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Measuring inclusive growth in the Highlands and Islands: a typology

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Key messages

- **Building on longer-term strategic research on place-based policy, and a responsive, collaborative project in 2020, this report describes the creation of a detailed typology of inclusive growth performance, at the small area level, for the Highlands and Islands of Scotland.**
- **Collaboration between researchers, statisticians and practitioners developed a meaningful framework of inclusive growth for the Highlands and Islands, which included recognised themes of inclusion and prosperity and the geographical and social contexts of different locations.**
- **Indicator compilation and calculation attempted to control for the diverse geography of the Highlands and Islands by using custom geographical aggregation, where appropriate, and included measures of Covid-19 impact and a novel Data Zone-level estimate of economic output. The multivariate analysis produced scores for seven concepts underlying inclusion and prosperity performance, and these measures and key demographic characteristics were used to produce a nine-fold classification of Data Zones in the Highlands and Islands region, showing areas with similar characteristics related to inclusive growth.**
- **The differences between these clusters, in terms of characteristics of inclusive growth 'performance', geographical distribution and population change, are described. With further refinement, this research and the approach described could significantly increase the evidence base around inclusive growth and rural diversity in Scotland.**

What were we trying to find out?

This report has been produced as part of a strategic research project on *place-based policy and implications for policy and service delivery*, involving researchers at the James Hutton Institute and Scotland's Rural College. The multivariate analysis and conceptual focus of this report represents a development of previous research, which assessed the quantitative evidence base required to understand local areas, regional differences, and rural diversity in Scotland (Hopkins and Copus, 2018). This work identified datasets relevant to a multi-dimensional wellbeing framework, drawn from the 11 themes used by the Organisation for Economic Co-operation and Development (OECD) in regional analysis (OECD, 2016a) and 'Better Life Index' assessment (OECD, 2016b). This conceptualisation aligns with the Scottish Government's interest in measuring progress towards diverse National Outcomes within the National Performance Framework (Scottish Government, 2019) and wider

recognition of the limitations of traditional economic indicators (including GDP) for measuring wellbeing in society (Costanza et al., 2009).

The most recent (2018) version of the National Performance Framework presents a purpose for Scotland: “To focus on creating a more successful country with opportunities for all of Scotland to flourish through increased *wellbeing*, and *sustainable and inclusive economic growth*” (Scottish Government, 2019: 2, emphasis added). The second of these priorities - Inclusive Growth - has grown in emphasis as a policy goal within Scotland. It has been cited as an aim of key regional policies: Regional Growth Deals¹ and City Region Deals², and is also central to broader strategies, including the Scottish Government’s Economic Action Plan (2019-20)³; Scotland’s Economic Strategy (2015) also cited inclusive growth as one of four priority areas alongside investment, innovation and internationalisation (Scottish Government, 2015: 8). Additionally, wider political rhetoric in the UK around ‘levelling up’⁴, and the launch of the Levelling Up Fund for improving regional infrastructure (HM Treasury, Ministry of Housing, Communities & Local Government, Department for Transport, 2021), has coincided with the work of the UK2070 Commission into regional inequalities. The latter’s final report ‘Make No Little Plans: Acting at scale for a fairer and stronger future’, published in February 2020, acknowledged the very high level of geographical inequality in the UK, its major social and economic consequences, and the need for urgent and extensive policy change to address this (UK2070 Commission, 2020). The unprecedented Covid-19 pandemic has obviously brought a range of personal and place-based issues and disadvantages to greater prominence, and a “...variety of socio-economic inequalities are likely to arise or deepen as a result of the crisis” (Blundell et al., 2021: 28).

Despite the growing interest in inclusive growth, there are uncertainties surrounding its meaning and measurement: “...its fuzziness makes it hard to operationalize; it remains unclear what works in achieving it...”, despite its positive focus on the improved distribution of economic growth (Lee, 2019: citation p. 429). This uncertainty has also been highlighted in the Scottish context: the report ‘Delivering Inclusive Growth in Scotland’ (Statham and Gunson, 2019) recommended that the “...Scottish Government could better develop a clear, consistent and applied definition of inclusive growth”, and noted “...a difficulty in measuring progress against inclusive growth at the national and sub-national level...” (ibid: p. 7). While

¹ See <https://www.gov.scot/policies/cities-regions/regional-growth-deals/> (Accessed 15th April 2021)

² See <https://www.gov.scot/policies/cities-regions/city-region-deals/> (Accessed 15th April 2021)

³ See <https://economicactionplan.mygov.scot/overview/inclusive-growth-approach-economy/> (Accessed 15th April 2021)

⁴ See <https://www.bbc.co.uk/news/56238260> (Accessed 19th April 2021)

some regional analyses relevant to inclusive growth have been developed, including the work of Scotland's Centre for Regional Inclusive Growth⁵, genuinely 'local' (small area) data around inclusion is limited, and the geography of Scotland's rural areas and islands present challenges for data availability and analysis (Scottish Council for Development and Industry, 2019).

In the context of a wider demand for information and data about inclusive growth, this report describes activities within, and outputs from, the 2020 project *ToWards Inclusive Growth*, which involved researchers at the James Hutton Institute and Biomathematics and Statistics Scotland (BioSS), and collaboration with researchers and practitioners at Highlands and Islands Enterprise. The project aimed to produce area profiles – a typology - reflecting characteristics of inclusive growth across the Highlands and Islands of Scotland. This reflected the overlapping interests of researchers at the James Hutton Institute and Highlands and Islands Enterprise, the growing interest in the concept described above, and the demand for a more nuanced, granular understanding of rural development in the Highlands and Islands in order to inform place-based interventions and support. The latter stems from an awareness of the limitations of the Fragile Areas classification (Highlands and Islands Enterprise, 2014) in the Highlands and Islands region, which represents an 'in or out' two-fold classification that inevitably simplifies and disguises a complex pattern of development.

What did we do? Collaboration and data analysis

The key 'end product' of the project was a classification of 630 small areas (Data Zones) in the Highlands and Islands region into nine distinct clusters, which show areas with similar characteristics related to inclusive growth. This focused analysis was informed by a longer period of engagement and collaboration in 2020, between the James Hutton Institute, BioSS, and Highlands and Islands Enterprise. Some of the engagement and knowledge exchange activities which were initially proposed or discussed were cancelled due to the Covid-19 pandemic: these were replaced by online discussions, and the following description includes the activities which did take place.

Developing a meaningful framework of inclusive growth in the Highlands and Islands

An in-person engagement workshop took place (Aberdeen, March 2020) and featured discussions and prioritising tasks necessary to produce the area profiles. Following this, a framework of inclusive growth in the Highlands and Islands, for use

⁵ See <https://www.inclusivegrowth.scot/about-us/> (Accessed 19th April 2021)

as a basis for indicator selection and analysis, was co-constructed through online discussions (Table 1) and published in May 2020⁶.

Table 1: Framework of inclusive growth for the Highlands and Islands

	Themes	Dimensions	Potential indicators
Primary themes	Inclusion	Income	Benefits In-work tax credits Low earnings
		Living costs	Housing affordability Housing costs Fuel poverty
		Labour market inclusion	Unemployment Economic inactivity Workless households
	Prosperity	Output growth	Output Diversity of business interests Private sector businesses Wages/earnings
		Employment	Workplace jobs Private/public sector employment balance People in employment Employment in low pay sectors
		Human capital	Educational attainment Intermediate/higher-level skills Type of workforce, occupations
Contextual themes	Physical geography and connectivity	Physical geography	Urban-rural classification Mainland or island Population density or sparsity Natural hazards
		Access to services	Transport infrastructure Access to key services Digital connectivity
		Environmental assets	Area of carbon 'sinks' Renewable energy potential / existing schemes Area protected / designated in some way
	Population and social characteristics	Social strength	Community strength and cohesion Commuting Second or empty homes
		Social infrastructure	Existence of community centres, libraries and similar facilities, community owned land

⁶ 'What makes up 'Inclusive Growth'? Developing a framework for Scotland's Highlands and Islands: blog published at <https://researchontheedge.org/what-makes-up-inclusive-growth/> (Accessed 12th April 2021). Note that the description of the framework within this section is partly adapted from this blog entry.

		Social vulnerability	Age structure Rates of disability, poor health (physical and mental) Ethnicity Gender Public transport infrastructure
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Note that the names of some of the potential indicators were shortened for the purposes of this table.

The two ‘primary themes’ in this framework, their underlying dimensions, and potential indicators were drawn from the Inclusive Growth Monitor, a framework produced for the Joseph Rowntree Foundation which has been used to measure inclusion and prosperity at the sub-national level in England (Beatty et al., 2016). Despite uncertainty and debate around the meaning of inclusive growth, the interplay between the themes of inclusion and prosperity is clearly central to its understanding, and they form part of conceptual discussions and measurement frameworks. For instance, the summary of inclusive growth in the Poverty and Inequality Commission’s 2019 report ‘Delivering Inclusive Growth in Scotland’, describes inclusive growth as “...about delivering an economy that combines fairness and prosperity and about economic growth that narrows inequalities by design” and “...about narrowing inequalities through the process of economic growth” (Statham and Gunson, 2019: 4); this definition was highlighted by Highlands and Islands Enterprise as the key definition for this project. Similarly, prosperity and inclusion are themes for indicators used within an annual analysis of inclusive economic growth in cities in the USA⁷. In this project, the Inclusive Growth Monitor framework was extended with two additional themes to capture the geographical and social contexts of different locations. These form longer-term resources or challenges for communities and may influence their resilience and vulnerability; for instance, it is recognised that the vulnerability of a place is a function of its geographic and social contexts (Cutter, 1996). In producing this framework, we recognised the diverse geography and environmental resources of the Highlands and Islands region, and the importance of capturing elements of community strength and social vulnerability, alongside the education and skills of the population which are included separately as ‘human capital’.

Compiling and selecting indicators for the analysis

The next stage was an iterative and collaborative process of indicator compilation and selection. The main activity was a compilation of data sources, indicators and

⁷ The Brookings Institute’s ‘Metro Monitor 2021’: see <https://www.brookings.edu/interactives/metro-monitor-2021/> (Accessed 12th April 2021)

metadata which could be used to measure 39 potential indicators, which align with the dimensions within the framework shown in Table 1. This process involved a review of online sources for Data Zone or small area level indicators, and a review of spatial data repositories for datasets relevant to the contextual themes. Following completion of the data source review, and agreement on an approach of selecting c. 1 indicator for each potential indicator, identified preferences and comments were provided by BioSS and Highlands and Islands Enterprise contributors, leading to a final selection by the report author. A number of quality criteria for indicators had been noted previously in the project, and during the indicator selection the requirement for selected indicators to fit potential indicators was loosened, with an alternative focus on ensuring that all dimensions within the framework were covered. Following the compilation of indicator selections, relevant data were downloaded for most of the indicators, which informed the development of more precisely defined 'final specific indicators'. Each of the 12 dimensions within the inclusive growth framework had at least one associated final specific indicator.

Data analysis and typology creation

The final dataset of 36 variables, with data for 630 Data Zones in the Highlands and Islands region, was produced: these indicators are listed in the Annex. There are some differences between these and the list of 'final specific indicators' mentioned above. The way that some indicators were calculated was changed: for example, the indicator 'Percentage of premises receiving a superfast connection' was calculated instead of two indicators on internet access. Other indicators were not calculated at all, such as areas of carbon sinks due to computing speed limitations. It is important to note that the indicators reflect the collaborative process and issues which were identified during this.

- A number of indicators were calculated using aggregations of small area-level data to 'accessible areas', a custom geography for each Data Zone representing the area within an estimated 30 minute travel time. This is because single Data Zone measurements do not contain information on nearby areas, and do not capture those resources or services which are outside the Data Zone, but which are easily accessible to it. The challenges posed by the very diverse geography of the Highlands and Islands – a region containing urban areas and towns, but also large sparsely populated regions and islands – for measuring socio-economic data are notable. Although Data Zones are a standard publishing unit in Scotland, they are more suited to densely-populated settlements and are less likely to reflect recognisable communities in rural areas (Hopkins et al., 2019).

- The importance of capturing the impacts of Covid-19 was noted, and an indicator describing the change in the claimant count due to the pandemic was included. This is similar in form to an indicator used in a small area-level index of local-level resilience to Covid-19 impacts (Currie et al., 2021).
- Indicators for economic output – the estimated gross value added of accessible areas (in millions of pounds, and per 1,000 employees) were also calculated. This represents a key indicator of economic output, but was only available for larger (NUTS3) regions. Following an approach suggested by Highlands and Islands Enterprise, small area estimates were produced using daytime population (by industry) from the 2011 Census.

Figure 1 presents a simple overview of the Hutton-led data analysis to produce the typology, which was informed by statistical guidance from BioSS and discussions with Highlands and Islands Enterprise and BioSS to share information and ideas. Following a discussion in November about the indicators produced, correlations between these, and the analysis required to create the area profiles, it was agreed that the analysis should involve forming a series of ‘dimensions’ from the indicators, which a) would not reflect those specified in the framework, and b) did not need to result from a fully data-driven approach. The analysis approach was also discussed at a second meeting in early December, and a two-step approach was proposed of a) identifying indicators in the dataset which were relevant to strengths and weaknesses in inclusion and prosperity to identify key underlying concepts, and then b) assessing links between these and additional contextual indicators to create the classification scheme. The quantitative analysis therefore used exploratory factor analysis, a multivariate technique “...that attempts to identify the smallest number of hypothetical constructs... that can parsimoniously explain the covariation observed among a set of measured variables...” (Watkins, 2018: 219-20), to identify a series of seven concepts or dimensions which underlie the indicators relevant to inclusion and prosperity ‘performance’ (Table 2).

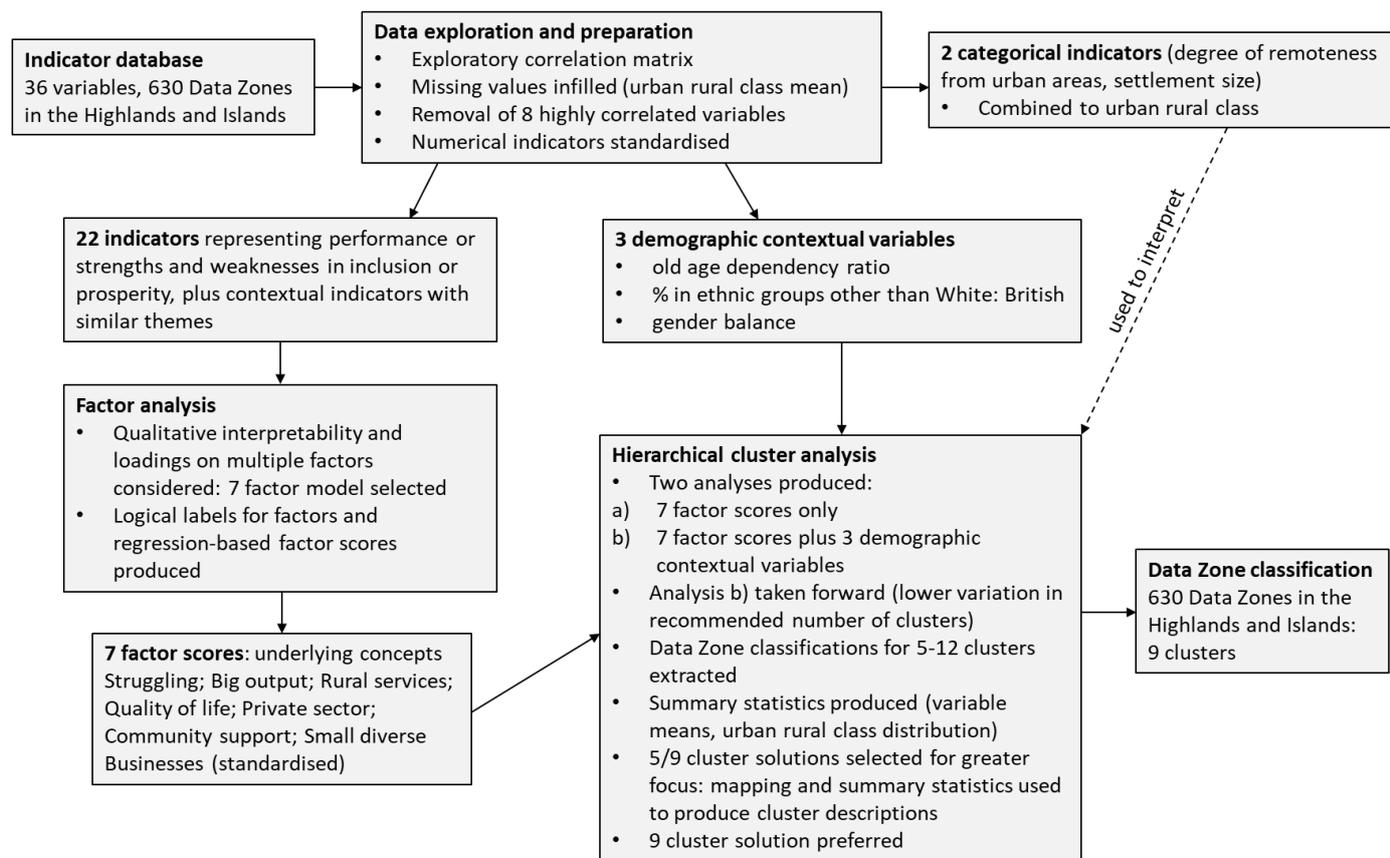
Table 2: Underlying concepts identified from the factor analysis, with interpreted names based on the variables loading on each factor.

Summary of factor loadings	Factor name
Evidence of low income and unemployment, and correlated poor life outcomes	Struggling
Economic strength and large employers	Big output
“Typical rural services”: high drive times to key services, poor broadband, relatively high numbers of vacant/second homes	Rural services

Not straightforward to interpret: includes positive loading for area within National Scenic Area and seems to reflect quality of life/wellbeing	Quality of life
Positive loadings for variables reflecting employment and workplaces within the private sector	Private sector
Positive loadings for variables reflecting accessible childcare places and local charities: high availability of supportive services	Community support
Economic output per 1,000 employees (negative loading) and economic diversity (positive loading) suggest small business activities and 'vibrancy'	Small diverse businesses

The second stage used hierarchical cluster analysis: one of a series of clustering approaches which aim to identify groups of similar cases within a dataset using a series of variables (Crawley, 2013: 819). Clusters of Data Zones in the Highlands and Islands were created using factor scores: "...estimates of the scores subjects would have received on each of the factors had they been measured directly" (Tabachnick and Fidell, 2001: 626) for the seven concepts/dimensions (Table 2), and three key demographic indicators, representing protected characteristics. The cluster analysis led to the identification of nine clusters of Data Zones with similar characteristics, which are described in the results section below.

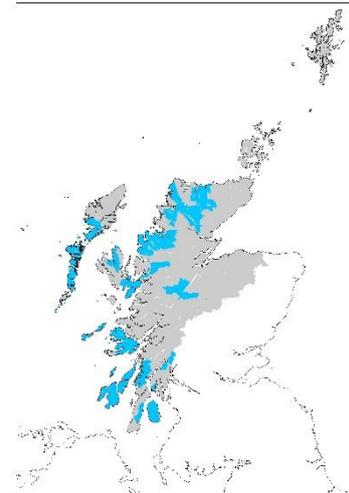
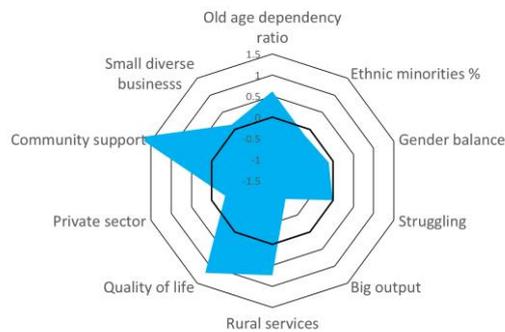
Figure 1: Overview of key stages of quantitative data analysis



The results: a small area-typology of inclusive growth performance in the Highlands and Islands

The nine clusters of Data Zones produced from the analysis are described below, using cluster mean values for a) the seven scores representing underlying concepts of inclusive growth performance, and b) standardised demographic contextual variables. The geographical distribution of the clusters is used in the description, but this was not used in the cluster definition; however, the groups of Data Zones show clear evidence of spatial clustering. Population data (total population and recent change) is also used for cluster description, only. For the Highlands and Islands region, the factor scores and demographic variables have a mean of 0 (shown as a black line on diagrams below), which assists in the interpretation of the clusters.

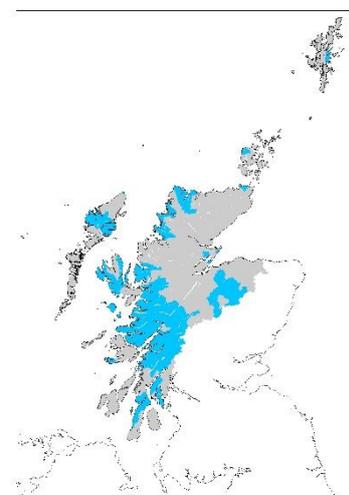
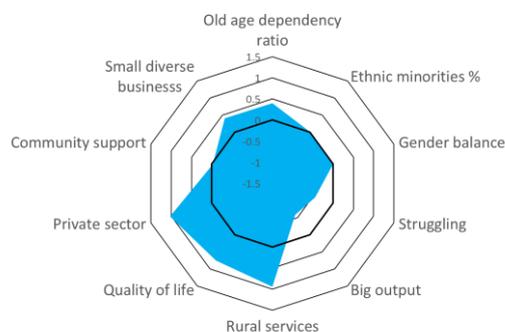
Cluster 1



Population (2019): 44,201
(2011-19): -2.21%

59 out of 60 Data Zones in **cluster 1** are in very remote rural areas, and the cluster is distributed across the west of the Scottish mainland and western isles. Considering the average values for inclusive growth concepts and demographics, the cluster is distinguished by very high values for 'Community support' (the highest mean of any cluster) and 'Quality of life' (second highest) which represent particularly positive attributes for life in these areas. The mean score for 'Big output' is the second lowest within the nine clusters, suggests typically lower economic output, and access to services and housing could be limited, but residents do not appear economically disadvantaged as the mean 'Struggling' score is close to the Highlands and Islands average. Typically areas in this cluster have a high proportion of older people, relative to the size of the working age population.

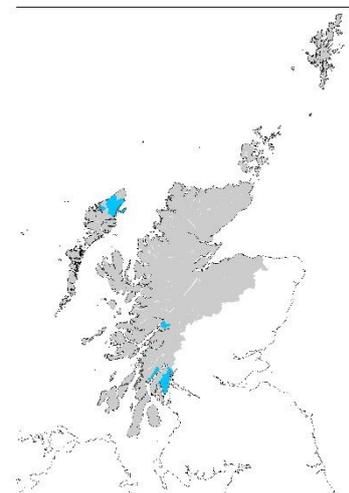
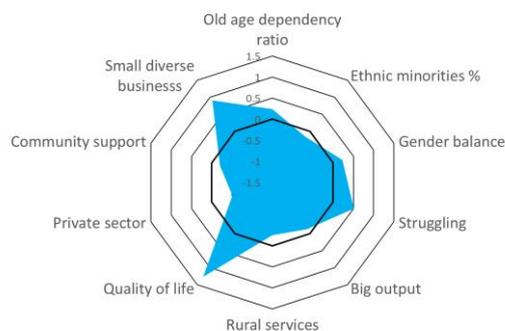
Cluster 2



Population (2019): 48,857
(2011-19): 0.68%

The vast majority (56/66) of Data Zones in **cluster 2** are classified as remote or very remote rural areas. Similar to cluster 1, this cluster includes several areas in the western Highlands and Islands, as well as locations around Strathspey and Inverness and some parts of Orkney and Shetland. Considering average values, key aspects of inclusive growth (Big output, Rural services and Quality of life) and demographics appear similar to those in cluster 1. Distinctive attributes of this cluster are a very low average value for 'Struggling' (the second lowest of any cluster), the highest average 'Private sector' value of any cluster, and the second highest 'Small diverse businesses' mean value of any cluster. These potentially indicate higher incomes and vibrant smaller businesses. The average 'Community support' score is however much lower than that of cluster 1, suggesting typically lower availability of these supportive services compared to nearby areas.

Cluster 3

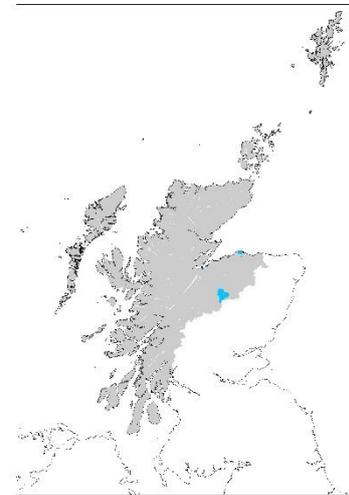
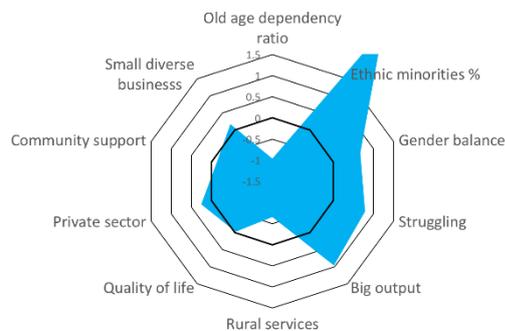


Population (2019): 42,538
(2011-19): -4.08%

Cluster 3 is clearly associated with remoter small towns and urban areas, and includes Stornoway and its surroundings, Mallaig, areas near Fort William and Oban, as well as Dunoon and parts of Rothesay. Of the 59 Data Zones classified in this cluster, 32 are parts of very remote small towns, 18 are in very remote rural areas, and 8 are in urban locations. This is one of three clusters which has lost over 4% of its population since 2011. Considering aspects of inclusive growth, the cluster has the highest mean 'Quality of life' value of any cluster, but also has a high average score for 'Struggling' (second highest of any cluster) implying generally poorer incomes and some economic difficulties. The average scores for 'Small diverse businesses' (the highest of any cluster) and low 'Private sector'

average may point to an economy of smaller businesses and a relatively strong role for the public sector, compared with other parts of the Highlands and Islands.

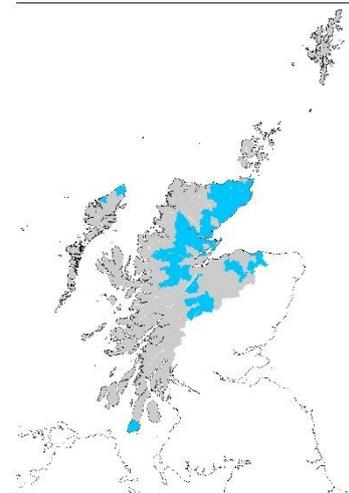
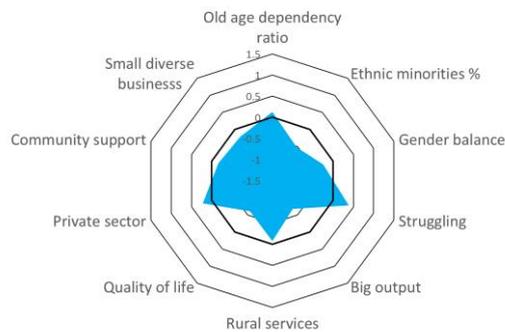
Cluster 4



Population (2019): 26,034
(2011-19): -4.46%

Cluster 4 is concentrated in urban areas (26 out of 35 Data Zones) and small towns (8 Data Zones), including areas in Inverness, Elgin, Fort William, Aviemore and Oban. The cluster suffered a population loss of nearly 4.5% from 2011-19, the most negative change in any cluster. Demographically this cluster appears very distinctive: compared with the Highlands and Islands overall it has a very high average ethnic diversity, a very low average old age dependency ratio, and a typical gender imbalance. The cluster averages for inclusive growth point to excellent services and economic strength in nearby areas, but the 'Struggling' mean – the highest of any cluster – suggests generally low incomes and poorer outcomes for residents.

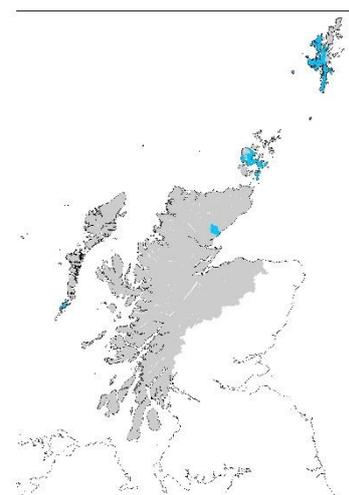
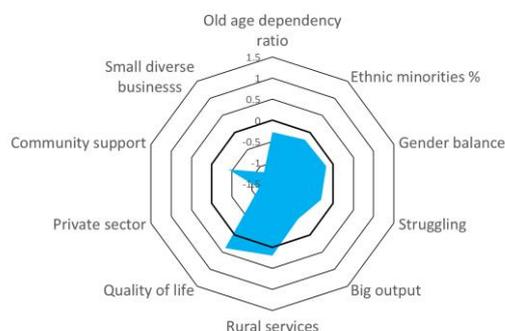
Cluster 5



Population (2019): 97,953
(2011-19): -2.11%

On the map, **cluster 5** surrounds Inverness and Elgin, as well as parts of the far north of Scotland (Wick and Thurso), Lewis, Campbeltown and parts of remoter settlements in southern Argyll. 128 out of 140 Data Zones in this cluster are in remote or very remote areas, with similar proportions of these in small towns and urban areas. The radar diagram shows that the average values for aspects of inclusive growth and demographics in cluster 5 are not extreme, but suggest a pattern of moderate disadvantage across multiple attributes. The mean values for 'Struggling', 'Big output', 'Quality of life', 'Community support' and 'Small diverse businesses' appear slightly more negative compared with the wider region.

Cluster 6

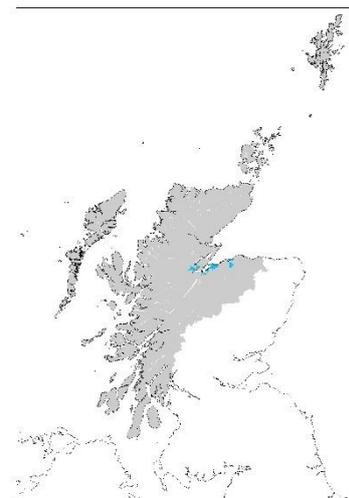
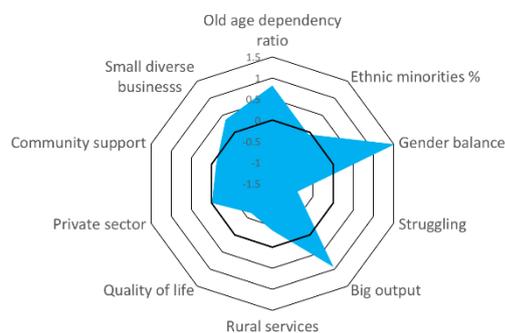


Population (2019): 39,798
(2011-19): 1.92%

Cluster 6 is associated with the Shetland and Orkney mainlands and scattered isolated locations (Barra, Campbeltown, Sutherland): all Data Zones are in very

remote rural areas or small towns. The 'Struggling' mean score suggests relatively good incomes, despite not being near economic centres ('Big output'). The average 'Private sector' score is the second lowest of any cluster and implies a strong role for the public sector in employment, the 'Small diverse businesses' average is very low which suggests these are generally less prominent. Supportive community services are typically less available than in other clusters: the 'Community support' average score is the lowest of any cluster.

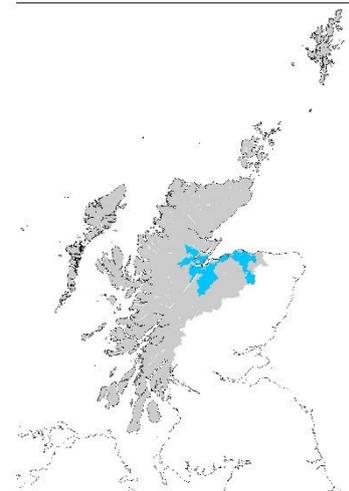
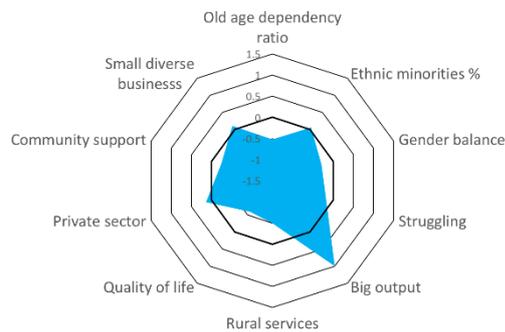
Cluster 7



Population (2019): 32,434
(2011-19): 3.81%

More than half (22/42) of the Data Zones in **cluster 7** are urban, and most (13) of the others are situated in accessible areas. These small areas are located around the Moray Firth coastline and areas close to Inverness and towns in Moray, and collectively experienced population growth of almost 4% from 2011-19. The 'Struggling' mean score is the lowest for any cluster, suggesting wealth, and 'Big output' and 'Rural services' averages suggest good access to high economic outputs and services. The 'Quality of life' average score is however the lowest of any cluster. The relatively high mean old age dependency ratio and typical gender imbalance relative to the Highlands and Islands as a whole suggest that the cluster contains retirement communities and areas favoured by older households.

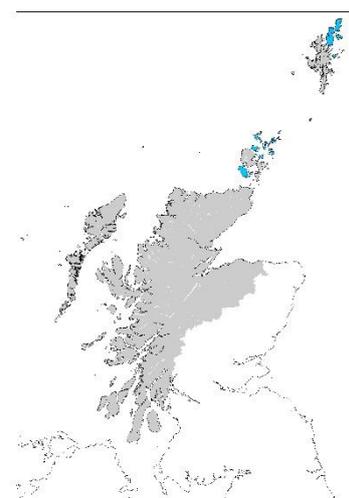
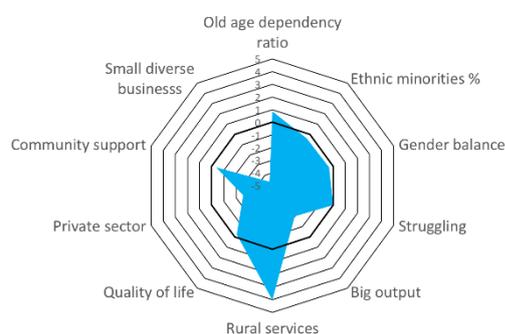
Cluster 8



Population (2019): 132,182
(2011-19): 5.16%

Cluster 8 has the largest population of any of the defined clusters, and as a whole has the most positive demographic trend since 2011: population growth of over 5%, and growth in the working age (16-64) population (the only cluster where the latter was the case). The geographical distribution of this cluster appears to neatly reflect the accessible ‘commuter’ areas of Inverness, Elgin and Forres and parts of these settlements. There are strong similarities in inclusive growth characteristics between clusters 7 and 8, although notable differences between the two clusters are (for 8) a somewhat higher ‘Struggling’ mean score, suggesting lower incomes and slightly poorer economic outcomes for residents, and a very different demographic profile – average values are younger and more gender balanced.

Cluster 9



Population (2019): 5,444
(2011-19): -4.09%

(Note: radar diagram has different scale to others)

Cluster 9 is the smallest cluster, containing only 8 Data Zones in the very remote outer islands of Orkney and Shetland. Extreme values imply significant demographic and economic challenges, and poor services. For example, the average old age dependency ratio is the highest of any of the clusters, and the 'Big output', 'Private sector' and 'Small diverse businesses' mean scores are each the lowest of the nine clusters. As a whole, this area lost over 4% of its population from 2011 to 2019.

Summary: what do we learn?

The nine clusters above, and the illustrated differences in terms of key dimensions of inclusive growth 'performance' and protected demographic characteristics, contribute to a more nuanced understanding of the strengths and challenges experienced by communities in the Highlands and Islands region. The clusters, the multi-dimensional approach to understanding inclusive growth, and the collaborative process and analysis used to produce them, can also help to meet demands for greater knowledge of inclusive growth at the sub-national level and are suitable for extension to other areas.

The multi-dimensional approach, based on seven identified themes of inclusive growth and Data Zone-level measurement, has close parallels with the 'bundles' concept in the ecosystem services literature; the latter recognises spatial patterns of different types of services, and the associations, correspondence and 'tradeoffs' between these (Raudsepp-Hearne et al., 2010). The description and summary statistics suggest a diverse region, with varying sets of 'strengths' related to different elements of inclusive growth. The descriptions above are based on mean values: further analysis on the size of these differences, and information on within-cluster variability, could be used to develop the understanding of these clusters. However, the descriptions above suggest that one cluster (9) is notably disadvantaged, while others seem to reflect different types of tradeoffs. For example, cluster 4 suggests urban or town-based inequality, while values in cluster 1 are consistent with attractive communities which are remote from economic centres. The spatial concentration of some of the clusters: either in certain forms of community (e.g. remoter small towns in cluster 3), or in close proximity in the same part of the region (e.g. commuter zones to larger settlements, in cluster 8) is notable as the analysis did not explicitly include these: these arguably reflect a strong influence of key place-based assets (e.g. agglomerations of jobs, attractive scenery) on outcomes.

At a highly uncertain time where an effective recovery from the Covid-19 pandemic is a major policy priority, alongside a wider recognition of the urgent need to address spatial inequalities, detailed typologies could support the targeting of place-specific policies at appropriate 'types' of communities (Iammarino et al., 2019), as a means of supporting a more inclusive and even recovery. The classification described in this report requires further investigation, and was developed for a single (although large) region of the north and west of Scotland, but offers potential to support the development of similar measures for other areas.

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Annex: Indicator list and raw data sources

Note: the indicator list contains all 36 indicators within the dataset created for analysis, but not all were used in the analysis. Variables in **red** were excluded due to high correlations. Variables in **blue** were numerical indicators which were standardised and included within the factor analysis. Variables in **green** were demographic contextual indicators which were standardised and included in the cluster analysis. PHY_REMOTE and PHY_SETTLE = categorical variables which were recombined into an Urban Rural Classification for the purpose of interpreting the clusters. PHY_SPARSE = categorical variable which was not used. Note: any errors in analysis or interpretation are those of the lead author.

Indicator list

Theme	Indicator	Description
Inclusion	INC_EMPDEP	Percentage of people who are employment deprived (2017)
	INC_CHILDR	Number of children in working families, receiving tax credits (2017/18) (estimated rate per 1,000 children)
	INC_INCDEP	Percentage of people who are income deprived (2017)
	INC_OCROWD	Percentage of people in households that are overcrowded (2011)
	LIV_VSHOME	Percentage of dwellings which are vacant or second homes (2019)
	LIV_TAXABC	Percentage of dwellings which are in Council Tax bands A-C (2019)
	LAB_CCOUNT	Claimant count, as a proportion of residents aged 16-64 (2019) (maximum value, %)
	LAB_ARANGE	Average annual range of claimant count (2016-19 ⁸) (percentage points)
	LAB_CORONA	Impact of Covid-19 pandemic on claimant count (March-September 2019 - March-September 2020) (percentage point change between maximum claimant count)
Prosperity	OUT_GVAEST*	Estimated GVA of accessible area (2017) (£ million)
	OUT_GVAEST1000*	Estimated GVA of accessible area (2017) (£ million per 1,000 employees)
	OUT_DIVERS2020*	Accessible workplaces: industrial diversity (2020) (Simpson Index ⁹)
	OUT_MICROB2020*	Accessible workplaces: proportion of micro-businesses (2020) (%)
	OUT_PWORKN2020*	Number of accessible private sector workplaces (2020) (number)
	OUT_INCOME	Median Gross Household Income estimate (2017) (£/week)
	EMP_PEMPLN2018*	Accessible employment within the private sector (2018) (employment)
	EMP_PEMPLP2018*	Percentage of accessible employment within the private sector (2018) (%)
	EMP_PWORKP2020*	Percentage of accessible workplaces within the private sector (2020) (%)
HUM_ATTAIN	Attainment of school leavers (2015-16 - 2017-18) (score, based on highest level of qualification attained for pupils of publicly funded secondary schools)	
Context - Physical	PHY_REMOTE	Degree of remoteness from urban areas
	PHY_SETTLE	Settlement size
	PHY_SPARSE	Population sparsity (within or outside the SPA)
	ACC_CHILDCPL1000*	Number of accessible child care places (2020) (within 30 minutes of Data Zone centroid, per 1000 children)
	ACC_DRIVET	Sum of average drive times to a GP surgery and retail centre (2018) (minutes)

⁸ These four years are after changes to indicator related to Universal Credit: see <https://www.nomisweb.co.uk/articles/922.aspx> (Accessed 29th April 2021)

⁹ See <https://www.rgs.org/CMSPages/GetFile.aspx?nodeguid=018f17c3-a1af-4c72-abf2-4cb0614da9f8&lang=en-GB> (Accessed 19th April 2021) for explanation of Simpson's Diversity Index.

	ACC_PUBLIC	Sum of average travel times by public transport to a GP surgery and retail centre (2018) (minutes)
	ACC_BBFAST	Percentage of premises receiving a superfast connection (January 2019)
	ENV_RENEWA	Capacity of renewable schemes, operational or awaiting/under construction (2020) (MW) (within 50km of Data Zone centroid)
	ENV_SCENIC	Area within National Scenic Areas (within 50km of Data Zone centroid)
Context - Population and social characteristics	SOCS_CHARIT1000*	Number of accessible active charities, which operate locally (2020) (within 30 minutes of Data Zone centroid, per 1000 people)
	SOCI_FACILI1000*	Number of accessible key community facilities (2020) (within 30 minutes of Data Zone centroid, per 1000 people)
	SOCV_OLDAGE	Old age dependency ratio (2019)
	SOCV_BIRTHW	Percentage of single births of low birthweight (2017-19) (%)
	SOCV_ILLFAC	Comparative Illness Factor (standardised ratio) (2017)
	SOCV_MORTAL	Standardised mortality ratio (2014-15 - 2017-18)
	SOCV_NONWBR	Percentage of residents who belong to ethnic groups other than 'White: British' (2011) (%)
	SOCV_GENDER	Gender balance (2019) (50% - female %, absolute value)

Note: variables marked "*" were calculated as aggregations to accessible areas

Raw data sources

Indicator	Raw data
INC_EMPDEP	Scottish Government: Scottish Index of Multiple Deprivation 2020v2 - indicators © Crown Copyright. http://www.nationalarchives.gov.uk/doc/open-government-licence/version/3/ .
INC_CHILD	HM Revenue and Customs: Personal Tax Credits: Number of Children. http://www.nationalarchives.gov.uk/doc/open-government-licence/version/3/ . National Records of Scotland: Table 1a: Estimated population by sex, single year of age and 2011 Data Zone area, and council area: 30 June 2017. © Crown Copyright 2019. Data supplied by National Records of Scotland.
INC_INCDEP	Scottish Government: Scottish Index of Multiple Deprivation 2020v2 - indicators © Crown Copyright. http://www.nationalarchives.gov.uk/doc/open-government-licence/version/3/ .
INC_OCROWD	National Records of Scotland: Census 2011 - table LC4410SC (© Crown copyright. Data supplied by National Records of Scotland).
LIV_VSHOME	National Records of Scotland: Household Estimates. http://www.nationalarchives.gov.uk/doc/open-government-licence/version/3/ .
LIV_TAXABC	National Records of Scotland: Dwellings by Council Tax Band. http://www.nationalarchives.gov.uk/doc/open-government-licence/version/3/ .
LAB_CCOUNT	Office for National Statistics: Claimant count by sex and age. ONS Crown Copyright Reserved [from Nomis on 20 October 2020].
LAB_ARANGE	Office for National Statistics: Claimant count by sex and age. ONS Crown Copyright Reserved [from Nomis on 20 October 2020].
LAB_CORONA	Office for National Statistics: Claimant count by sex and age. ONS Crown Copyright Reserved [from Nomis on 20 October 2020].
OUT_GVAEST	Office for National Statistics: Regional gross value added (balanced) by industry: all NUTS level regions: Table 3c: NUTS3 current price estimates. http://www.nationalarchives.gov.uk/doc/open-government-licence/version/3/ .
OUT_GVAEST1000	National Records of Scotland: Census 2011 - Table DT603SCdz - Industry - Daytime population - 2011 Data zones. © Crown copyright 2018. Lookup 1 (DZ-NUTS3): Scottish Government - GI-SAT (Geographic Information Science and Analysis Team): Data Zone Centroids 2011. Copyright Scottish Government, contains Ordnance Survey data © Crown copyright and database right (2020). Office for National Statistics: NUTS Level 3 (January 2018) Boundaries. Contains National Statistics data © Crown copyright and database right [2017]. http://www.nationalarchives.gov.uk/doc/open-government-licence/ .

	Lookup 2 (DZ-LA): Scottish Government: Scottish Index of Multiple Deprivation 2020v2 - indicators © Crown Copyright. http://www.nationalarchives.gov.uk/doc/open-government-licence/version/3/ .
OUT_DIVERS2020	Office for National Statistics: UK Business Counts - local units by industry and employment size band. ONS Crown Copyright Reserved [from Nomis on 20 October 2020].
OUT_MICROB2020	Office for National Statistics: UK Business Counts - local units by industry and employment size band. ONS Crown Copyright Reserved [from Nomis on 20 October 2020].
OUT_PWORKN2020	Office for National Statistics: UK Business Counts - local units by industry and employment size band. ONS Crown Copyright Reserved [from Nomis on 20 October 2020].
OUT_INCOME	Scottish Government (data prepared by Heriot-Watt University in association with David Simmonds Consultancy): Local Level Household Income Estimates, Weekly, (£), Banded Income, 2017. Crown Copyright. http://www.nationalarchives.gov.uk/doc/open-government-licence/version/3/ .
EMP_PEMPLN2018	Office for National Statistics: Business Register and Employment Survey public/private sector : open access. ONS Crown Copyright Reserved [from Nomis on 20 October 2020].
EMP_PEMPLP2018	Office for National Statistics: Business Register and Employment Survey public/private sector : open access. ONS Crown Copyright Reserved [from Nomis on 20 October 2020].
EMP_PWORKP2020	Office for National Statistics: UK Business Counts - local units by industry and employment size band. ONS Crown Copyright Reserved [from Nomis on 20 October 2020].
HUM_ATTAIN	Scottish Government: Scottish Index of Multiple Deprivation 2020v2 - indicators © Crown Copyright. http://www.nationalarchives.gov.uk/doc/open-government-licence/version/3/ .
PHY_REMOTE	Scottish Government: Scottish Government Urban Rural Classification 2016 - Data Zone Lookup and 8 Fold Description. Copyright Scottish Government, contains Ordnance Survey data © Crown copyright and database right (2020).
PHY_SETTLE	Scottish Government: Scottish Government Urban Rural Classification 2016 - Data Zone Lookup and 8 Fold Description. Copyright Scottish Government, contains Ordnance Survey data © Crown copyright and database right (2020).
PHY_SPARSE	Hopkins, J. and Piras, S. (2020) Population projections and an introduction to economic-demographic foresight for Scotland's sparsely populated areas (2018-43). Available at https://www.hutton.ac.uk/sites/default/files/files/research/srp2016-21/rd341briefprojectionsandforesightintro.pdf .
ACC_CHILDCPL1000	Care Inspectorate: Datstore (as at 30 September 2020) CSV. https://www.nationalarchives.gov.uk/doc/open-government-licence/version/3/ . National Records of Scotland: Table 1a: Estimated population by sex, single year of age and 2011 Data Zone area, and council area: 30 June 2019. © Crown Copyright 2020. Data supplied by National Records of Scotland.
ACC_DRIVET	Scottish Government: Scottish Index of Multiple Deprivation 2020v2 - indicators © Crown Copyright. http://www.nationalarchives.gov.uk/doc/open-government-licence/version/3/ .
ACC_PUBLIC	Scottish Government: Scottish Index of Multiple Deprivation 2020v2 - indicators © Crown Copyright. http://www.nationalarchives.gov.uk/doc/open-government-licence/version/3/ .
ACC_BBFAST	Ofcom: Connected Nations update: Spring 2019: Fixed output area data. https://www.nationalarchives.gov.uk/doc/open-government-licence/version/3/ . National Records of Scotland: Output Area 2011 to Data Zones and Intermediate Zones 2011. © Crown copyright. Data supplied by National Records of Scotland.
ENV_RENEWA	Department for Business, Energy and Industrial Strategy: Renewable Energy Planning Database (REPD): Public Database - June 2020 (Q2). http://www.nationalarchives.gov.uk/doc/open-government-licence/version/3/ .
ENV_SCENIC	Scottish Government GI-SAT (Geographic Information Science and Analysis Team): National Scenic Areas. Copyright Scottish Government, contains Ordnance Survey data © Crown copyright and database right (2020).
SOCS_CHARIT1000	Office of the Scottish Charity Regulator: Scottish Charity Register. © Crown Copyright and database right [2020]. Contains information from the Scottish Charity Register supplied by the Office of the Scottish Charity Regulator and licensed under the Open Government Licence v.3.0. (http://www.nationalarchives.gov.uk/doc/open-government-licence/version/3/).

	National Records of Scotland: Table 1a: Estimated population by sex, single year of age and 2011 Data Zone area, and council area: 30 June 2019. © Crown Copyright 2020. Data supplied by National Records of Scotland.
SOCI_FACIL1000	Ordnance Survey: OS Open Map - Local. Contains OS data © Crown copyright and database right 2020. National Records of Scotland: Table 1a: Estimated population by sex, single year of age and 2011 Data Zone area, and council area: 30 June 2019. © Crown Copyright 2020. Data supplied by National Records of Scotland.
SOCV_OLDAGE	National Records of Scotland: Table 1a: Estimated population by sex, single year of age and 2011 Data Zone area, and council area: 30 June 2019. © Crown Copyright 2020. Data supplied by National Records of Scotland.
SOCV_BIRTHW	Public Health Scotland: Low Birthweight. http://www.nationalarchives.gov.uk/doc/open-government-licence/version/3/ .
SOCV_ILLFAC	Scottish Government: Scottish Index of Multiple Deprivation 2020v2 - indicators © Crown Copyright. http://www.nationalarchives.gov.uk/doc/open-government-licence/version/3/ .
SOCV_MORTAL	Scottish Government: Scottish Index of Multiple Deprivation 2020v2 - indicators © Crown Copyright. http://www.nationalarchives.gov.uk/doc/open-government-licence/version/3/ .
SOCV_NONWBR	National Records of Scotland: Census 2011 - table KS201SC (© Crown copyright. Data supplied by National Records of Scotland).
SOCV_GENDER	National Records of Scotland: Table 1b: Estimated population by sex, single year of age and 2011 Data Zone area, and council area: 30 June 2019. © Crown Copyright 2020. Data supplied by National Records of Scotland. National Records of Scotland: Table 1c: Estimated population by sex, single year of age and 2011 Data Zone area, and council area: 30 June 2019. © Crown Copyright 2019. Data supplied by National Records of Scotland.

The SIMD 2020 technical notes (Available at <https://www.gov.scot/binaries/content/documents/govscot/publications/statistics/2020/09/simd-2020-technical-notes/documents/simd-2020-technical-notes/simd-2020-technical-notes/govscot%3Adocument/SIMD%2B2020%2Btechnical%2Bnotes.pdf>) contain information on raw data sources for SIMD variables. Additionally, the calculation of the indicator INC_OCROWD was based on information in these.

Aggregation of data to 30 minute service areas from Data Zone Centroids, for Data Zones in the HIE area: data sources for service areas cited in: Hopkins, J. and Piras, S. (2020) Population projections and an introduction to economic-demographic foresight for Scotland's sparsely populated areas (2018-43). Available at <https://www.hutton.ac.uk/sites/default/files/files/research/srp2016-21/rd341briefprojectionsandforesightintro.pdf>. (Note: these travel time calculations are estimates, rather than exact measurements, due to assumptions made over journeys, calculations using road segments of different lengths, inaccuracies in junctions/routing, and selection/editing of ferries including infilled travel times).

Spatial datasets used in calculations:

Scottish Government - GI-SAT (Geographic Information Science and Analysis Team): Data Zone Centroids 2011. Copyright Scottish Government, contains Ordnance Survey data © Crown copyright and database right (2020).

Office for National Statistics: NUTS Level 2 (January 2018) Boundaries. Contains National Statistics data © Crown copyright and database right [2017]. <http://www.nationalarchives.gov.uk/doc/open-government-licence/>.

Scottish Government - GI-SAT (Geographic Information Science and Analysis Team): Intermediate Zone Boundaries 2011. Copyright Scottish Government, contains Ordnance Survey data © Crown copyright and database right (2020).

Office for National Statistics: ONS Postcode Directory (August 2020). Contains OS data © Crown copyright and database right [2020]; Contains Royal Mail data © Royal Mail copyright and database right [2020]; Source: Office for National Statistics licensed under the Open Government Licence v.3.0.

Additional information in “The results: a small area-typology of inclusive growth performance in the Highlands and Islands” section

Maps: © Crown copyright and database right (2021). All rights reserved. The James Hutton Institute, Ordnance Survey Licence Number 100019294. Spatial data shown derived from Ordnance Survey (OS) Boundary-Line™, NUTS 2016 boundaries: © EuroGeographics for the administrative boundaries; Data Zone Boundaries 2011: Copyright Scottish Government, contains Ordnance Survey data © Crown copyright and database right (2020).

Raw population data: National Records of Scotland Data Zone population estimates for [30 June 2011](#), [30 June 2019](#): © Crown Copyright 2019, © Crown Copyright 2020.

Software used in data analysis

R Core Team (2020) R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. <https://www.R-project.org/>. (Use of packages: ‘[corrplot](#)’, ‘[psych](#)’, ‘[GPArotation](#)’, ‘[cluster](#)’, ‘[NbClust](#)’, ‘[rgdal](#)’, ‘[rgeos](#)’) (Analysis included code adapted from https://uc-r.github.io/hc_clustering, <https://gis.stackexchange.com/questions/163445/getting-topologyexception-input-geom-1-is-invalid-which-is-due-to-self-intersec>)

Esri (2019) ArcGIS Desktop 10.7.1.

Note (update: February 2022)

This report was updated in February 2022 to remove an error in a description on page 9.