



Animal &
Plant Health
Agency

Livestock Demographic Data

Group:

Sheep population report

**Livestock population density maps
for GB using December
2020/January 2021 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 provide 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 in animal health and welfare policy work, to assess the economic or social impact of particular policies, for contingency, disease control and resource planning.

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 southern Scotland, with additional areas of high population density in 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.

Comparison with data from the June 2021 full Census of Agricultural Survey, indicated that the GB sheep population increased by approximately 95% between winter 2020/21 and summer 2021. 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>).

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. 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 133,241 holdings in GB that were previously recorded as keeping sheep and/or goats. The questionnaire was completed by 101,889 respondents, giving an overall return rate of 76.5%. Out of those returning the questionnaire, 70,979 holdings (65.6%) were keeping sheep.

For England, the questionnaire was sent to 88,545 holdings, and responses were received from 69,838 respondents (78.9%) of which 44,193 holdings (63.3%) were keeping sheep.

For Scotland, the questionnaire was sent to 26,867 holdings, responses were received from 18,920 respondents (70.4%) of which 13,622 holdings (72.0%) were keeping sheep.

For Wales, the questionnaire was sent to 17,829 holdings. The total number of responses received was 13,131 (73.6%), which reported 13,164 sheep holdings (100.3%)¹.

The data are therefore derived from the 70,979 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-

¹ A respondent can report one or more holdings on the questionnaire.

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).

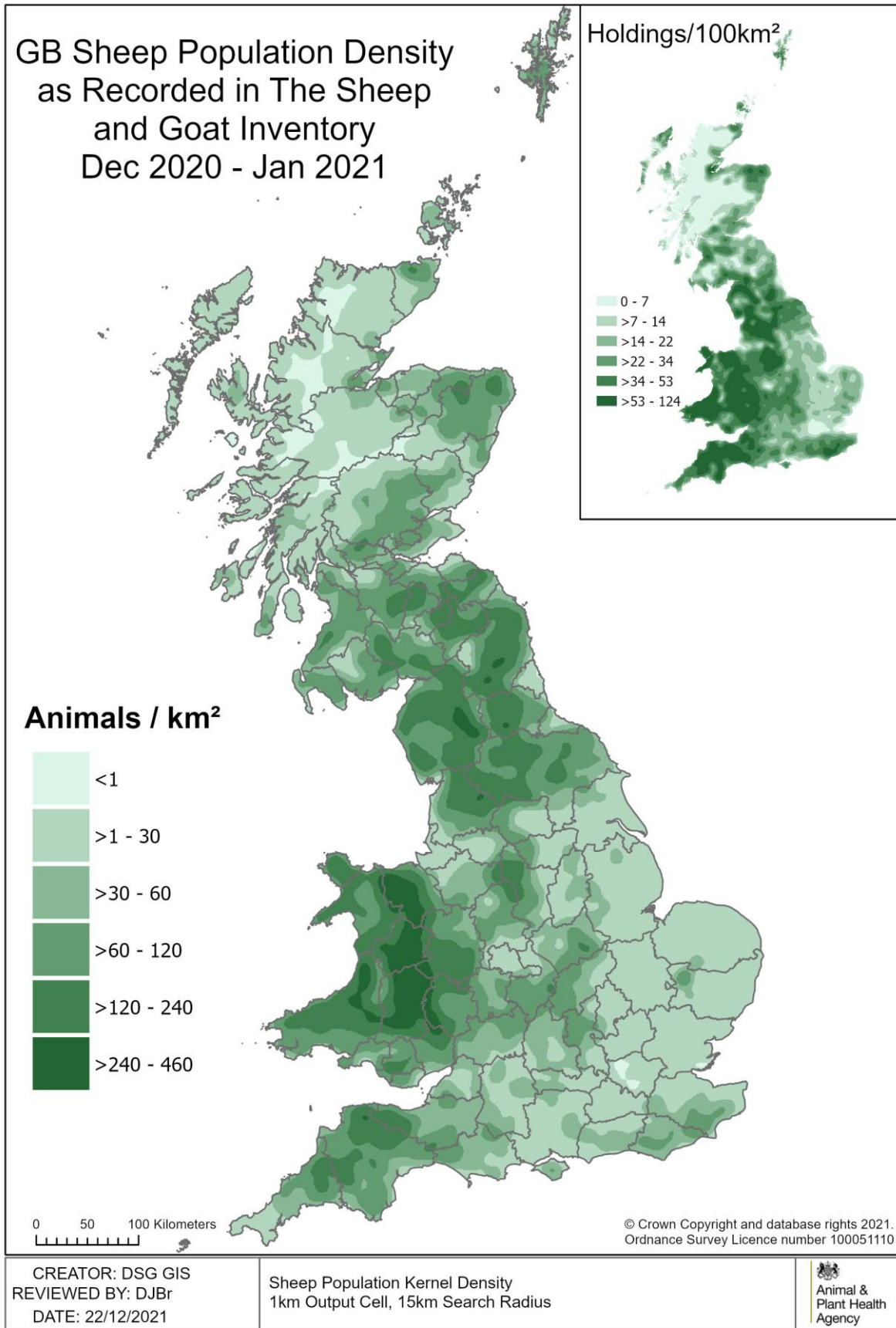


Figure 1 Sheep population density in GB (Sheep and Goat Inventory Dec 2020/Jan 2021)

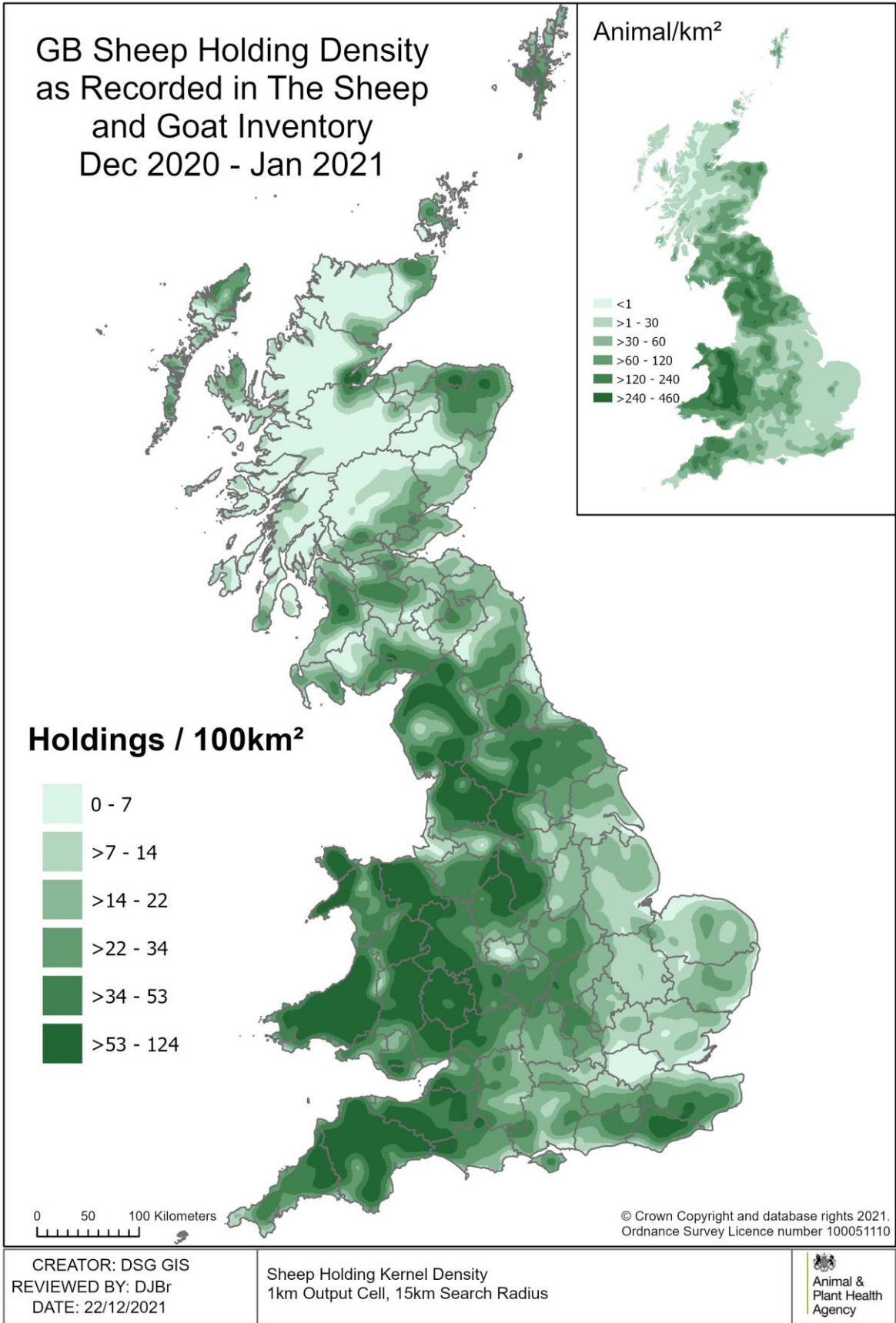


Figure 2 Sheep holding density in GB (Sheep and Goat Inventory Dec 2020/Jan 2021)

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

Country	Number of sheep holdings	Number of sheep
England	44,193	8,177,839
Scotland	13,622	3,777,691
Wales	13,164	3,934,746
Total GB	70,979	15,890,276

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 (August 2021)

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 2020/21 inventory there was a response rate of 70% for Scotland, 79% for England, and 74% 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
<p>Relevance of data</p> <p><i>[degree to which data meets user needs in terms of currency, geographical coverage, content and detail]</i></p>	<p>Spatial coverage: The data cover GB (England, Scotland, and Wales).</p> <p>Temporal coverage: The data presented are for December 1st, 2020 (England and Scotland) and January 1st 2021 (Wales). The data were accessed in August 2021.</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>
<p>Timeliness</p> <p><i>[the degree to which data represent reality from the required time point]</i></p>	<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>
<p>Accuracy and precision</p> <p><i>[extent of data error and bias and how well data portrays reality]</i></p>	<p>How were the data collected? Questionnaires are sent once a year by post 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>https://www.gov.uk/sheep-and-goats-identification-registration-and-movement</p> <p>What steps have been taken to minimise processing errors?</p> <p>The data collected through the survey is subject to manual validation to check the data accuracy. Not all data that fails</p>

	<p>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 2020 and January 2021 were 79% for England, 70% for Scotland and 74% 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% of holdings in England, 30% of holdings in Scotland and 26% 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 79% increase in the estimated sheep population in England between the population in this report and the June 2021 Agricultural Census). AMLS holds movement data, which can compare information 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</p>

	<p>was likely to be more comprehensive than for the last few years. However, a large number of the holdings contacted were no longer keeping sheep and will be 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 -</p>

enquiries@apha.gov.uk

Annex 2: Number of sheep holdings and number of sheep per county

Results of GB Sheep and Goat Inventory, December 2020/January 2021. 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	605	48,191
	BEDFORDSHIRE	199	19,324
	BERKSHIRE	208	28,622
	BUCKINGHAMSHIRE	546	100,358
	CAMBRIDGESHIRE	381	25,163
	CHESHIRE	970	126,181
	CLEVELAND	110	19,216
	CORNWALL AND ISLES OF SCILLY	1,726	262,474
	CUMBRIA	3,249	1,077,596
	DERBYSHIRE	1,387	195,642
	DEVONSHIRE	3,940	746,786
	DORSET	1,020	128,875
	DURHAM	1,000	312,202
	EAST SUSSEX	861	105,603
	ESSEX	475	20,146
	GLOUCESTERSHIRE	1,177	153,722
	GREATER LONDON	73	3,153
GREATER MANCHESTER	332	33,085	
HAMPSHIRE	910	73,757	

Country	County	Number of sheep holdings	Number of sheep
	HEREFORDSHIRE	1,508	319,430
	HERTFORDSHIRE	223	20,194
	HUMBERSIDE	657	61,193
	ISLE OF WIGHT	164	22,562
	KENT	1,134	132,004
	LANCASHIRE	1,827	362,795
	LEICESTERSHIRE	795	152,114
	LINCOLNSHIRE	865	111,138
	MERSEYSIDE	73	3,774
	NORFOLK	777	72,012
	NORTH YORKSHIRE	3,427	913,764
	NORTHAMPTONSHIRE	698	129,894
	NORTHUMBERLAND	1,162	657,531
	NOTTINGHAMSHIRE	359	60,000
	OXFORDSHIRE	631	96,359
	SHROPSHIRE	1,917	463,866
	SOMERSET	1,912	283,057
	SOUTH YORKSHIRE	353	47,813
	STAFFORDSHIRE	1,361	169,530
	SUFFOLK	624	58,358
	SURREY	404	29,301
TYNE & WEAR	46	5,246	
WARWICKSHIRE	678	130,563	
WEST MIDLANDS	116	9,671	

Country	County	Number of sheep holdings	Number of sheep
	WEST SUSSEX	550	59,477
	WEST YORKSHIRE	954	96,978
	WILTSHIRE	881	109,153
	WORCESTERSHIRE	928	119,966
SCOTLAND	ABERDEENSHIRE	1,250	345,912
	ANGUS	267	89,173
	ARGYLL	825	226,095
	AYRSHIRE	774	237,812
	BANFFSHIRE	436	113,646
	BERWICKSHIRE	229	127,668
	BUTE	73	22,557
	CAITHNESS	464	100,065
	CLACKMANNANSHIRE	25	9,987
	DUMBARTONSHIRE	87	24,178
	DUMFRIESHIRE	739	288,404
	EAST LOTHIAN	109	47,749
	FIFE	280	65,592
	INVERNESS-SHIRE	1,346	176,779
	KINCARDINESHIRE	160	42,524
	KINROSS	61	20,894
	KIRKCUDBRIGHT	441	157,328
	LANARKSHIRE	580	180,184
	MIDLOTHIAN & EDINBURGH	153	77,907
MORAY	195	54,313	

Country	County	Number of sheep holdings	Number of sheep
	NAIRN	67	18,757
	ORKNEY	402	60,642
	PEEBLES	150	108,113
	PERTH	746	295,004
	RENFREW	117	34,004
	ROSS & CROMARTY	1,324	115,475
	ROXBURGH	369	229,438
	SELKIRK	93	91,018
	SHETLAND	727	135,078
	STIRLING	247	82,613
	SUTHERLAND	413	67,497
	WEST LOTHIAN	89	22,014
	WIGTOWN	384	109,271
WALES	CLWYD	1,657	558,255
	DYFED	4,403	928,989
	GWENT	866	168,887
	GWYNEDD	2,246	673,447
	MID GLAMORGAN	388	109,450
	POWYS	3,098	1,399,215
	SOUTH GLAMORGAN	183	29,252
	WEST GLAMORGAN	323	67,251