



Animal &
Plant Health
Agency

Livestock Demographic Data

Group:

Sheep population report

**Livestock population density maps
for Great Britain using December
2021/January 2022 data**



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APHA is an Executive Agency of the Department for Environment, Food and Rural Affairs and also works on behalf of the Scottish Government, Welsh Government and Food Standards Agency to safeguard animal and plant health for the benefit of people, the environment and the economy.

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Who are these reports for and what is their purpose?

These reports are suitable for use in animal health and welfare policy work or by anyone who requires an estimate of the distribution and size of the sheep population at Great Britain (GB) level. This type of population level information is often required to provide official statistical returns to the World Organisation for Animal Health (WOAH), assess the economic or social impact of particular animal health policies, for contingency, disease monitoring/control and resource planning, or to provide evidence to trading partners.

Who did this work?

The reports are produced by the Livestock Demographic Data Groups (LDDG). The LDDGs were formed in January 2014 and are made up of APHA representatives from data, epidemiology, species expert and GIS work groups.

What do the data show about the population?

The maps show the density of animals (Figure 1) and the density of holdings (Figure 2). The estimated number of holdings and number of sheep per country is shown in Table 1.

A livestock holding is defined as the land and buildings used to keep livestock. Each holding has a unique County Parish Holding (CPH). A livestock business can have more than one holding, which can include permanent holdings (used for more than one year) and temporary holdings (used for less than one year).

In line with the common understanding of the GB sheep population, the maps show that the sheep holdings and sheep population of GB are mainly distributed across Wales, northern England and eastern and southern Scotland, with additional areas of high population density in the midlands, south-west and south-east England.

The data used is obtained from the annual Sheep and Goat inventory, which is carried out during the winter, and gathers data on the number of sheep and/or goats kept per holding. Most lambs are born in the spring, and then reared and sent for slaughter in the autumn. Therefore, the winter inventory represents the adult breeding flock and only the lambs that are kept for breeding or fattening. Although the number of sheep is higher in the summer due to the annual lamb crop, the spatial distribution of sheep and sheep holdings is similar in winter and summer.

What do the data not show about the population?

The data from the annual Sheep and Goat Inventory do not include the majority of lambs born during the previous year, because most lambs are born in the spring, after the inventory has taken place in December/January and are slaughtered prior to the next inventory.

According to the June 2021 full Census of Agricultural Survey, the total number of sheep and lambs in June 2021 was 30.92 million, of which 15.38 million (49.7%) were lambs (<https://www.gov.uk/government/statistical-data-sets/structure-of-the-agricultural-industry-in-england-and-the-uk-at-june>), indicating that the GB sheep population decreased by approximately 50% between summer 2021 and winter 2021/22. This difference was mainly due to the June 2021 survey including the spring lamb crop, many of which were slaughtered before the 2021/22 winter inventory.

How accurate are the data?

There are important assumptions and uncertainties with these estimates, which the user should take into consideration. Limitations of the dataset are discussed in detail in the data quality statement ([Annex 1](#)) and it is important that the user considers these in the context of their work. Population and holding density maps are each classified to different scales and units and due care must be taken regarding their interpretation.

The Sheep and Goat Inventory holds information about the location and animal count of sheep holdings in GB in winter. All sheep and goat keepers are required to register their holding and it is a legal requirement to complete the annual sheep and goat inventory. This is described in the data quality statement. The results are summarised in Table 1 and visualised in Figures 1 and 2.

Questionnaires were sent to 110,019 holdings in GB that were previously recorded as keeping sheep and/or goats. The questionnaire was completed by 85,735 respondents, giving an overall return rate of 77.9%. Out of those returning the questionnaire, 65,637 holdings (76.6%) were keeping sheep.

For England, the questionnaire was sent to 74,369 holdings, and responses were received from 58,441 respondents (78.6%) of which 40,148 holdings (68.7%) were keeping sheep.

For Scotland, the questionnaire was sent to 18,825 holdings, responses were received from 14,206 respondents (75.5%) of which 14,026 holdings (98.7%) were keeping sheep.

For Wales, the questionnaire was sent to 16,825 holdings. The total number of responses received was 13,088 (77.8%), of which 11,463 holdings (87.6%) were keeping sheep.

The data are therefore derived from the 65,637 sheep holdings that returned a response to the inventory survey. The characteristics of the non-responders are unknown, and the effect of these missing data has not been evaluated, but assuming that many non-responders are no longer keeping sheep or goats, any underestimate in number of holdings and number of sheep is likely to be small.

The sheep and goat inventory collects data on the number of animals kept on 1st December for England and Scotland, and on 1st January for Wales. It is not expected that the collection of data for England and Scotland one month earlier than for Wales would have much effect on the data.

How were the maps produced?

The maps have been created using the kernel density function in ArcGIS software. This tool distributes population information over a defined radius (15km radius used for the figures presented within this report), creating a smooth density surface. Two key parameters that require adjustment are the search radius distance and the size of the output surface grid. Discussion at the LDDG meetings informed these criteria, and their selection is recognised as a subjective process (Pfeiffer et al., 2008). A search radius of 15km was deemed sufficient to enable distinction between categories and a 1km grid square was used for the density surfaces themselves. The classification bins were limited to six, to aid in cross referencing areas of the map to the key.

Comparison between the maps was optimised by assigning similar parameters between the species. However, further refinement of the parameters for each species' dataset could represent the information more accurately. Note that the ArcGIS Kernel Density tool does not take into account edge effects, and as such density estimates in and around coastal areas may be under estimated (Charpentier & Gallic, 2016).

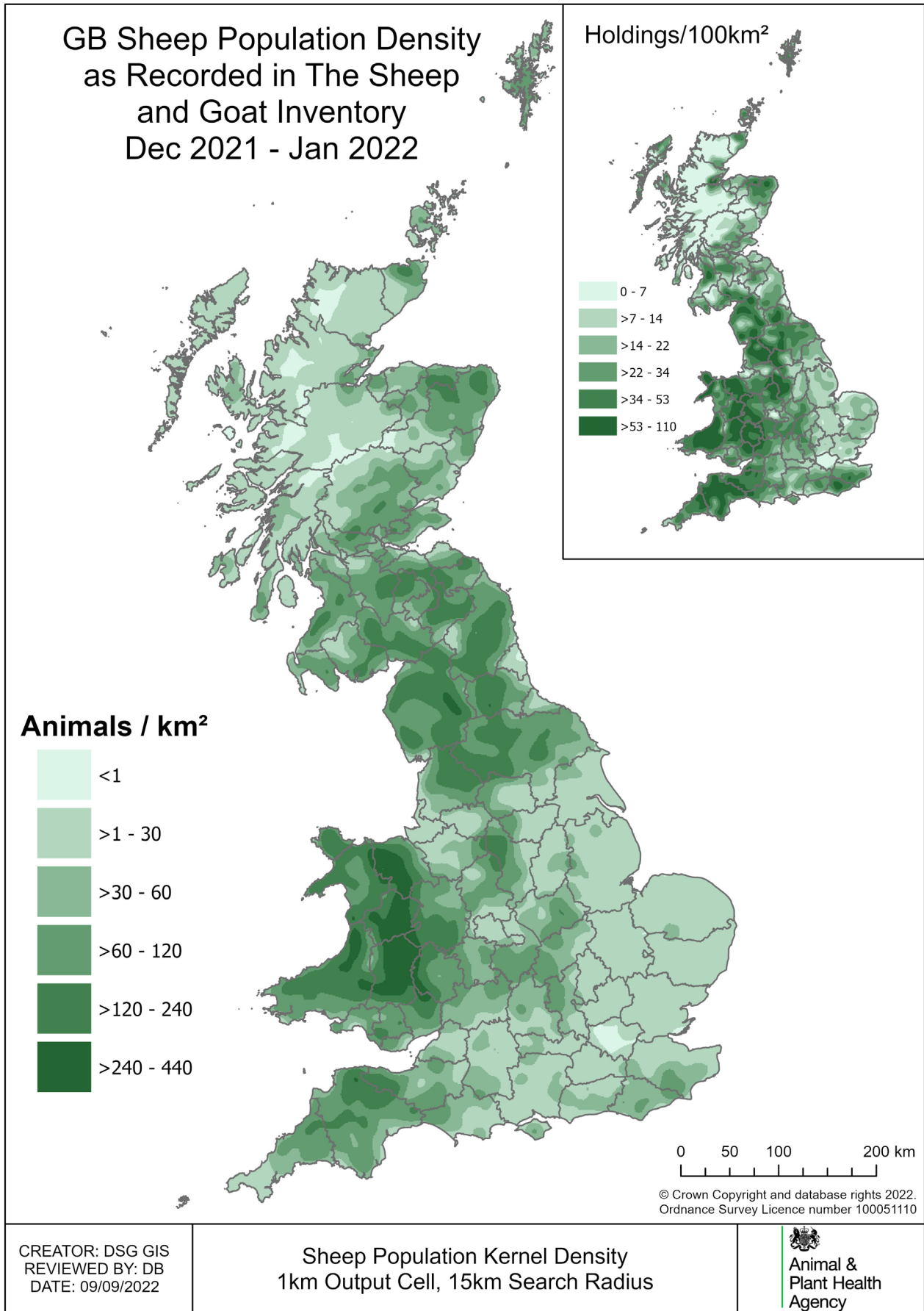


Figure 1 Sheep population density in GB (Sheep and Goat Inventory Dec 2021/Jan 2022)

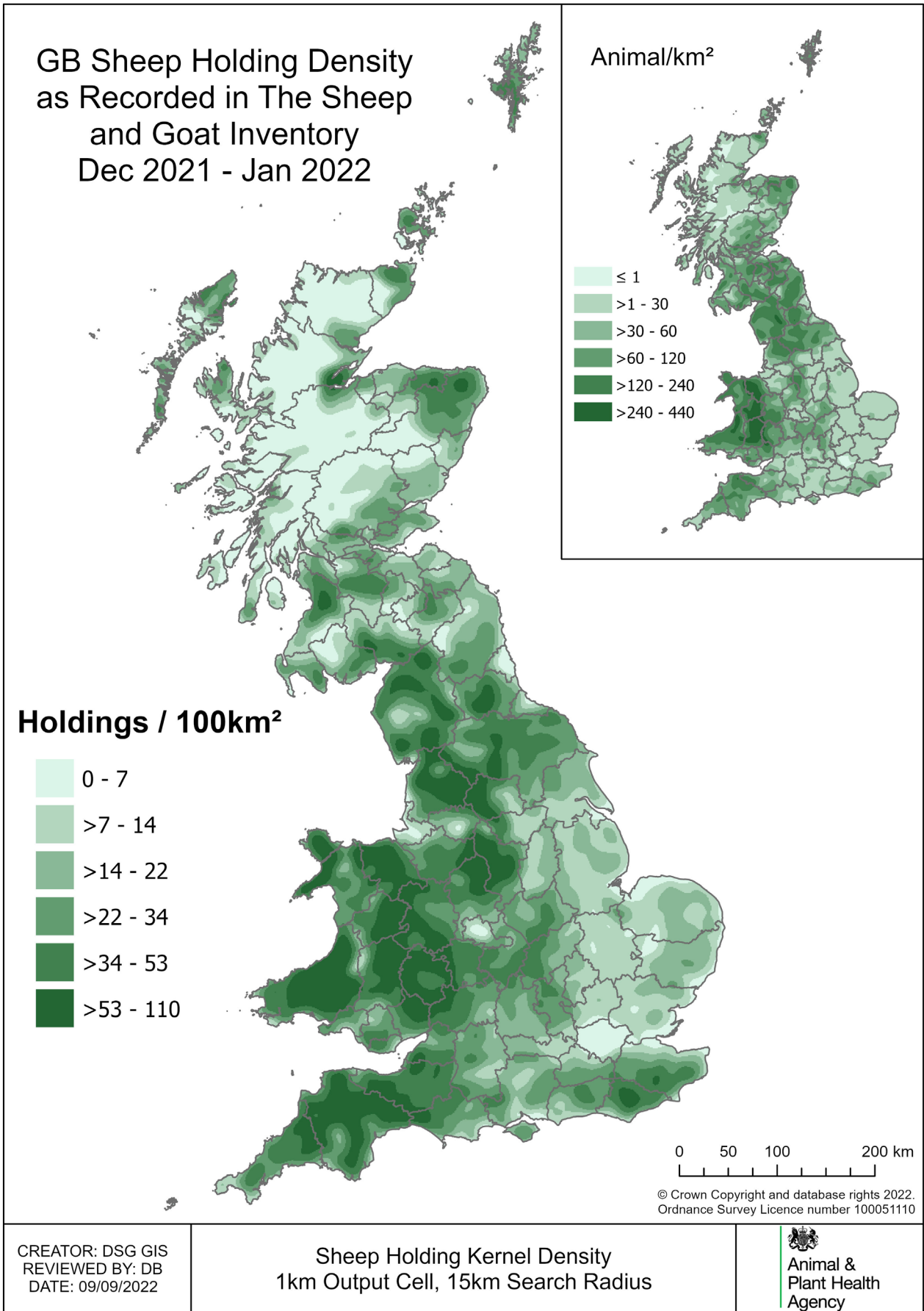


Figure 2 Sheep holding density in GB (Sheep and Goat Inventory Dec 2021/Jan 2022)

Table 1: Number of sheep holdings and number of sheep by country in GB, Dec 2020/Jan 2021 and Dec 2021/Jan 2022. The number of sheep holdings and number of sheep per county in Dec 2021/Jan 2022 is provided in [Annex 2](#).

Country	Number of sheep holdings			Number of sheep		
	Dec 2020/Jan 2021	Dec 2021/Jan 2022	% Change	Dec 2020/Jan 2021	Dec 2021/Jan 2022	% Change
ENGLAND	44,193	40,148	-9.2%	8,177,839	7,535,523	-7.9%
SCOTLAND	13,622	14,026	3.0%	3,777,691	4,034,032	6.8%
WALES	13,164	11,463	-12.9%	3,934,746	3,928,139	-0.2%
GB TOTAL	70,979	65,637	-7.5%	15,890,276	15,497,694	-2.5%

Acknowledgements

The LDDG is grateful to Defra, Welsh Government, Scottish Government, and APHA Weybridge DSG staff who handle the Sheep and Goat Inventory data and Rapid Analysis and Detection of Animal Related Risks (RADAR) data warehouse for their assistance in producing this report.

References

- Charpentier, A., & Gallic, E. (2016). Kernel density estimation based on Ripley's correction. *Geoinformatica*, 20(1), 95–116. <https://doi.org/10.1007/s10707-015-0232-z>
- Pfeiffer, D. U., Robinson, T. P., Stevenson, M., Stevens, K. B., Rogers, D. J., & Clements, A. C. A. (2008). *Spatial Analysis in Epidemiology* (1st ed.). Oxford University Press.

Annex 1: Data quality statement for sheep (September 2022)

Introduction

This data quality statement provides an overview of the quality of the data used to underpin the kernel density holding and livestock maps. This statement is written in the context of the data being used to provide an overview of the livestock demographics within Great Britain. The statement may not necessarily relate to data quality for other purposes.

Overview and purpose of source data used

Data were supplied by the Data Systems Group (DSG), APHA Weybridge and sourced from the Sheep and Goat Inventory via the APHA Rapid Analysis and Detection of Animal-related Risks (RADAR) data warehouse.

Sheep and Goat inventory (via RADAR) was chosen to represent the sheep and goat data as this has the most inclusive coverage on holdings across GB. This dataset records the number of sheep and goats kept on all registered individual premises. The inventory data is collected once a year (1st December for England and Scotland, and 1st January for Wales) by means of a questionnaire which is sent to every registered sheep and goat holding in GB, and, for England, additional holdings recorded in the Animal Reporting and Movement Service (ARAMS) and in Sam (APHA customer database). The questionnaire requests the number of sheep and/or goats kept per holding. This gives a winter count of the population. For the winter 2021/22 inventory there was a response rate of 75.5% for Scotland, 78.6% for England, and 77.8% for Wales.

The Agricultural Survey was also considered as a source of data. These data are collected in the summer months and so include lambs born in the spring and therefore show a much larger population than in the Sheep and Goat inventory. However, this survey only collects data on larger agricultural holdings and not on smaller holdings. It was therefore decided that the sheep and goat inventory gave a better picture of all holdings in Great Britain, but the agricultural survey could be used if a summer count was required. In general, sheep numbers are approximately 70% higher in summer due to the presence of the lamb crop.

The Animal Movement Licensing System database (AMLS) was also considered as a source of data, but this only shows movements of batches of animals and not individual counts and so it was decided this was not suitable.

Category <i>[definition]</i>	Quality description
Relevance of data <i>[degree to which data meets user needs in terms of currency, geographical coverage, content and detail]</i>	<p>Spatial coverage: The data cover GB (England, Scotland, and Wales).</p> <p>Temporal coverage: The data presented are for December 1st, 2021 (England and Scotland) and January 1st, 2022 (Wales). The data were accessed in September 2022.</p> <p>Key data items available: The dataset includes species (sheep or goat) and number of animals on holding, purpose of holding, CPH, name and address of keeper/holding.</p>
Timeliness <i>[the degree to which data represent reality from the required time point]</i>	<p>How often are the data collected? The data are collected annually on December 1st for England and Scotland, and January 1st for Wales.</p> <p>When does the data become available? The data are available and uploaded into RADAR about 6 months after the survey is collected by the Defra Statistics Team based in York ('York Stats').</p> <p>Data reference period: The data are a snapshot at the date of the survey.</p> <p>How often are the data updated? Data are updated annually.</p>
Accuracy and precision <i>[extent of data error and bias and how well data portrays reality]</i>	<p>How were the data collected? Questionnaires are sent once a year by post or by email to all holdings that have registered or are recorded as keeping sheep or goats.</p> <p>Sample & collection size: All holdings registered or recorded as keeping sheep or goats are sent a questionnaire, so the survey is intended to be a full census of all known potential sheep holdings. It is not known how many other holdings are keeping sheep that have not registered or been recorded in ARAMS or Sam. The counts of holdings and number of sheep is obtained from all the holdings that returned the inventory form.</p> <p>Further information on rules for registering a holding where sheep and goats are kept:</p> <p>Sheep and goat keepers: register your holding and flock or herd - GOV.UK (www.gov.uk) What steps have been taken to minimise</p>

	<p>processing errors? The data collected through the survey is subject to manual validation to check the data accuracy. Not all data that fails validation can be corrected/confirmed as the survey team cannot always get in contact with the keeper. There are several different errors that can be detected such as incorrect flock number, or illegible forms. The team check every form and verify the information where possible.</p> <p>What are the response rates? Response rates for the surveys conducted in December 2021 and January 2022 were 78.6% for England, 75.5% for Scotland and 77.8% for Wales.</p> <p>Are any parts of the population unaccounted for in the data collection? The Defra Statistics Team did not receive returns from around 21.4% of holdings in England, 24.5% of holdings in Scotland and 22.21% holdings in Wales to which the questionnaires were sent. However, it is not known whether non-responders represent particular parts of the population. There may also be holdings that are not registered or recorded, and therefore did not receive the inventory form. In order to minimise the number of holdings not represented, information about the annual inventory and how to access the questionnaire is shared through various social media alerts.</p> <p>There is guidance on how to register your holding and flock or herd at: https://www.gov.uk/guidance/sheep-and-goat-keepers-register-your-holding-and-flock-or-herd</p> <p>More information on how to keep and update a holding register in the annual sheep and goat inventory at: https://www.gov.uk/guidance/sheep-and-goat-keepers-how-to-keep-a-holding-register</p>
<p>Comparability</p> <p><i>[how well these data can be compared with data taken from the same dataset and with similar data from other sources]</i></p>	<p>Within dataset comparability: The format and survey methods are similar between years.</p> <p>Other dataset comparability: The data compares with the Agricultural Survey, which shows data collected in the summer and therefore also includes lamb populations. There was an approximately 48% decrease in the estimated sheep population in England, an approximately 41% decrease in Scotland, and an approximately 58% decrease in Wales, between the June 2021 Agricultural Census and the population in this report.</p> <p>The AMLS holds movement data, which can compare information</p>

	<p>on holding locations and relative sizes. However, both datasets have a difference in data capture, as does data held within Sam.</p>
<p>Coherence</p> <p><i>[degree to which data can be or have been merged with other data sources]</i></p>	<p>How consistent are the data over time? If there are differences, what are they and what is their impact? Have there been changes to the underlying data collection? The list of holdings in England to be included in the 2020 inventory was updated to include all registered holdings, plus any additional holdings recorded in ARAMS and Sam, and therefore was likely to be more comprehensive than for the previous few years. However, a large number of the holdings contacted were no longer keeping sheep and were removed from the list for the 2021/22 survey.</p> <p>Have any real-world events impacted on the data since the previous release? No.</p> <p>What other data sources are these data comparable with? Location data are comparable between the Agricultural survey, Sam and the Animal Movement Licensing System (AMLS). The Agricultural survey data has been used for total population and the AMLS for total holdings.</p> <p>What other data sources in society report similar information? How do these data sources compare? Industry has their own datasets, but these are obtained from, for example, the sheep and goat inventory and Agricultural Survey. It is thought they are unlikely to offer any additional information.</p>
<p>Interpretability</p> <p><i>[how well the data is understood and utilised appropriately]</i></p>	<p>Is there a particular context that this data needs to be considered within? This is a winter survey and as sheep production is highly seasonal the population will be much higher during the summer, post lambing.</p> <p>What other information is available to help users better understand this data source? There is a metadata catalogue for RADAR available at http://ahvlaintranet/day-to-day/tools-and-applications/Pages/radar.aspx</p> <p>Are there any ambiguous or technical terms that may need further explanation? No.</p>

<p>Accessibility</p> <p><i>[availability of relevant information and access to the data in a convenient and suitable manner]</i></p>	<p>What data are shared and with whom? Addresses and coordinates of individual locations cannot be released without Confidentiality Agreements. DSG access data through RADAR or directly from York Stats.</p> <p>Contact details for data source queries:</p> <p>Agricultural Survey England: Farming-statistics@defra.gov.uk</p> <p>Agricultural Survey Wales: Stats.agric@wales.gov.uk</p> <p>Agricultural Survey Scotland: agric.stats@scotland.gov.uk</p> <p>ScotEID Livestock Traceability - support@scoteid.com</p> <p>Freedom of Information (FOI), Environmental Information Regulations (EIR) and Subject Access requests - enquiries@apha.gov.uk</p>
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Annex 2: Number of sheep holdings and number of sheep per county

Results of GB Sheep and Goat Inventory, December 2021/January 2022. Data for counties with 6 or less holdings have been excluded from this table for data protection reasons.

Country	County	Number of sheep holdings	Number of sheep
ENGLAND	AVON	552	40,963
	BEDFORDSHIRE	186	13,910
	BERKSHIRE	178	26,009
	BUCKINGHAMSHIRE	490	98,022
	CAMBRIDGESHIRE	343	27,063
	CHESHIRE	875	102,178
	CLEVELAND	101	15,463
	CORNWALL AND ISLES OF SCILLY	1,585	243,671
	CUMBRIA	2,959	1,005,187
	DERBYSHIRE	1,290	184,097
	DEVONSHIRE	3,605	705,407
	DORSET	929	119,099
	DURHAM	911	274,480
	EAST SUSSEX	772	101,791
	ESSEX	432	22,934
	GLOUCESTERSHIRE	1,046	136,176
	GREATER LONDON	60	1,959
GREATER MANCHESTER	298	30,436	
HAMPSHIRE	806	67,549	

Country	County	Number of sheep holdings	Number of sheep
	HEREFORDSHIRE	1,354	291,110
	HERTFORDSHIRE	194	15,725
	HUMBERSIDE	597	55,211
	ISLE OF WIGHT	147	20,637
	KENT	1,048	125,167
	LANCASHIRE	1,672	343,983
	LEICESTERSHIRE	704	139,630
	LINCOLNSHIRE	795	116,517
	MERSEYSIDE	63	4,501
	NORFOLK	707	67,999
	NORTH YORKSHIRE	3,126	858,659
	NORTHAMPTONSHIRE	639	126,581
	NORTHUMBERLAND	1,026	581,486
	NOTTINGHAMSHIRE	316	42,536
	OXFORDSHIRE	574	90,174
	SHROPSHIRE	1,736	418,579
	SOMERSET	1,733	258,417
	SOUTH YORKSHIRE	314	45,741
	STAFFORDSHIRE	1,271	162,501
	SUFFOLK	565	37,928
	SURREY	374	30,097
	TYNE & WEAR	39	4,435
	WARWICKSHIRE	614	118,928
	WEST MIDLANDS	103	11,734

Country	County	Number of sheep holdings	Number of sheep
	WEST SUSSEX	483	55,520
	WEST YORKSHIRE	884	84,128
	WILTSHIRE	793	102,284
	WORCESTERSHIRE	859	108,921
SCOTLAND	ABERDEENSHIRE	1,272	372,262
	ANGUS	299	99,880
	ARGYLL	850	246,009
	AYRSHIRE	830	254,132
	BANFFSHIRE	446	141,011
	BERWICKSHIRE	240	135,927
	BUTE	91	27,021
	CAITHNESS	473	110,521
	CLACKMANNANSHIRE	18	9,944
	DUMBARTONSHIRE	82	27,696
	DUMFRIESHIRE	785	314,726
	EAST LOTHIAN	106	38,869
	FIFE	291	90,060
	INVERNESS-SHIRE	1,387	189,615
	KINCARDINESHIRE	158	51,242
	KINROSS	61	23,483
	KIRKCUDBRIGHT	451	177,996
	LANARKSHIRE	589	194,715
	MIDLOTHIAN & EDINBURGH	154	89,527
MORAY	202	57,935	

Country	County	Number of sheep holdings	Number of sheep
	NAIRN	79	25,865
	ORKNEY	435	67,249
	PEEBLES	157	110,031
	PERTH	733	317,200
	RENFREW	137	34,924
	ROSS & CROMARTY	1,322	120,026
	ROXBURGH	385	224,015
	SELKIRK	87	54,272
	SHETLAND	782	149,710
	STIRLING	235	88,913
	SUTHERLAND	428	60,612
	WEST LOTHIAN	78	18,353
	WIGTOWN	383	110,291
WALES	CLWYD	1,486	523,370
	DYFED	3,800	911,374
	GWENT	706	173,321
	GWYNEDD	2,083	715,252
	MID GLAMORGAN	310	110,669
	POWYS	2,668	1,402,265
	SOUTH GLAMORGAN	155	29,480
	WEST GLAMORGAN	255	62,408