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Improving access to geospatial climate risk data

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1 Executive summary

1.1 Background

The planning system in Scotland is used to make decisions about future developments and use of land in towns, cities and countryside. Planning authorities are required to prepare evidence reports as part of the local development plan (LDP) process. These provide a summary of the baseline data used and explain the implications of the LDP.

Supported by National Planning Framework 4 (NPF4), planning LDPs should account for and address current and future climate risks, and enable places to adapt accordingly. Accurate, sub-national spatial data, which identifies geographic features such as rivers and utilities, is vital to create effective plans with a sound evidence base to evaluate climate risks. Fully evidencing climate risk requires an understanding of hazards, but also exposure and vulnerability, typically requiring interpretation of multiple datasets at once.

This report explores the geospatial resources that are available to support the evidence gathering stage with a view to improving access to geospatial data on climate risk. It identifies existing data, data gaps, barriers, and resources needed for evidence-based planning and delivery.

1.2 Key findings

Through engagement with a selection of Scottish Planning Authorities, we found:

1.2.1 Data for evidence reports

- A wide range of data is required to assess climate vulnerabilities and impacts, some of which require substantial climate and data expertise to interpret.
- Most required data is free for planning authorities.

- Planning authorities tend to rely on datasets familiar to them - such as Flood Maps (SEPA), Dynamic Coast, Scottish Index of Multiple Deprivation (SIMD), and OS MasterMap to assess climate risks like flooding, coastal erosion, and social vulnerability. These datasets are highly usable, with consistent coverage and quality across Scotland, but sometimes require geospatial expertise for analysis.
- There are additional datasets and tools which would benefit from further adoption by Planning Authorities, especially the Local Authority Climate Service. Additional datasets related to wildfire risk, air quality and land use may offer value, but would require some transformation, processing and interpretation to the climate context.
- Significant data gaps exist for urban heat islands, storm damage, health, water, infrastructure and landslides. Proxies (e.g. combining urban form, green space, and housing quality data) are suggested for urban heat island assessments. However, these must be approached in a considered way, which balances the potential effort to develop the interpretation against the likely risk.

1.2.2 Planning authorities' approach

- There is a knowledge gap on how climate risk impacts planning. Some planning authorities have limited prior experience on climate risk, fewer technical data skills within their teams and no dedicated climate change professional. This leads to planning authorities mainly focusing on flood risk, where they have more familiarity.
- Planning authority use of spatial data is limited, despite support for it in the Local Development Planning Guidance. This underuse may result from limited awareness of the guidance and expectations of evidence reports, and a lack of capacity and skills to interpret geospatial data.
- Planners expressed a wish for a simplified approach to incorporate climate adaptation considerations into their plans.
- Planning authorities find it challenging and time-consuming to gather data from multiple providers.
- There is value in carrying out Climate Risk and Vulnerability Assessments (CRVAs) to better direct the use of data but there is no consistent approach or simple tool available for planning authorities to use.
- Collaboration across planning authorities allows knowledge and resources sharing, which leads to more consistent and effective outcomes.
- Given the wide range of potential data and analysis, planning authorities benefit from instances where work had been undertaken ahead of the LDP process to provide a view of which risks are most impactful, allowing a more focused approach to data.

1.2.3 Briefing note for planning authorities

- Many planning authorities lack clarity on which data should be used for assessing climate risks and vulnerabilities, and how to interpret it. We have created an accompanying briefing note (Section 9.5), which should help by providing guidance on more usable and interpretable data.

Contents

2 Glossary / Abbreviations table

ADMS	Atmospheric Dispersion Modelling System
BGS	British Geological Survey
CC BY	Creative Commons Attribution License (further detail in 9.1.2)
CLIMADA	CLIMate ADAptation, Economics of Climate Adaptation
CRVA	Climate Risk and Vulnerability Assessment
CCRA	Climate Change Risk Assessment
DSM	Digital Surface Model
DTM	Digital Terrain Mode
EFFIS	European Forest Fire Information System
GIS	Geographic Information System
HabMoS	Habitat Map of Scotland
LA	Local Authority
LACS	Local Authority Climate Service
LDP	Local Development Plan
LiDAR	Light Detection and Ranging
LPA	Local Planning Authority
LSOA	Lower Super Output Area
NGD	National Geographic Database
NPF4	National Planning Framework 4
OGL	Open Government Licence (further detail in 9.1.2)
OpenCLIM	Open Climate Impacts Modelling framework
OS	Ordnance Survey
SNAP3	(Third) Scottish National Adaptation Plan
SEPA	Scottish Environmental Protection Agency
SIMD	Scottish Index of Multiple Deprivation
Sniffer	Independent charity - knowledge brokers for a resilient Scotland
PSGA	Public Sector Geospatial Agreement (further detail in 9.1.2)
UHI	Urban Heat Island
UKCCRA3	(Third) UK Climate Change Risk Assessment
UKCP18	UK Climate Projections 2018
UK-CRI	UK Climate Risk Indicators

3 Context and approach

3.1 Context

The reduction of emissions and adaptation to current and future risks of climate change is a challenge which is vital to be addressed via the planning system. The planning system provides opportunities to adapt to both current and future risks of climate change, as well as the potential to promote nature recovery and restoration in the area.

As part of the effort to modernise and update the planning system, the Scottish Government aims to align land-use planning with an outcomes-based approach to deliver sustainable development. This approach supports the National Performance Framework National Outcomes (Scottish Government, 2015) and supports the United Nations Sustainable Development Goals (United Nations, 2015).

Development planning, which outlines how places should change and where development should and should not happen, requires planning authorities to prepare and publish a local development plan (LDP)[1], updating on a 5 yearly basis.

The National Planning Framework 4 (NPF4) (Scottish Government, 2023c),puts climate change adaptation and resilience front and centre. A clear understanding of the impact of hazards and risks related to climate is required for an effective plan, and this must be underpinned by the effective use of climate risk data.

3.1.1 Defining climate risk

In this report, we refer climate risk in line with existing climate literature. **Risk** is defined as a combination of hazard, exposure and vulnerability (IPCC 2014).

Hazards are physical events which may have adverse effects, such as sea level rise & increased heat.

Exposure indicates the presence of people, resources, infrastructure which could be impacted by the hazard, and the extent to which they can be reached by the hazard. Physical proximity is one key consideration in understanding degree of exposure.

Vulnerability indicates to which extent people, resources or infrastructure could be more or less impacted by a hazard

Crucially, data can indicate hazard, exposure, vulnerability, or potentially a combination of the factors if indicating risk. However, if a dataset was not designed with the above in mind, it would need to be reinterpreted to a climate risk context. As an example, Ordnance Survey provides extensive data on the location of buildings, infrastructure and natural features, but

[1] The LDP is required under The Town and Country Planning (Scotland) Act 1997 (Scottish Government, 1997), as amended by the Planning (Scotland) Act 2019 (Scottish Government, 2019). Relevant secondary legislation and published guidance includes The Town and Country Planning (Development Planning) (Scotland) Regulations 2023 (Scottish Government, 2023a) as well as Local Development Planning Guidance (Scottish Government, 2023b).

geospatial analysis would be required to derive metrics such location to flood zones to indicate risk of flooding.

There is a substantial range of potential hazards associated with climate change in Scotland (Grace et. Al 2025). For this report, our engagement with the planning authorities focussed on the applicability of data, therefore a simplified grouping of hazards and risks was used (Table 1). In instances where datasets were particularly applicable to vulnerability and exposure, this is discussed in detail in Section 4.

Table 1 - Hazards and risks, as summarised in this report

Hazard Groups	**Rainfall & Storms**	**Temperature & Water Scarcity**	**Sea Level Rise**
Well Represented Hazards and Risks	Flooding Costal Erosion	Health risks Air pollution	Loss of land Flood risk
Potentially Under Represented Hazards and Risks	Storm damage Landslides	Water pollution Agricultural changes Habitat changes Urban Heat Islands	Habitat Loss Infrastructure damage

3.1.2 Local development plan evidence reports

Evidence reports are an early, statutory step in the development of a local plan. It provides a summary of the baseline data and other information which will form the basis of the plan.

This research focuses on the evidence gathering stage for climate risk – specifically, the tasks of early engagement and data collection, preparation of the evidence reports and a gate check by the Planning and Environmental Appeals Division (DPEA).

Evidence reports should be proportionate, with planning authorities having the discretion to tailor them to local characteristics and conditions. The Local Development Planning Guidance (Scottish Government, 2023b) provides guidance to support planning authorities in preparing evidence reports, including potential datasets relevant to NPF4 policies for climate change adaptation planning.

In addition to data access, there is a need to draw out implications of the data for the plan. It is not just about accessing the geospatial climate risk dataset but also ensuring its usability to accurately inform local development plans.

3.2 Rationale for this research

The lack of easily accessible spatial data on climate risk at a sub-national resolution has been identified as a key barrier to localised understanding of climate change adaptation by local authority planning officers.

Data gaps and accessibility issues create barriers to planning authorities producing proportionate, evidence-based plans. The aim of this research is to establish options for improved, simplified access by Scottish planning authorities to geospatial data that enables consistent, collaborative climate adaptation in local planning.

The intended audience for this research includes the Scottish Government and planning authorities. The work was commissioned on behalf of the Scottish Government, with particular interest for colleagues from the Climate Change Division and Planning, Architecture and Regeneration Directorate. A standalone briefing note and data catalogue (see Section 9.5) has also been produced specifically for planning authorities to showcase the available datasets.

3.3 Research methodology

The research involved an evidence review including a review of relevant literature, planning requirements and an in-depth data analysis of available risk data and its characteristics. Stakeholder engagement was conducted with planning authorities which were at various stages of evidence report development (see Figure 1) from early planning to successful completion. The engagement included interviews, as well as a wider workshop (See 9.3). Findings from these activities were the analysed to understand current needs, challenges and possible solutions to improve the process.

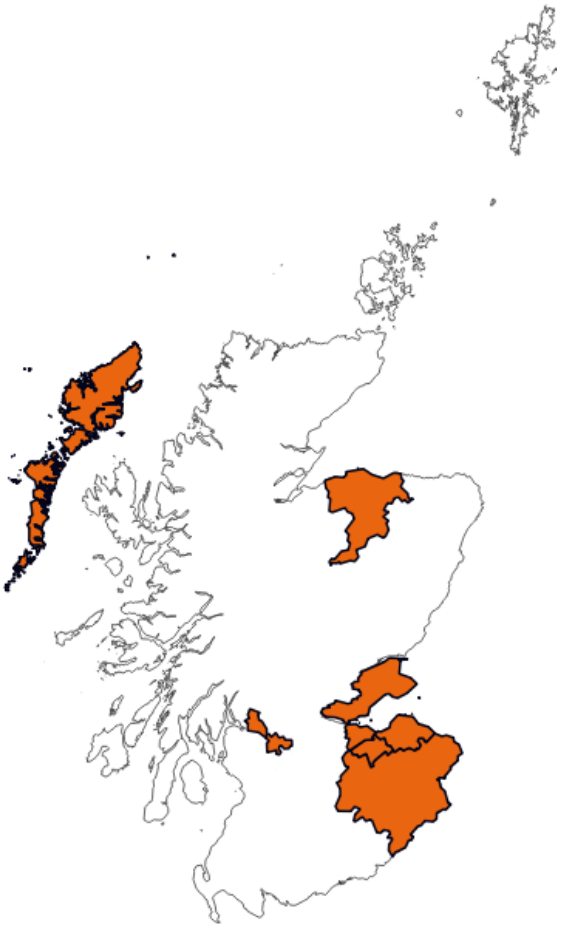

Figure 1 – Planning authorities engaged with in this study included Western Isles, Moray, West Dumbarton, Glasgow City, the Lothians, the Borders and Fife

4 Climate risk data

Effective data is central to the local development plan, and it is key that the right data is used and referenced for the evidence report. Additionally, the evidence report is expected to rely on spatial data, for which baseline evidence sources should be accessible.

There is a large range of data potentially available for use in evidence reports. This section provides a consolidated assessment of key datasets.

Our engagement with planning authorities identified:

- Five climate-related datasets that were familiar to planning authorities and were - or were intended to be - used to produce the evidence report.
- Eight datasets which would be valuable if used more extensively by planning authorities in the preparation of evidence reports.
- Five areas of concern to planning authorities in relation to the evidence report which did not have a dataset available, or a clear methodology, documented below as data gaps.

In this section, key aspects of the data are provided, such as name, the organisation providing the data. The data license under which the data is made available is provided, the full implications of the license to usage by planning authorities is detailed in Section 9.1.2.

The majority of datasets reviewed are updated and published at a rate sufficient for their purpose, though we have noted instances where there may not be a clear long term plan for the maintenance of the data.

Several other datasets were identified as having potential value. For the full list of all data sources reviewed please see the accompanying data catalogue (Section 9.5)., which catalogue includes details of the metadata and access links.

4.1 Key datasets already in use

Through the interviews and workshop, there were multiple datasets already in use by planning authorities in the production of the evidence reports, though not consistently in all cases. The most popular datasets are discussed in this section, along with a narrative of how the datasets were applied and if any issues were faced.

Table 4.1 – Key datasets already in use by planning authorities

Section	Dataset name	Provider	License[2]	Hazard Applicability[3]	Usability[4]
4.1.1	Flood Maps	SEPA	OGL	Rainfall, Storms, Sea Level rise	High
4.1.2	Dynamic Coast	NatureScot	OGL and PGSA	Rainfall, Storms, Sea Level rise	High
4.1.3	Scottish Index of Multiple Deprivation	Scottish Government	OGL	All hazards/ vulnerability	High
4.1.4	OS MasterMap	Ordnance Survey	OGL/ PSGA	All hazards	Medium
4.1.5	Light Detection and Ranging (LiDAR)	Scottish Government	OGL	All hazards	Low

4.1.1 Flood Maps

Provider	License	Hazard Applicability	Usability
SEPA	OGL	Rainfall, Storms, Sea Level rise	High

The consensus among most participants was that the Flood Maps from the Scottish Environment Protection Agency (SEPA) were a useful source for assessing increased flooding risks, which could be an outcome of both increased magnitude and frequency of rainfall, storms and sea level rise. The SEPA data is presented using a simple index (high, medium and low risk) down to 'street' level, which lends to easy interpretation by all stakeholders. The SEPA data also distinguishes between current flood risk, and future flood risk up to the 2080s, in the 'Future Flood Maps' layer. One participant also commented that the support provided by SEPA is also incredibly useful. Given the flood data also overlaps with other planning use cases out with the evidence report, there is a lot of familiarity with the data.

[2] A detailed description of licensing terms and their implication, such as **OGL, PSGA, BSD and CC-BY** are provided in 9.1.2 - Data Licensing

[3] The relevance of the dataset to the hazard groups as discussed with participants. Definitions are shown in Table 1

[4] Captures ease of use by local authority officials. See 9.1.1 - Usability for more detail

4.1.2 Dynamic Coast

Provider	License	Hazard Applicability	Usability
NatureScot	OGL and PGSA	Rainfall, Storms, Sea Level rise	High

Data from Dynamic Coast is used by multiple planning authorities. This project undertook a wide range of analyses, from coastal change due to sea level rise to the social disadvantage of the population exposed to coastal erosion. The output is a series of datasets on coastal erosion, intended as a broad planning tool for 'street' to 'regional scale' mitigation. The data also includes social vulnerability as an indicator. For coastal planning authorities, the data was seen as valuable and usable, though may not be as accurate or applicable in estuarine areas. The outputs include a mixture of OGL and PSGA data, so while most of the data is fully open, not all layers can be supplied to all stakeholders.

4.1.3 Scottish Index of Multiple Deprivation

Provider	License	Hazard Applicability	Usability
Scottish Government	OGL	All hazards/ vulnerability	High

The Scottish Index of Multiple Deprivation (SIMD) dataset provides a range of indices which can be used to highlight areas of high deprivation that may face a higher impact from climate risks. The data is presented at Lower Layer Super Output Area (LSOA) level (e.g. 'neighbourhood' level) and summarises social issues in simple to interpret indices. The housing index specifically accounts for houses which are overcrowded, and those which do not have central heating – key factors to consider when assessing risks related to several climate hazards.

4.1.4 OS MasterMap

Provider	License	Hazard Applicability	Usability
Ordnance Survey	OGL/ PSGA	All hazards	Medium

There is a large range of data available from the Ordnance Survey (OS), which can cover a range of topics from housing, infrastructure to green space and biodiversity. OS also provides products which can be used as backdrop maps to improve the accessibility of data when shared with stakeholders. The OS MasterMap range of datasets has been used in local government for various purposes since its launch in 2001, so there is likely to be organisational familiarity, especially in GIS teams. OS has been in the process of refreshing its key products with the introduction of the National Geographic Database (NGD). This is intended to add additional data to OS's products to serve further analytical use cases and adds data such as the presence of green roofs and solar panels on buildings (coming in future release), habitat classifications and building ages. OS data is largely licensed under PSGA or OGL, and access is provided via the OS Datahub. OS also has products which

identify areas of greenspace, namely MasterMap Greenspace and OS Open Greenspace. OS data is all high resolution, 'street' level data.

OS data is of high quality and coverage, providing street level data across Great Britain, which is updated frequently. Indicators for climate hazards, however would need to be derived through analysis. This would generally require geospatial skills and tools, but additionally, OS datasets tend to be large and complex. OS has made some efforts to address the complexity of accessing large data, including 'Select+Build' features, and API access. All planning authorities, as PSGA members, can access direct technical support from OS.

4.1.5 Light Detection and Ranging (LiDAR)

Provider	License	Hazard Applicability	Usability
Scottish Government	OGL	All hazards	Low

LiDAR data from the Scottish Remote Sensing portal is valuable for assessing risks related to flooding. Digital Surface Model (DSM)/Digital Terrain Model (DTM) data from LiDAR can be easily interpreted and integrated with other steps in the analysis. The Scottish Remote Sensing portal has OGL licensed LiDAR data in a relatively easily accessible form – however, the coverage of the data is mostly focussed on the Central Belt, limiting the ability for some planning authorities to use. Additional coverage for the data was announced as part of the Future Farming Investment Scheme[5], which should improve the usability of this data in the future. The data is high resolution, supporting analysis at 'street' level.

4.2 Suggested datasets for future wider use

The following datasets were discussed in interviews and workshops, but we found that not all planning authorities sampled were using them. For some datasets, the low uptake by planning authorities was due to difficulty in the use, or accessing of the dataset, whereas for others low uptake was down to a lack of familiarity.

In this section we have provided a narrative for these datasets to indicate where they may be of value for planning authorities to use going forward.

[5] New deal for agriculture - gov.scot

Table 4.2 – Suggested datasets which could be used by Planning authorities for further value

Section	Dataset name	Provider	License[6]	Hazard Applicability[7]	Usability[8]
4.2.1	Local Authority Climate Service	Met Office	OGL	All hazards	High
4.2.2	Habitat Map of Scotland	NatureScot	OGL	All hazards	Medium
4.2.3	European Local Climate Zones	Demuzere et. al. (2022)	CC BY 4.0	All hazards	High
4.2.4	UK Climate Risk Indicators (UK-CRI)	UK Climate Resilience Programme	CC BY 4.0	All hazards	High
4.2.5	River Basin Management Plans	SEPA	OGL	All hazards	Medium
4.2.6	Neighbourhood Flood Vulnerability Index (NFVI) and Social Flood Risk Index (SFRI)	Climate Just	OGL	Rainfall & Storms	High
4.2.7	UK Climate Projections 2018 (UKCP18)	Met Office	OGL	All Hazards	Low
4.2.8	GeoSure, GeoCoast and GeoClimate	British Geological Survey	OGL and Licensed	Rainfall & storms, sea level rise	Low

4.2.1 Local Authority Climate Service

Provider	License	Hazard Applicability	Usability
Met Office	OGL	All hazards	High

The newly launched Local Authority Climate Service (LACS) from the Met Office aims to provide planning authorities across the UK with crucial information on climate change to support decision-making. The LACS provides a simple interface for analysing changes related to key hazards and includes climate averages and climate indicators. A Climate Report can be generated through the Climate Explorer. Planning authorities can add data and then use

[6] A detailed description of licensing terms and their implication, such as **OGL, PSGA, BSD and CC-BY** are provided in 9.1.2 - Data Licensing

[7] The relevance of the dataset to the hazard groups as discussed with participants. Definitions are shown in Table 1

[8] Captures ease of use by local authority officials. See 9.1.1 - Usability for more detail

it in other applications such as Excel and Power BI. It is built using geospatial technology from Esri UK and is part of the Climate Data Portal (Met Office, 2024b) which hosts the information within the Local Authority Climate Projections Explorer. The LACS also includes guidance on the process of assessing climate risk with 'regional' level data. The Met Office launched the new beta service on 9 October, so as a new service has not yet seen widespread adoption in planning authorities. The Met Office are inviting feedback to help drive improvements of the LACS - the conclusions of which could be used as the basis to feed into this improvement process. Additionally, it could increase the number of Scottish planning authorities involved, increasing their awareness and knowledge of the system, and also make sure the LACS delivers the service that Scottish planners need. The LACS is not currently configured to provide reports for National Park planning authorities, but does cover all Scottish local authorities.

4.2.2 Habitat Map of Scotland

Provider	License	Hazard Applicability	Usability
NatureScot	OGL	All hazards	Medium

The Habitat Map of Scotland (HabMoS) is a composite dataset including different layers of detailed habitat data. All have been given a common Habitat Coding from the European Nature Information System (EUNIS). Using this data, a mapping of the existing habitats in a planning authority can be created. High value, or at risk habitats can then be identified, and habitat loss due to hazards such as sea level rise can be accounted for . The data is OGL licensed, with 'street' level resolution. HabMoS brings together habitat and land use data from multiple sources into one map, but the data is not interpreted in the context of climate hazards, so further interpretation and combination with additional datasets would be required to draw conclusions.

4.2.3 European Local Climate Zones

Provider	License	Hazard Applicability	Usability
Demuzere et. al. (2022)	CC BY 4.0	All hazards	High

The European Local Climate Zone (LCZ) data creates a simple typology for the built environment and landcover which is intended to support decision-making around climate risks. The data aims to characterise the urban landscape into broad categories (such as low-rise and high-rise housing) so that interactions between urban form and risks such as poor air quality, flooding and heatwaves can be modelled. Data is provided at 'neighbourhood' level resolution. One workshop participant reported that they had undertaken a ground truthing exercise in their local authority and confirmed that the data was broadly valid. As the data was recently, in 2022 and was aimed at the climate academic community, this dataset has not yet found widespread use in planning authorities. There are not currently any regular updates or revisions published for the LCZ data. Given the data is at 'neighbourhood' resolution, there is less need for it to be updated frequently, as only large changes to the urban landscape would be detected. As well as the detailed methodology

being public, an LCZ Generator tool is provided by Ruhr University Bochum[9] which provides potential opportunities for updated datasets to be created for Scotland in the future.

4.2.4 UK Climate Risk Indicators (UK-CRI)

Provider	License	Hazard Applicability	Usability
UK Climate Resilience Programme	CC BY 4.0	All hazards	High

UK-CRI data simplifies analysis of many risks into indices. For temperature related risks, the data includes an estimation of days (or events) per year of events including heat waves, amber heat-health alerts, tropical nights (nights with a minimum temp of 20 °C). This extends to heat related impacts on infrastructure, such as road melting and high temperatures on rail. The impact of hazards on agriculture such as growing season and heat stress are also reported. Rather than creating new climate data, the UK-CRI is an interface on existing datasets (primarily Met Office) which simplifies complex data into more easily interpreted indices. The Met Office publishes annual updates to its climate data, though the UK-CRI tool does not receive updates as frequently. At 'regional' scale, it is less critical that the data is frequently updated, though after 5-10 years if the tool does not receive data updates, it may become far less appropriate to use.

4.2.5 River Basin Management Plans

Provider	License	Hazard Applicability	Usability
SEPA	OGL	All hazards	Medium

River basin management plans set out actions to address current issues affecting water quality, water resources and fish. The management plans can be used in context with other data sources to understand risks which impact river health. River basin management plans are not explicitly geospatial datasets but relate to river basins which can be represented geospatially. The issues faced using this data mainly lie in the river basin boundaries not aligning with local authority boundaries, so requires some analysis. In addition, the key use case of the dataset is not climate risk or hazard related, so will require reinterpreting to the climate context.

4.2.6 Neighbourhood Flood Vulnerability Index (NFVI) and Social Flood Risk Index (SFRI)

Provider	License	Hazard Applicability	Usability
Climate Just	OGL	Rainfall & Storms	High

[9] LCZ Generator

A national flood vulnerability dataset was created by the Joseph Rowntree Foundation and is publicly available via the ClimateJust Maps tool. This dataset provides and easily to use, ready-made index describing flood vulnerability by combing physical flood risk with several factors which represent socio-economic vulnerability to flooding. However, it is based on 'street level' data published in 2011, which at this scale becomes quickly outdated. England and Wales had their index updated in 2022. An updated Scottish equivalent would be a useful tool for planning authorities to explore the vulnerability to this specific and pressing hazard.

4.2.7 UK Climate Projections 2018 (UKCP18)

Provider	License	Hazard Applicability	Usability
Met Office	OGL	All Hazards	Low

The Met Office is the authoritative source for key climate projection data for the UK. UKCP18 products are commonly used for temperature and precipitation projections, but it can also provide data on humidity, wind and sea level rise. The climate projections generally support analysis at a 'neighbourhood' to 'regional' level, dependent on the specific data UKCP18 product.

The Met Office provides a UKCP18 User Interface for querying and extracting the data, graphs and pre-paired maps (plus access to the full data catalogue for those experienced in handling large datasets), but this does require some expertise in the underlying data to navigate, limiting its usability to planning authorities that have GIS teams or capability. This was reflected in the workshops, as some participants expressed concern that the climate data accessed from the UKCP18 portal was sometimes difficult to use. In addition, there is further interpretation work required to convert a numerical value from the data into a clear indicator which can be used to influence a decision. This interpretation of the climate data and translation into implications for the LDP was also found challenging , with some planning authorities being unable to fully explore what the data means for their plan.

The UKCP18 data is a crucial underpinning to climate analysis and has been used by some planning authorities. More recently the data has been made more usable with a set of pre-prepared indicators by tools such as the Met Office Local Authority Climate Service (where GIS users can also visualise the mapped data and also add their own geospatial data), and UK Climate Risk Indicators.

4.2.8 GeoSure, GeoCoast and GeoClimate

Provider	License	Hazard Applicability	Usability
British Geological Survey (BGS)	OGL and Licensed	Rainfall & storms, sea level rise	Low

Participants expressed an interest in data from the British Geological Survey, which has the potential to address risks such as coastal erosion and landslides. The BGS GeoSure, GeoCoast and GeoClimate datasets indicate risks arising from multiple hazards, with a range of open and licensed datasets. The use of BGS data was not widespread among participants, partly due to the licensing cost associated with the premium datasets.

There may be more value to be gained from these datasets, but it would likely require the supporting geotechnical knowledge and interpretation, unless a simpler way of indicating future risks is provided.

4.3 Perceived gaps and ways to address gaps

When discussing risks, participants expressed several areas where they felt there was insufficient data available to meet their needs. This was due more to the limited understanding of what data was required to support the analysis, rather than specific datasets lacking appropriate spatial and temporal resolution or having gaps in coverage.

It should also be considered that if these data gaps were closed, what value would they provide to the evidence reports in each planning authority, and to what extent would the planning process be able to take useful action on the data. Urban heat islands serve as a useful example – while it would be possible to carry out a detailed analysis in each planning authority, for rural, or northerly authorities, the risk could be understood to be minimal by using an understanding of the local context and long term heat risk from tools like the Local Authority Climate Data Service (see 4.2.1).

In this section, we list the key gaps and explore some datasets and approaches which could be used to address those gaps.

4.3.1 Urban heat islands

Participants generally expressed a lack of data to understand the risks associated with the urban heat island (UHI) effect. The overheating risk methodology can be derived from both UKCCRA3 (Built Environment chapter) and the previous Environmental Audit Committee evidence reviews (e.g. 2018). Determining the extent of the effect of UHIs in urban areas can be done using a temperature sensor network (at high spatial resolution), modelling (e.g. using dedicated products such as Envi-MET, adapting more commonly used modelling approaches, e.g. atmospheric dispersion modelling systems (ADMS) (Zhong *et al.*, 2024), or analysis of high-resolution satellite data products. However, these approaches may not be suitable for all planning authorities due to resource or lack of specialist knowledge. Overheating risk is likely to be greater in areas where urban form is compact, where there is less green and open space, and where the housing quality is poor. As such, combining datasets on Local Climate Zones (to give urban form), green space, and Scottish Index of Multiple Deprivation may act as a proxy for estimating urban heat island magnitude (e.g. Ferranti *et al.,* 2023). Housing quality can also be indicated in further detail by Home Analytics data from the Energy Savings Trust which provides specific attributes on building fabric. This is a simpler approach using GIS datasets that planning authorities may be able to use for their evidence reports.

4.3.2 Storm and wind damage

While there are multiple datasets for inundation and coastal erosion, we did not find much work done to understand wind damage to buildings, or from trees. Tree fall risk is a statutory responsibility so it may be that planning authorities have some of this data held within parks or urban forestry teams. There are datasets which use remote sensing techniques to identify trees. One such dataset is National Tree Map from BlueSky – however, as this is a proprietary, licensed dataset it is unclear if the cost of this dataset outweighs the value which can be gained.

4.3.3 Landslides

While participants did discuss landslide risk, there was no broad consensus on the approach, nor most appropriate data. The open data published by the BGS could serve as a potential baseline assessment of current risk which, if found to be sufficiently high, further research could be carried out incorporating premium data, or input from specialists.

4.3.4 Health infrastructure

Data on the locations of key health infrastructure are available from NHS Scotland and accessible via the Spatial Hub. However, the use of these datasets in the context of the evidence reports would require further interpretation in order to drive decision making in the climate context. Whilst it would be possible to interpret which areas could be exposed to hazards such flooding and coastal erosion, understanding the magnitude of the risk on health infrastructure from hazards such as heating would require additional data to determine vulnerability such as building age and fabric. In the workshops, these aspects were not raised by participants, suggesting that this has not been a focus for planning authorities thus far.

4.3.5 Water infrastructure

Relevant data on water infrastructure, from Scottish Water for example, for the climate context is either available piecemeal, or not published. To understand which data would be required, planning authorities would need more knowledge as to which risks are likely to require water infrastructure data to assess.

4.4 Further observations

Wildfire risk was one aspect investigated by some planning authorities. Seasonal risk forecasts, as well as real-time monitoring is published by the European Forest Fire Information System[10] (EFFIS). This is a valuable resource for assessing the current risk landscape for fires, but additional context would be required for evaluating future risk (see UK-CRI in Section 4.3 above).

Datasets such as the Scottish Air Quality Database[11] provide information on air quality monitoring, analysis and interpretation of data, and pollutant trends at national and local levels. Historical data can also be accessed via the Met Office. Since these are observational datasets, they can be used for assessing current risk, but additional context would be required for evaluating future risk.

For more rural or agricultural planning authorities, there was also value in land use and land cover data from NatureScot, which allows risk to peatlands and croplands to be assessed. For coastal areas this data could also be analysed alongside Dynamic Coast data.

Based on the interviews and workshop discussions, participants expressed several areas where they had difficulty using data for specific outcomes or were not sure what to use.

[10] https://forest-fire.emergency.copernicus.eu/apps/effis_current_situation/index.html

[11] https://www.scottishairquality.scot/

Most of the datasets which were found to be of value for the evidence report were not hosted by a single source such as the Improvement Service Spatial Hub. The overhead effort of data acquisition for the planning authorities could be improved by more of the data providers providing a copy of their data to the Spatial Hub. However, this approach would not be straightforward with all datasets, such as those which are licensed (e.g. BGS), or those were the provider includes an analytical interface for extracting key indicators (Met Office LACS or UK-CRI).

4.5 Analytical tools

We reviewed several different analytical tools, such as CLIMADA[12] and OpenCLIM[13] which are designed to support users in analysing climate datasets and produce new data outputs indicating risk. These tools are open source, adaptable and suitable for academic use cases. In our interviews and workshops, we did not receive any feedback from planning authorities on these tools, suggesting they do not use them. As they require a high degree of specific technical proficiency (e.g. running python code), they may not be particularly suited to the planning authority teams who are producing evidence reports.

[12] https://wcr.ethz.ch/research/climada.html

[13] https://tyndall.ac.uk/projects/openclim/

5 Current Approach

5.1 Climate Risk and Vulnerability Assessments

Climate Risk and Vulnerability Assessments (CRVAs) or Climate Change Risk Assessments (CCRAs) are available for some planning authorities and some regions of Scotland. These include the Clyde area, and one in preparation for south east Scotland.

Nationally, there is the UK CCRA Independent Assessment (Climate Change Committee, 2021a) and the National Summary for Scotland (Sniffer, 2021). These documents are long, difficult to navigate, and have a comprehensive list of wide-ranging risks. For anyone with limited familiarity with climate science and/or individual sectors, it is hard to understand which risks are most relevant to their planning authority or which risks are most important to planning. Risks in these documents are categorised with urgency and magnitude scores, and there is no scoring of impact or likelihood (apart from flooding likelihood) at a national, regional or local scale. Planning authorities need this information for their evidence report requirements, but it is not provided in the national CCRA3.

National documentation on adaptation (i.e. Scottish Climate Change Adaptation Programme: progress report 2023 to 2024) does not directly relate to local planning process and/or is difficult for the untrained person to see the links. The wider list of literature reviewed is given in Section 9.4.1.

5.1.1 Local climate risk assessment barriers and challenges - findings from the academic literature

Research related to mapping climate risk has increased rapidly in recent years. Studies are usually area- and problem-specific, which means that there is no standardised approach. Some maps focus on the local level, such as a city scale, but some have also looked nationally. Some also consider both spatial scales. Similarly, maps that assess climate risk can vary in perspective, such as focusing on one climate hazard because it disproportionately affects the study area the map is produced for. While many do take a multi-hazard approach, some focus on specific challenges such as heat, flooding, and drought.

Methodological process can also vary greatly across such assessments which may affect results so, for decision-makers, it can be challenging to decide which method is most appropriate to use. One key feature of many CRVA maps is the weighting of variables, which affects the extent of which specific variables may influence overall scoring. The SIMD dataset from the Scottish Government, as an example, weights income and employment indicators more heavily than housing in its determination of the deprivation index. However, in a climate risk context, a different weighting may be more appropriate. From a local perspective, weighting variables may be beneficial as they can provide more accurate results for decision-makers. However, in some cases it is difficult to achieve and an unweighted approach is preferred. Reasons can include

- a lack of data or local studies
- the risk of politicisation that may underpin the decisions upon weighting which links to subjectivity and
- complexities around how different climate hazards may weight other variables differently.

Ultimately, adaptation to climate change should be a process that is iterative and embedded into organisational practices. Knowledge underpinning decisions may be imperfect, incomplete, or comprise other challenges such as those outlined above. It is important nevertheless that the process is started with the best knowledge and data available at the time. In repeating the process, more experience is gained, and the challenges can begin to be addressed (Greenham *et al*., 2024b).

5.2 Approach to the evidence report

5.2.1 Current position

In both the interviews and workshop, the planning authorities were at different stages of preparing their evidence reports. This ranged from those at very early stages of preparation through to authorities who have drafted their evidence report and received feedback from the Gate Check[14]. It is important to note that the small number of authorities having received the Gate Check at the point of the interviews and workshop, meaning a small sample may have impacted some of the feedback, alongside the relatively small sample of planning authorities that could be engaged during this short project.

The participants' attitudes towards producing the evidence report were slightly more positive than their understanding of climate risks in general, with a generally positive sentiment (Figure 2)

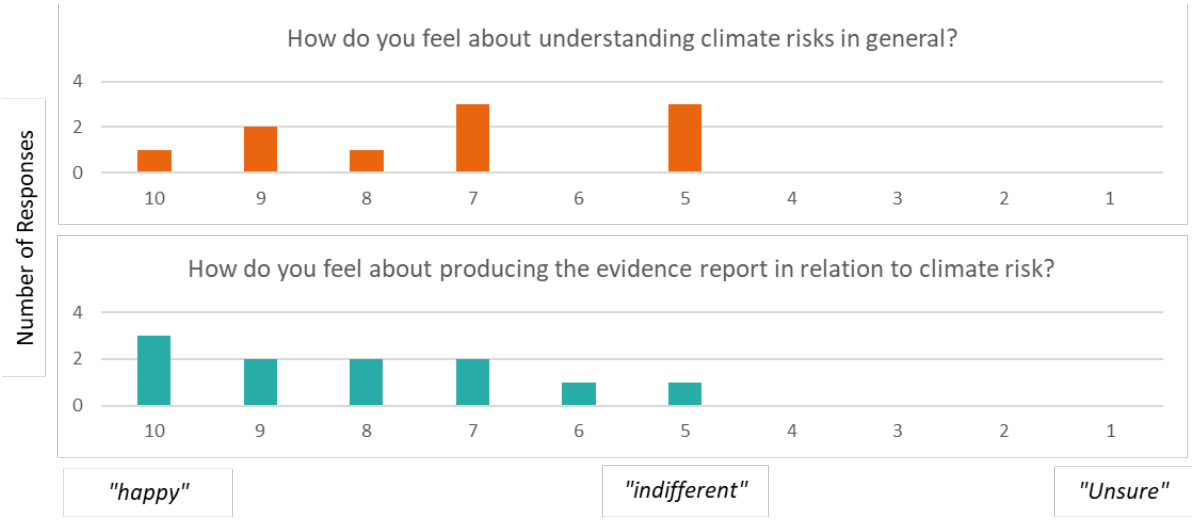

Figure 2 - Sentiment captured during the workshop from the participants

5.2.2 Different approaches

The approaches used by planning authorities varied significantly, with different methods to identify data including policy review, evidence audits and workshops.

[14] Administered by the Planning and Environmental Appeals Division, the Gate Check is a process through which the sufficiency of the evidence report is assessed, to confirm there is a sound evidence base on which to prepare a Local Development Plan

The teams undertaking evidence reports ranged in number of staff from 1-2 to 4-5 people. The use of specialist data or climate specialist colleagues in other departments within the planning authorities varied.

There appears to be a disparity on the anticipated timescales and resources required to undertake the evidence report. This depends on the extent to which planning authorities have already undertaken a climate change risk or vulnerability assessment and could be more reflective of local authority capabilities to conduct and deliver the output.

Some authorities have access to pre-prepared local or regional climate risk assessments or are part of existing climate ready projects (see Section 5.6). Others have access to climate change profiles, which provided an overview of expected future climate change. We also found some authorities had not explored climate risk and therefore had little existing evidence or experience to work from.

However, it was noted that even those planning authorities which had undertaken previous assessments found it difficult to access primary data. They were mainly using the conclusions of the past risk assessments to inform their evidence reports.

The implications of interpreting the data in a climate context and what the evidence actual means for informing or changing the local development plans was not always clear.

5.3 Using data to produce the reports

Concerns were raised by participants over the dynamic nature of the data, new data being published, and old data being updated. Not only did this make it hard to identify the latest datasets, but it also gave rise to concerns about evidence becoming out of date soon after reports were developed[15].

Concerns were also raised about the complex array of caveats and limitations that are inherent in much of the data. This included concerns about their own understanding and interpretation, and how these limitations should be portrayed in the reports in a non-technical manner.

Another issue raised was an inability to find locally specific data at a sub-local authority resolution; one local authority wanted to take a 'neighbourhood'-level approach but felt that data did not exist to support this.

5.4 Data accessibility challenges

Challenges in accessing and fully utilising data exist at several points, and in ways which varied across planning authorities.

Firstly, a very broad set of potential datasets which could be used exists. The planning authorities had to locate many different data sources to compile the data they needed.

Next, the data needed to be downloaded and formatted from the different data sources and while most of the data required is licensable freely to planning authorities, we found a

[15] From an LDP guidance perspective the evidence available at the time of writing the report is proportionate and sufficient.

subset where the licensing implications and restrictions were unclear. In the case where the work was being carried out by organisations external to the planning authorities (e.g. Sniffer), additional barriers were faced as access to PSGA licensed data is not immediately granted, and additional contractor licenses need to be provided. PSGA contractor licenses are free, and they limit the scope of external use of the data to specifically the contracted work.

Once the data is obtained, its application to understanding climate risks and hazards is not always straightforward. Some information is in a readily usable format, while others require expert input before analysis is possible. In the case of datasets such as Dynamic Coast, or data presented via the Met Office Local Authority Climate Service, data is pre-transformed and interpreted in a climate context. As an example, the Met Office LACS provides simple indices such as “Average Number of Extreme Summer Days”. This contrasts with datasets such as UKCP18, where a user will need to download the dataset, isolate the area of interest, extract the climate values, and determine what metric to rate them against. This is a time-consuming process, requiring both geospatial and climate expertise.

Understanding how to link the data back to the guidance and the requirements of the evidence report is a key required outcome, and the extent to which accessing this insight from the data can be achieved varies widely across the datasets used.

5.5 Understanding climate risks

Concerns were expressed in the workshop by participants from smaller planning and development teams about resourcing, where there was little or no dedicated resource within the team, or even access to a dedicated individual with climate change knowledge. This makes the process more difficult and time consuming for these planning authorities.

Risks vary from area to area, but additionally will vary over time as the climate changes. We found that many workshop participants were focused on a current view of risk, rather than being informed on how risks might change based on future projections. Risks across different hazard areas discussed, and whether they seemed well represented or potentially underrepresented in the workshops are outlined in Table 1. Additionally, not all planning authorities had fully defined which hazards were most appropriate for their region.

Given many planning authorities already have a track record in modelling flood risk, and have a greater understanding of flood risks specifically, there is a heavy focus on flooding. There is less awareness of other climate risks, specifically future climate risks, and how they may relate to development planning. In some cases, there is confusion between climate mitigation (through reduction of greenhouse gas emissions) and adaption to reduce climate risk.

5.6 The value of pre-existing work

In some instances, planning authorities were (or will be) able to build upon pre-existing work. Of particular value is work focused on climate risk, and the production of data layers specifically to allow easy interpretation from a wide range of users.

The data and findings from examples like Climate Ready Clyde and Climate Ready South East Scotland can be re-used and built upon for consistency, as well as reducing the effort required for an evidence report specifically. However, planning authorities who have not benefited from these will be at a relative disadvantage.

5.6.1 Climate Ready Clyde

Climate Ready Clyde (CRC)[16] is a leading cross-sector initiative funded by 12 member organisations and supported by Scottish Government to create and deliver a shared vision, strategy and action plan for an adapting Glasgow City Region. CRC have produced Glasgow City Region's Adaptation Strategy and Action Plan (Sniffer, 2024a) which includes a webmap (created by Clydeplan) that shows the location of postcodes most vulnerable to the impacts of climate change (Clydeplan, 2022). This includes heat risk (derived from the 4EI Heat Hazard Index[17]) and a layer highlighting postcodes within the top two heat risk bands. The work from CRC on the Climate Risk and Opportunity Assessment and data layers in the vulnerability map directly informed Glasgow City Council's Evidence report.

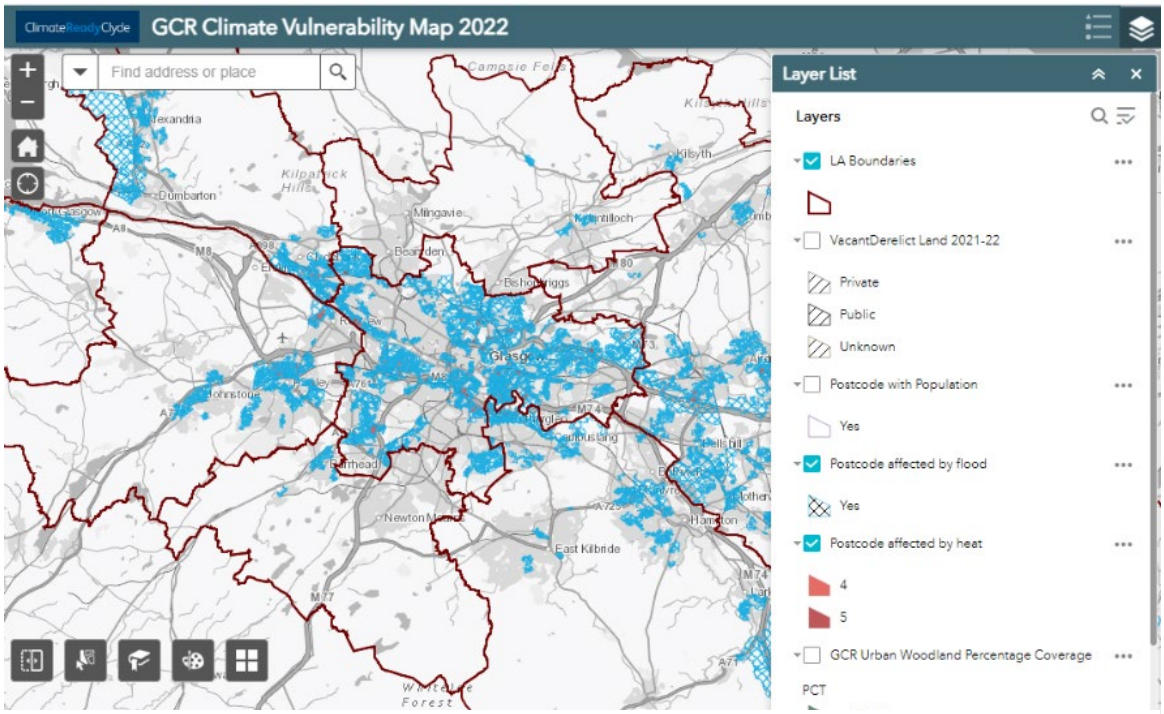

Figure 3 - Glasgow City Region Climate Vulnerability Map

5.6.2 Climate Ready South East Scotland

A new project to support collaborative climate action in the Edinburgh and south east Scotland City Region. Climate Ready South East Scotland[18] is led by Sniffer, working in partnership with the region's six local authorities: City of Edinburgh, East Lothian, Fife, Midlothian, Scottish Borders and West Lothian.

Climate Ready South East Scotland plans to:

[16] https://climatereadyclyde.org.uk/

[17] https://www.4earthintelligence.com/capabilities/heat/

[18] https://climatereadyses.org.uk/

- Identify and prioritise the risks and opportunities from climate change to Edinburgh and south east Scotland's society, economy and environment between now and 2080.
- Lay the foundation for a transformational approach to climate adaptation and resilience for the city region.
- Support a just transition to a net zero and climate resilient economy, in a way that delivers fairness and tackles inequality and injustice.

A detailed assessment of the climate risks and opportunities faced by the Edinburgh and south east Scotland City Region will be carried out, and is intended to be published by March 2025. This assessment will both draw on the best available scientific evidence, and work with communities across the region to gather and share their experiences of climate change. It will inform decision-making across the region, laying the foundation for collaborative climate adaptation action (Sniffer, 2024b).

5.7 Overall observations planning authorities' approaches

We collated six overall observations, looking across the literature review, interviews and workshop.

5.7.1 A focus on flooding and a lack of awareness of available non-flood data

Knowledge and understanding of flood risk and applicable datasets is much more established with planning authorities. While this experience is valuable, it does lead to a focus on flooding to the detriment of the consideration of other risks.

In general, the participants revealed a lack of awareness around climate change projection data, including where to source it and how to use it. As an example, whilst some participants with backgrounds and expertise in climate had knowledge of the data, planners in general were far less familiar with UKCP18 data, when asked about data they used. Most questions on data were directed back to flood information. In one interview, when questioned more on UKCP18 there appeared to be no knowledge of where this data can be located and how to access it. Some statements suggested a lack of understanding of what climate projections are and different scenarios used, however this was not fully probed in the interviews. This data is key in understanding the risks that planning authorities will face in the future and the degree of potential impact.

5.7.2 Spatial data not always used

The use of spatial data appears limited even though the use of it in evidence reports is supported by the Local Development Planning Guidance (Scottish Government, 2023b). Whilst some spatial datasets are well known by planning authorities (e.g. SEPA flood maps) the use of further datasets is not extensive due to poor understanding of the geospatial data required and/or ability and access to staff with the right skills to use and interpret geospatial data.

5.7.3 Simple indices support interpretation

Interviewees generally favoured datasets which provide simple indices tailored to the climate risk context, such as SEPA flood maps and Dynamic Coast. These datasets allow interpretation by users without specific climate or data expertise. This contrasts with the

UKCP18 data, as an example, which provides users with hazard data like temperature and rainfall values over time. Considerable interpretation would need to be done to translate this data into a measure of risk which can be interpreted. Users without climate or geospatial data experience can be supported in understanding the implications if the data is pre-prepared, and presented with relatively simple indicators.

Section 9.2 provides examples of tools and datasets which have been developed outwith Scotland, used to support users without climate expertise in understanding risks.

5.7.4 Simplification of the approach is needed

There is a need to simplify the approach that planners adopt, to enable them to incorporate climate adaptation into their plans. The evidence report is an important part of this process to help development of a baseline and support understanding of the climate risks faced by planning authorities now and in the future. To do this, a Climate Risk and Vulnerability Assessment (CRVA), which considers key hazard, vulnerability and exposure data, is a valuable prerequisite to identify those risks which can be mitigated by planning. Spatial data is key to undertaking an accurate and specific assessment, although there is currently no simple tool to support it. An example of this would be the methods and approach taken by the University of Birmingham for work done for one local authority (Birmingham) and one regional authority (West Midlands) in England (see Section 9.2). Aside from a tool, authorities would benefit from greater understanding of the key datasets which provide the best outcomes. This mirrors findings from the evidence report gate checks completed to date.

5.7.5 Prior work and climate data skills are advantageous

There was a general observation (which was also identified by several stakeholders) that some planning authorities faced greater challenges in the evidence report process. This is because they have little prior work on climate risk, less technical data skills within the team and no dedicated climate change professional within the Council.

5.7.6 Planning support and guidance is not specific on the application of data

The literature review illustrates that there is little information on climate risks and resilience that is written to support either local authority planners or the evidence report process. There is a wide range of data available, which could be used in many different approaches to be applied to understanding climate risk and appropriate adaptations. Furthermore, there is a gap in knowledge on how climate risk impacts planning and how planners can enhance climate resilience through planning requirements and the local development plan. Such information contextualised for Scottish planners would be invaluable to support the evidence report process and would allow adaptation to become business as usual within planning processes.

6 Conclusions

The following conclusions drawn from this research project to improve the evidence base for climate resilient planning policy are:

6.1 Accessibility and usability of data

- There are numerous and varied datasets required to consider the range of vulnerabilities to, and impacts from, climate risks. There are several key datasets which are underutilised by planning authorities currently.
- Many planning authorities do not have a clear and specific understanding of what data is needed to assess climate risk and vulnerabilities. The accompanying Briefing Note for Scottish Planning authorities to this research report (see Section 9.5) should provide support in providing signposted usable data.
- Significant data gaps exist for urban heat islands, storm damage, health, water infrastructure and landslides. Proxies can be used, e.g. combining urban form, green space, and housing quality to assess urban heat island risk. However, consideration should be taken to ensure a consistent methodology, and a proportional amount of effort given potential risk.
- The most useable and accessible data sources, such SEPA, Dynamic Coast, and Met Office LACS provide pre-determined, simple indices which provide a clear indication of climate risk. These allow planners to make clear decisions, without having to apply climate or data expertise to determine risk themselves.
- Not all datasets provide simple indices, however, there are several datasets which could be used by planning authorities in the evidence reports which are not widely used currently. A consistent methodology for planners on how the indicators can be derived and used to incorporate adaptation and resilience into local planning would be advantageous.
- Longer term, a single entry-point to these datasets would make this process easier for the planners and ensure that all Planning authorities have similar data to undertake the assessments
- The data required is also mostly free for planning authorities, however, there are some licensing differences to be aware of when publishing to the public. See 9.1.2 - Data Licensing for further detail.
- Accessibility could also be improved with further guidance on certain requirements mean and how they can be achieved. For example, the requirements ask planning authorities to assess the likelihood of risks occurring. This is a complex task, requiring knowledge of the climate hazards, how they will change, uncertainties, the ranges of climate outcomes depending on scenarios. Guidance on how to define likelihood and how to use data to evaluate likelihood is important, and can be paired with a specific indication of which dataset can be used for that purpose.

6.2 Understanding and capacity

- Planning authorities find it time-consuming and difficult to get the required data from all the different providers.
- Undertaking climate change risk assessments prior to the evidence report would provide a better understanding of which risks and hazards are most impactful. However, planning authorities may need help doing this (especially the smaller planning authorities and/or those without climate and GIS and data experts), including:
    - Direct funding to outsource.
    - Support to identify partners and apply for funding.
    - Sharing or secondment of staff with climate resilience/climate science and GIS and data skills.
    - Collaboration and co-funding with neighbouring/regional planning authorities, like the 'Climate Ready' regional projects.

  As an example, Sniffer is an independent charity that supports and coordinates the climate ready programmes in Scotland, including work such as webinars which discuss the use of different datasets. Sniffer currently hold a Scottish Government funded contract (Adaptation Scotland) to provide some capacity building support to planning authorities. This could be expanded to provide wider support for the climate change risk assessment process and support planners in translating the findings into the evidence report and the local development plans.
- It should also be noted that the assessment of likelihood of risks occurring, beyond flood risk, is not undertaken in the UKCCRA3 or Scotland's national summary.
- It is useful to understand and address vulnerability at the evidence report stage, although stakeholders did not seem familiar with this as a concept or how it might be assessed.

7 Potential for action

Based on the findings from this research, the following actions could be explored in the short term to enhance and improve the coverage and usefulness of evidence reports:

- Engage with the Met Office for a review of planner-specific user experience when accessing the latest UK Climate Projections (UKCP18)
    - The impression from most stakeholders was that UKCP18 projections are daunting and avoided by planners. The Met Office Local Authority Climate Service (LACS) (Met Office, 2024a) is still in beta, and feedback should be provided on how it could further meet the needs of Scottish planners.
    - Explore whether non-flood related climate data could be sourced directly via an existing data service for the creation of bespoke Climate Risk and Vulnerability Assessment indices and geospatial data portal relevant to planning in Scotland.
    - Explore the inclusion of features to support the National Park planning authorities in the LACS.
- Engage with the British Geological Survey (BGS) to explore expansion of access for the assessment of landslide risk - and potential inclusion of licensed data.

- Provide planners with further detail on which aspects of various datasets are valuable for their local plans, including the climate risks which planning should address (e.g. overheating, surface water flooding).
- Encourage cross-authority engagement and collaboration. Given the inconsistent availability of knowledge, skills and capacity, peer learning and support can potentially provide a valuable approach to improving quality and consistency.
- Share and promote the list of data (from this research) as a standalone resource, cross referenced with the relevant climate risks. See accompanying data catalogue (Section 9.5).
- This research also clarifies which data licences may be required to support evidence report production, and further guidance on the impacts of the different license types.
- Investigate funding options for regional Climate Risk and Vulnerability Assessments. As a first step, a CRVA provides a clear steer on what the key risks are, therefore allowing a more targeted approach to the Evidence reports.
- Scope out the requirements for a Climate Risk and Vulnerability Assessment data platform for centralising the hosting of key datasets. In addition, this should include the development of new datasets and indicators which allow interpretation to non-climate, or non-geospatial users more easily. This could be delivered as a new tool or an extension to an existing one.

There is potential in the longer term to make the key national datasets available, with pre-interpreted indices available in one location. The data could have simple (e.g. high, medium, low) indices with user friendly guidance on what the data is, what it means and caveats (this could be 4-5 key hazards, with a climate vulnerability index). It could link directly to the datasets that have been identified in this report and could also potentially use some of the data from the analytics tools. This would require further research and dialogue with potential providers.

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9 Appendices

9.1 Definition of Terms

9.1.1 Usability

Usability is summarised as follows:

- '**High'** – a dataset which provides simple indices in a climate hazard and risk context and access and can be interpreted easily. Users will not need specific GIS or climate expertise to understand planning outcomes from these datasets.
- '**Medium'** – data is relatively accessible but requires expertise to interpret or transform. To understand the data in a climate hazard and risk context, as well as planning outcomes, specific expertise in either climate, or GIS will be required.
- **'Low'** – a dataset which requires specialist knowledge, expertise or skills. Extensive expertise, as well as time and effort will need to be applied to this data in order to arrive at indicators that can be used to make planning decisions.

9.1.2 Data Licensing

The information is provided as guidance on the description and general consequences of the common license types encountered for data. However, care should always be taken to ensure that if any data is used, the license and its limits should be validated before use or distribution.

Table 9.1 – Relevant data licences and their impact on planning authorities

License Name	Description	Outcomes for planning authorities	Link
OGL – Open Government License	A UK government defined license that encourages the public sharing of government created data	OGL generally supports data being used for most purposes internally at a local authority, and shared publicly in full	Open Government Licence (nationalarchives.gov.uk)

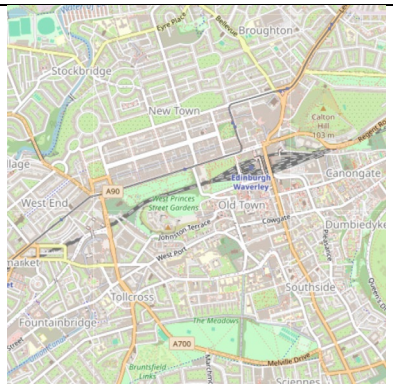
License Name	Description	Outcomes for planning authorities	Link
PSGA – Public Sector Geospatial Agreement	The license under which premium Ordnance Survey data is licensed to UK central and local governments	The PSGA license generally supports planning authorities in using data internally for all government functions. However, the data cannot be published and shared publicly in full. OS provides details on the full obligations.[19]	Public sector licensing guide | OS (ordnancesurvey.co.uk)
CC-BY – Creative Commons Attribution	A permissive public copyright license that enables the free distribution of copyrighted work	CC-BY generally supports data being used for most purposes internally at a local authority, and shared publicly in full, so long as attribution is given. There are many sub types of Creative Commons licenses, so refer to the Creative Commons site for more details	Deed - Attribution 4.0 International - Creative Commons
BSD – Berkly Software Distribution	A permissive, free software license	BSD is licenses are generally for software rather than data, but it is a very permissive license that imposes few limits on what can be done – a local authority could use BSD licensed software for any use internally, and then publish publicly in full	BSD licenses - Wikipedia

[19] https://www.ordnancesurvey.co.uk/customers/public-sector/public-sector-licensing/publish-share-data

License Name	Description	Outcomes for planning authorities	Link
Copyright or Proprietary	Some of the datasets listed carry specific licensing terms. These must be validated against the specific use cases in any instance.	Refer to the given license directly – but generally, there will be limits to internal use and external publishing.	N/A

9.1.3 Data Scale and Resolution

Table 9.2 – Description of the shorthand terms used to describe spatial resolution as used in this report. Inset maps © OpenStreetMap contributors

Scale	Spatial Resolution	Example
'street'	<50cm	
'neighbourhood'	50cm – 1km	

Scale	Spatial Resolution	Example
'town'	1km – 15km	
'regional'	15km+	
'national'	100km+	

9.2 Example Tools to support Interpretation

9.2.1 Climate Risk Vulnerability Assessment methods – the University of Birmingham

A Climate Risk and Vulnerability Assessment (CRVA) map is a method co-developed by the WM-Air project team at the University of Birmingham with local and regional stakeholders across Birmingham and the West Midlands. A CRVA map shows how geospatial climate risk data may be used by local planning authorities. It is pulled together using different environmental, physical, and socio-economic datasets to understand how climate risk varies across an area. The mapping approach prioritises using publicly accessible data and can be replicated by other planning authorities to improve climate resilience (Greenham *et al*., 2023).

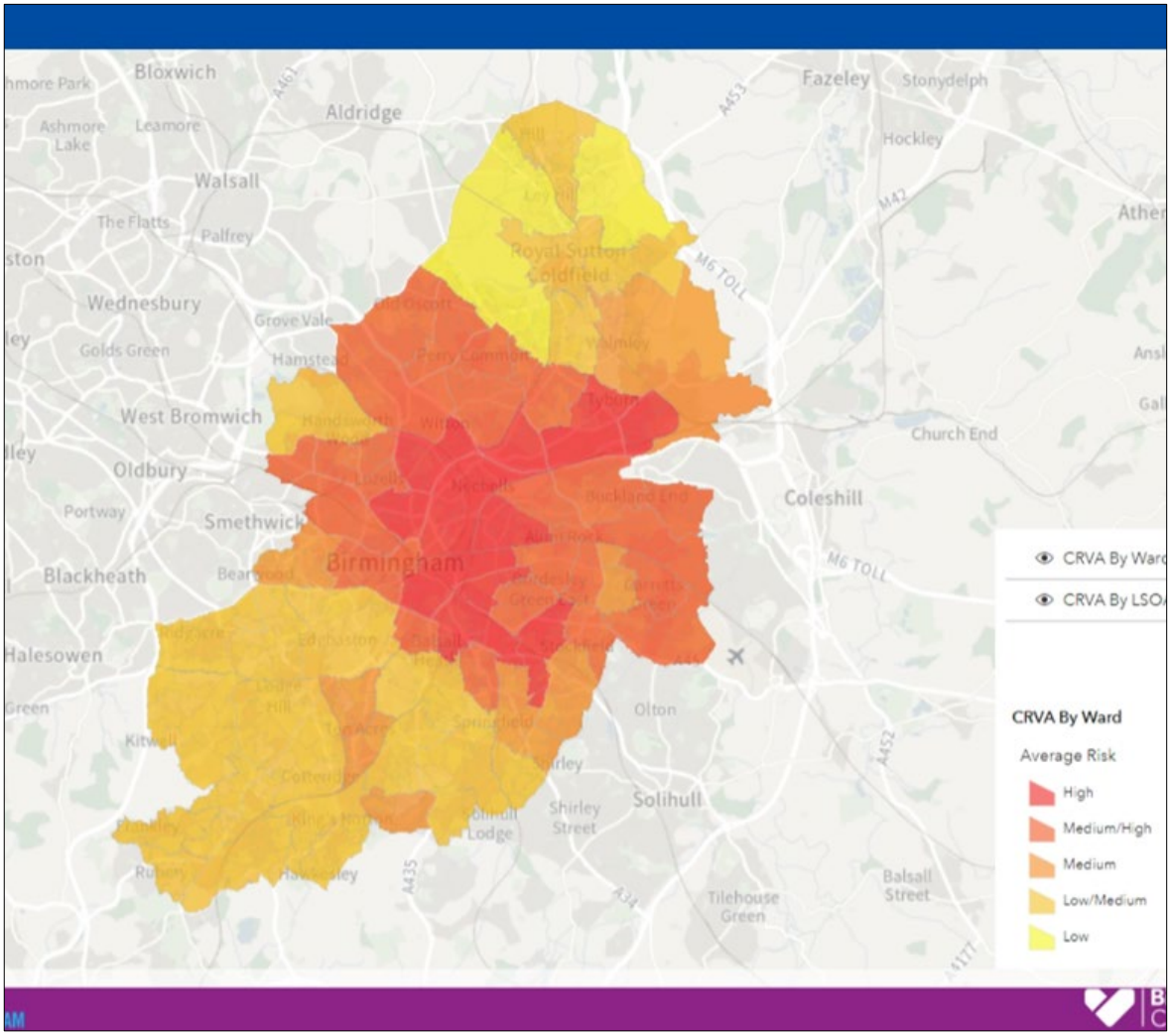


Figure 4 - Birmingham City Council Climate Risk and Vulnerability Assessment map

Birmingham City Council recently published their CRVA (Greenham *et al*., 2023) on the city's website (Birmingham City Council, 2024). The CRVA map scores areas of Birmingham based on compiling the presence and extent of 11 different factors that may influence the impact of climate change, where the higher the score, the more at-risk and vulnerable an area and

its citizens are likely to be to climate change. The approach is considered a Minimum Viable Product (MVP), i.e. it works, and refinements can be made through use.

9.2.2 West Midlands Climate Risk and Vulnerability Assessment (WM-CRVA) Map

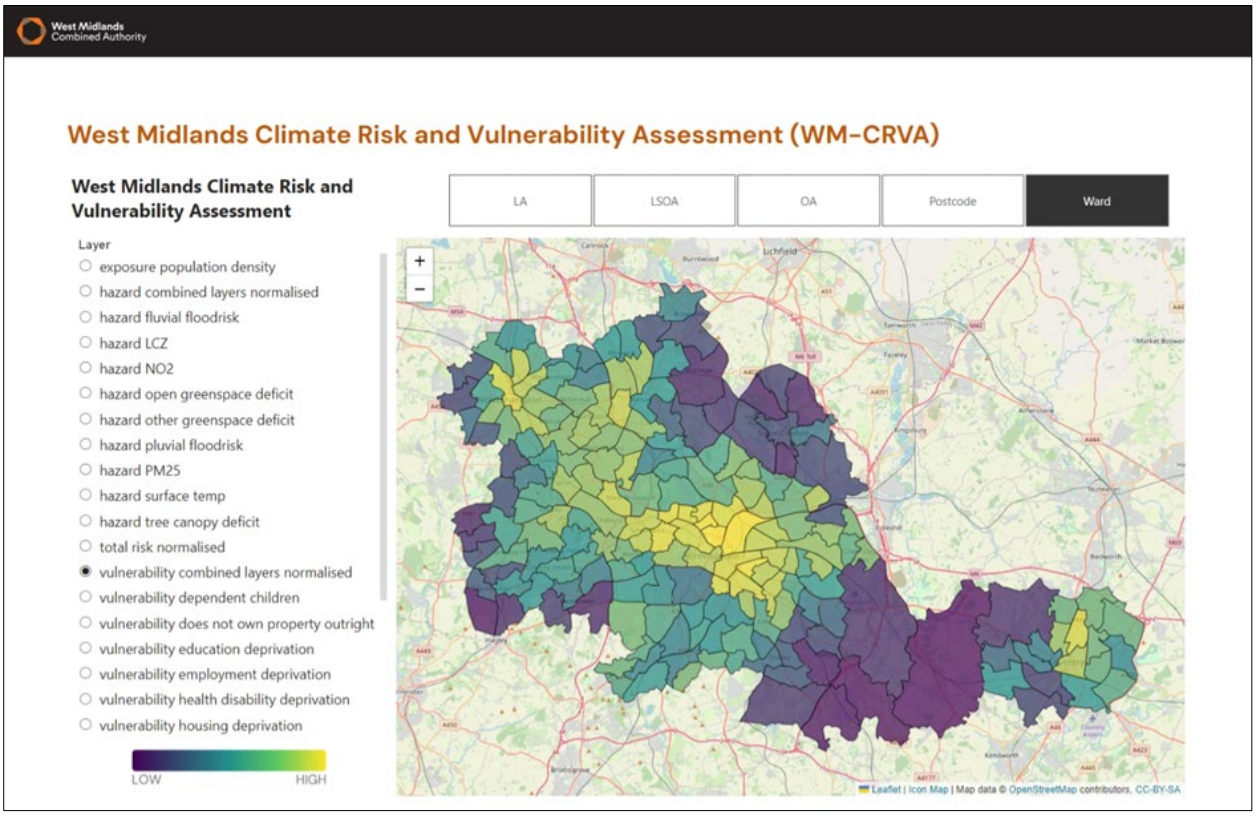


Figure 5 - West Midlands Combined Authority Climate Risk and Vulnerability Assessment Map

The University of Birmingham also collaborated with the West Midlands Combined Authority (WMCA); co-developing a CRVA map for the wider West Midlands (Greenham *et al*., 2024a). It takes forward the Birmingham MVP approach by including greater consideration of vulnerability. The overall CRVA map scores are based on 24 different factors, each of which is considered one of either a hazard, vulnerability, or exposure factor influencing climate risk.

9.3 Methodology

Our approach included two key phases the Discovery phase and the Analysis phase. The discovery phase involved a continuation of planning and refining the scope, and identifying the key tasks needed to ensure we had the full background and context to successfully undertake the research. The Analysis phase involved the main research tasks, including stakeholder engagement and a deep dive analysis of currently available climate risk and hazard data. Both are described in more detail below.

9.3.1 Discovery Phase

- A desktop literature review was conducted (August 2024). The literature included covered information on climate change methods, past climate risk or vulnerability studies (where spatial data was used), and information relevant to climate risk in Scotland as well as the latest policy documents around climate adaptation for Scotland. Here we identified which risks were commonly highlighted within Scotland and what data has been used by others to represent those risks. As well as summarising the key policies relevant to the topic climate change risk and adaptation for the Evidence reports. The literature review findings were summarised in an excel spreadsheet. The full references to the literature are included in Appendix Literature review (Section 9.4.1).
- Three of the currently available evidence reports were also reviewed, this allowed us to understand the current work by planning authorities and what approaches they took. We also began to identify gaps between the produced Evidence reports and the requirements.
- A long list of potential workshop invitees was developed, this was to be refined within the analysis phase.
- Identified a proposed list of relevant data with key search parameters for deep dive assessment. Research partners the University of Birmingham shared the data lists for both their CRVA mapping projects for Birmingham City Council and the West Midlands Combined Authority for review in the context of identifying the same UK wide datasets of their Scottish equivalents.
- Set out an initial stakeholder engagement plan for the approach to both the interviews and a workshop, which was reviewed by and agreed with CXC.

9.3.2 Analysis Phase

- Undertook the dataset deep dive and identified key practical characteristics including cost, availability, and accessibility
- In the stakeholder engagement plan the approach for both the interviews and workshops were also set out. For the interviews we identified a list of stakeholders, this included three planning authorities that had or were in the process of undertaking the Evidence reports. We asked to speak to relevant individuals who had written the reports or who would be or were significantly involved in gathering climate evidence. Here, knowledge gained from the literature review was used to develop appropriate questions to help us better understand the local authority's approach to gathering evidence, their understanding of the requirements and any difficulties they had faced or anticipated facing, and confidence with the topic (a full

list of the interview questions can be found in Appendix Interview responses, Section 9.4.2).

- When selecting stakeholders for both interviews and workshops we aimed to get a mix of stages within the development report process. We also ensured we had a good geographic spread of participants representing the wide range of planning authorities in Scotland. This included, coastal, city based, and Island based planning authorities.
- During this analysis phase we held three interviews with representatives of Fife Council (21st August 2024), Comhairle Nan Eilean Siar (28th August 2024) and Glasgow City Council (3rd September 2024). Interviews included multiple members of the Arup team representing planning, Climate and data expertise as well as a note taker. All interviews were recorded with the permission of the participants. Interview findings were summarised in Appendix Interview responses (Section 9.4.2).
- After the initial interviews a virtual 'Prioritisation Workshop' (17th September 2024) which included representatives from the planning authorities we interviewed, other planning authorities (across a geographic spread and at differing stages in their LDP) and other relevant wider stakeholders (such as representative from Sniffer). The workshop was developed using the findings of the interviews, so that the activities probed at areas of interest and or areas not fully covered by the interviews. The aim of this workshop was to further discuss how planning authorities can improve their access to geospatial data for climate adaptation.

9.3.3 Underlying assumptions

CXC facilitated introductions to key stakeholders for engagement. Engagements were virtual, via Microsoft Teams.

The sample of planning authorities involved was not aiming to be extensive or include all Scottish LPAs, given the scope, size and duration of this research project, but aimed to have good representation across geography, size and stage of progress with the Evidence report.

9.4 Literature review and stakeholder engagement

9.4.1 Literature review

A desktop literature review was conducted during the discovery phase, and a full list of references is provided here.

Table 9.3: Full list of references for literature review

Full reference	**Link**
Birmingham City Council (2024) Climate Risk and Vulnerability Assessment map.	https://maps.birmingham.gov.uk/webapps/CRVA/
Bristol City Council (2021) "Keep Bristol Cool"	https://bcc.maps.arcgis.com/apps/instant/portfolio/index.html?appid=986e3531099f48d393052fab91ceff51
Centre for Sustainable Energy and the Town and Country Planning Association (2023) Spatial planning for Climate resilience and Net Zero (CSE&TCPA). UK Climate Change Committee	Spatial planning for climate resilience and Net Zero (CSE & TCPA) - Climate Change Committee (theccc.org.uk)
Climate Ready Clyde - Glasgow City Region (GCR) Climate Vulnerability Map 2022	GCR Climate Vulnerability Map 2022 (arcgis.com)
Climate Ready Clyde: Climate Risk and Opportunity Assessment for Glasgow City Region (2022)	Climate Ready Clyde
Falkirk Council (2024) Falkirk Local Development Plan 3 Evidence report	Topic Paper - Energy, Climate Change and Resources (falkirk.gov.uk)
Fife Council (2024) Fife Local Development Plan 2 - Evidence report	01-The-Evidence-Report-with-images-Council-version.pdf (fife.gov.uk)
Glasgow City Council (2024) City Development Plan 2 Evidence report	CDP2 Climate Mitigation and Adaptation (glasgow.gov.uk)
Greater London Authority (2022) London Climate Risk - A Spatial Analysis of Climate Risk Across Greater London: Methodology Report.	https://data.london.gov.uk/dataset/climate-risk-mapping
Greenham, SV., Ferranti, EJS., Cork, NA., Jones, SA., Zhong, J., Haskins, B., Grayson, N., Needle, S., Acton, WJF., MacKenzie, AR., Bloss, WJ. (2024b). Mapping climate risk and vulnerability in the West Midlands. A guidance document produced by the WM-Air project, University of Birmingham	https://doi.org/10.25500/epapers.bham.00004371

Full reference	Link
Greenham, SV., Jones, SA., Ferranti, EJS., Zhong, J., Acton, WJF., MacKenzie, AR., Grayson, N., 2023. Mapping climate risk and vulnerability with publicly available data. A guidance document produced by the WM-Air project, University of Birmingham.	Mapping climate risk and vulnerability with publicly available data. A guidance document produced by the WM-Air project, University of Birmingham. - ePapers Repository (bham.ac.uk)
Kent and Medway Council (2020) Kent and Medway Climate Change Risk and Impact Assessment	https://www.kent.gov.uk/__data/assets/pdf_file/0015/111381/CCRIA-for-Kent-and-Medway-part-one-methodology-and-summary-findings.pdf
Met Office (2024) Spatial Climate Risk Assessments: A tool for understanding future risk and adaptation planning. Insights.	Spatial Climate Risk Assessments: A tool for understanding future risk and adaptation planning - Met Office and its Local Authority
Perth and Kinross Climate change risk and vulnerability assessment (in press)	NA - not published
Ricardo (2023) Surveying the evidence landscape for UK-focused spatial climate risk assessment.	Surveying the evidence landscape for UK-focused spatial climate risk assessment (Ricardo) (ukclimaterisk.org)
Scottish Government (2019) Climate Ready Scotland: Second climate change adaptation programme 2019-2024	Climate Ready Scotland: climate change adaptation programme 2019-2024 - gov.scot (www.gov.scot)
Scottish Government (2023b) Local Development Planning Guidance	Local development planning guidance (www.gov.scot)
Scottish Government (2024) Scottish Climate Change Adaptation Programme: progress report 2023 to 2024	Scottish Climate Change Adaptation Programme: progress report 2023 to 2024 - gov.scot (www.gov.scot)
Scottish Government / Riaghaltas an h-Alba (2024) Draft Scottish National Adaptation Plan (2024-2029): Actions today, for a climate resilient future. 31 January 2024.	Supporting documents - Climate change - national adaptation plan 2024 to 2029: consultation - gov.scot (www.gov.scot)
Sniffer (2021) Third UK Climate Change Risk Assessment (CCRA3) Technical Report: Summary for Scotland	Summary for Scotland (CCRA3-IA) - UK Climate Risk
UK Climate risk indicators (2024) University of Reading and Institute of Environmental Analytics.	https://uk-cri.org/

Full reference	Link
West Midlands Combined Authority (2024) Climate Risk and Vulnerability Assessment map.	West Midlands Climate Risk and Vulnerability Assessment (WM-CRVA): LSOA — West Midlands Combined Authority (west-midlands-combined-authority.github.io)

9.4.2 Interview responses

This section provides the interview questions and a summary of the answer given by all three planning authorities interviewed.

Q1: What is your role in preparing the Evidence report?

- Most stakeholders interviewed were planning officers based in planning services or equivalent.
- Teams working on this topic of the Evidence report ranged from 1-2 to 4-5 members of staff as the core team. Though generally one or two key individuals took responsibility or a key co-ordination role.
- Use of expertise outside of teams also varied including some drawing on data individuals or climate and sustainability officers.

Q2: What is the status of your Evidence report? And what are the next steps?

- Ranged from early stages of prep to just complete and complete and addressing feedback.

Q3: How clear to you were the requirements / guidance for assessing climate risk through the Evidence report?

- Responses to this question were mixed, some stated the guidance "left a lot open to interpretation", feeling it was hard to understand what they actually needed to do.
- One Local Authority said the guidance was clear in answer to this question but after further probing it appeared they were not sure on several of the elements within the requirements.
- One response stated that requirements were easier to interpret due to knowledge of other resources.

Q4: How did you assess climate risk/climate change within your Evidence report?

- In one interview the approach had not been developed and it was too early to discuss.
- The other two planning authorities relied heavily on information that had been previously produced for the area, such as past climate profiles or regional risk assessments. Using this information and interpreting it rather than new information or raw data designed specifically for the Evidence report.
- One Local Authority took a place-based approach but struggled with assessing climate risk on this level.

Q5: How have you assessed vulnerability to climate change and inequalities?

- This question was generally not well answered indicating that there was a lack of understanding on the requirements around assessing vulnerability.
- One Local Authority alluded to have a copy of a vulnerability index, but not sure where it was sourced from (potentially from SEPA).

Q6: Do you know what datasets were required to undertake climate risk assessment?

- One Council in the early stages indicated that they did not yet know what datasets would be required to complete assessments but were aware of the recommended data sets.
- Another realised on using report summarising previous regional risk assessments and interpreted screenshots from these reports. They had tried to get the data but had difficulty locating/accessing it.
- Generally, when talking about data the focus was flood data. No participant mentioned raw climate projection data. Heat hazard data was mentioned by a single Local Authority but in the context of difficulties getting the data.

Q7: Do you know how to/have the ability to access them (within the team)?

- Answers for this question were mixed some had dedicated contacts they could reach out too for data others stated they struggled knowing which data was relevant.
- When probed there generally seemed to be a lack of knowledge on what data was out there, without even thinking about how to access, use and interpret the data.
- General staff resources were flagged as an issue and time needed to use datasets.
- One Local Authority had external GIS support for these kind of tasks from a cross local authority collaboration to share resource, with a 2-year secondment, though this was a resource with a limited timescale.

Q8: Is there anything else you would like to share about the process?

- One set of interviews mentioned that they were beginning to realise the size and scope of the task of gathering and analysing climate risk data as they begin process of evidence gathering.
- One Local Authority mentioned concern about understanding how all of this actually linked into to planning and how in general the evidence would be used to influence planning.
- One also mentioned they had a lot of support from their climate team and could sense check and problem solve with their guidance. This was an invaluable resource.

9.4.3 Workshop

Arup and the University of Birmingham undertook a stakeholder workshop on 17 September 2024 for ClimateXChange Scotland and the Scottish Government on Improving access to geospatial climate risk data. The purpose of this workshop was to discuss together how planning authorities can improve their access to geospatial data for climate adaptation in the context of development planning.

The online workshop brought together planning authorities (across a geographic spread and at differing stages in their LDP) to better understand their needs as a local planning authority and/or climate policy team:

- to prepare Evidence reports,
- as users of this geospatial climate risk data and;

- understand any current challenges or gaps that need addressing

The workshop provided information on key hazards and risks the planning authorities had been or anticipated focussing on and what data would or had been used. The workshop built on the interviews by delving deeper into the data and methods of analysis. Providing further insight on data gaps, ease of use and challenges faced by the planning authorities.

9.5 Additional Resources

9.5.1 Data catalogue

The data catalogue spreadsheet is available online:

Improving access to geospatial climate risk data - Data catalogue

9.5.2 Briefing note for planning authorities

The briefing note for planning authorities is available online:

Geospatial climate data for evidence reports briefing note

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