wales) [computer file]. UK Data Service Census Support. Downloaded from: http://edina.ac.uk/census

Ability to respond (heat)	A person's or community's ability to respond to climate and extreme weather events is governed primarily by social factors. With respect to heat this includes factors such as social networks and mobility. The map shows the result of an equally-weighted combination of neighbourhood-level scores for indicators within the domains associated with respect to heat: • Income • Information use – language • Social networks • Mobility • Crime • General accessibility • General infrastructure Neighbourhood mapping uses Middle Super Output Areas (MSOAs) from the UK Census, 2011. More information is available in the ClimateJust user guide and list of limitations. This area-based representation provides only a broad, national-scale indication of local patterns and users are strongly encouraged to build on this starting point with finer scale geographical data and other local data holdings. Acknowledgements: See indicator information for relevant data acknowledgements for this dataset. Mapping is based on Office for National Statistics, 2011 Census: Digitised Boundary Data (England and Wales) [computer file]. UK Data Service Census Support. Downloaded from: http://edina.ac.uk/census