Livestock Demographic Data Group:
Cattle population report

Livestock population density maps for GB 2018

OGL

Document information

LDDG	Cattle
Report reference	CP17/18
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Data source	Cattle Tracing System (CTS) / Radar
Data year	July 2017

Contents

Who are these reports for?

These reports are suitable for use in animal health and welfare policy work which requires an estimate of the distribution and size of the cattle population at GB level. This type of population level information is often required to assess the economic or social impact of particular animal health policies, for contingency, disease control and resource planning, or to provide evidence to trading partners. There are important assumptions and uncertainties with these estimates which the user needs to take into consideration and can be found at Annex 1.

Who did this work?

The Livestock Demographic Data Groups (LDDG) were formed in January 2014 and are made up of APHA representatives from data, epidemiology, species expert and GIS work groups. The work was initiated and completed between April 2017 and March 2018. The LDDGs are grateful to British Cattle Movement Service (BCMS), IBM and APHA Weybridge DSG staff who handled the Cattle Tracing System (CTS) data and the APHA Rapid Analysis and Detection of Animal Related Risks (RADAR) data warehouse for their assistance in producing this report.

What do the data show about the population?

Figures 1 and 2 show either the density of animals, with a small map to show how this compares with the density of holdings, or vice versa. In contrast to other livestock species, there is little difference for cattle between the two distributions. Both the cattle population density and holding maps reflect common understanding of the cattle industry demographic. The greatest density of cattle population and holdings is generally on the west side of Great Britain; this includes Ayrshire, Dumfries & Galloway, Cumbria, Cheshire, southwest Wales, Devon, Somerset and Cornwall. The areas with the sparsest cattle population and holding densities also reflect common understanding of the cattle industry demographic; these include parts of northwest Scotland and parts of East Anglia.

How accurate are the data?

The data are derived from the CTS by analysis of all the reported movements of cattle on and off holdings in Great Britain at 1st July 2017; such movements are reported continuously and with a slight delay. Thus the data best represent the numbers and locations of cattle in the period up to three months before the date the data were extracted (i.e. 1st April 2017). The output of this analysis is stored in 'RADAR', an APHA information management system; where location data are missing in the record due to subsequent updates, RADAR derives this from other information using a 'best address' algorithm.

Therefore there can be a discrepancy between the 'RADAR' location and that provided originally through CTS; 88% of RADAR and CTS locations are within 2km, but notably 3% are > 20km apart. The supporting quality statement provides further detail on the limitations in the data (Annex 1).

What do the data not show?

The population data provides for a single snapshot in time (as at July 1st 2017). It does not draw out the variation in beef and dairy production, or the pattern of movements between cattle herds, or the effect of seasonal breeding on the number of young calves.

The representation of the cattle demographic by data from CTS is near complete, but not perfect. A small number of movements are not recorded, either due to non-compliance or are not required to be recorded (for example linked herd movements). However, these are believed to be few and to not significantly impact the data presented.

There is uncertainty inherent in the information displayed. Limitations in the dataset are discussed in the supporting quality statement (Annex 1) and it is important that the user considers these in the context of their work. Similarly population and holding density maps are classified to different scales and units and due care must be taken regarding their interpretation.

How were the maps produced?

The figures have been created using the kernel density function in *ArcGIS software*. This tool distributes population information over a defined radius (15km radius 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[1]. 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 aide in cross referencing areas of the map to the key. Note that the ArcGIS Kernel Density tool does not take into account edge effects[2], and as such density estimates in and around coastal areas may be under estimated.

Comparison between the maps was optimised by assigning similar parameters between the species in this series of reports to those used in previous reports. However, further refinement of the parameters for each species dataset could represent the information more accurately and will be explored.

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[1] Pfeiffer, D. Spatial Analysis in Epidemiology, 2008. p47.
[2] https://www.e-education.psu.edu/geog586/l5_p15.html

Figure 1: Cattle population density in GB (CTS)

GB Cattle Population Density as Recorded in CTS July 2017

Holdings/100km²

< 1
> 1 - 10
> 10 - 25
> 25 - 50
> 50 - 100
> 100 - 136

Cattle/km²

< 1
> 1 - 10
> 10 - 25
> 25 - 50
> 50 - 100
> 100 - 147

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0   50   100 Kilometers

CREATOR: DSG GIS

DATE: 15/02/2018

Cattle Population Kernel Density
1km Output Cell, 15km Search Radius

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Plant Health
Agency

Figure 2: Cattle holding density in GB (CTS)

GB Cattle Holding Density
Density as Recorded in CTS
July 2017

Cattle/km²

< 1
> 1 - 10
> 10 - 25
> 25 - 50
> 50 - 100
> 100 - 147

Holdings/100km²

< 1
> 1 - 10
> 10 - 25
> 25 - 50
> 50 - 100
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0   50   100 Kilometers

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Cattle Holding Kernel Density
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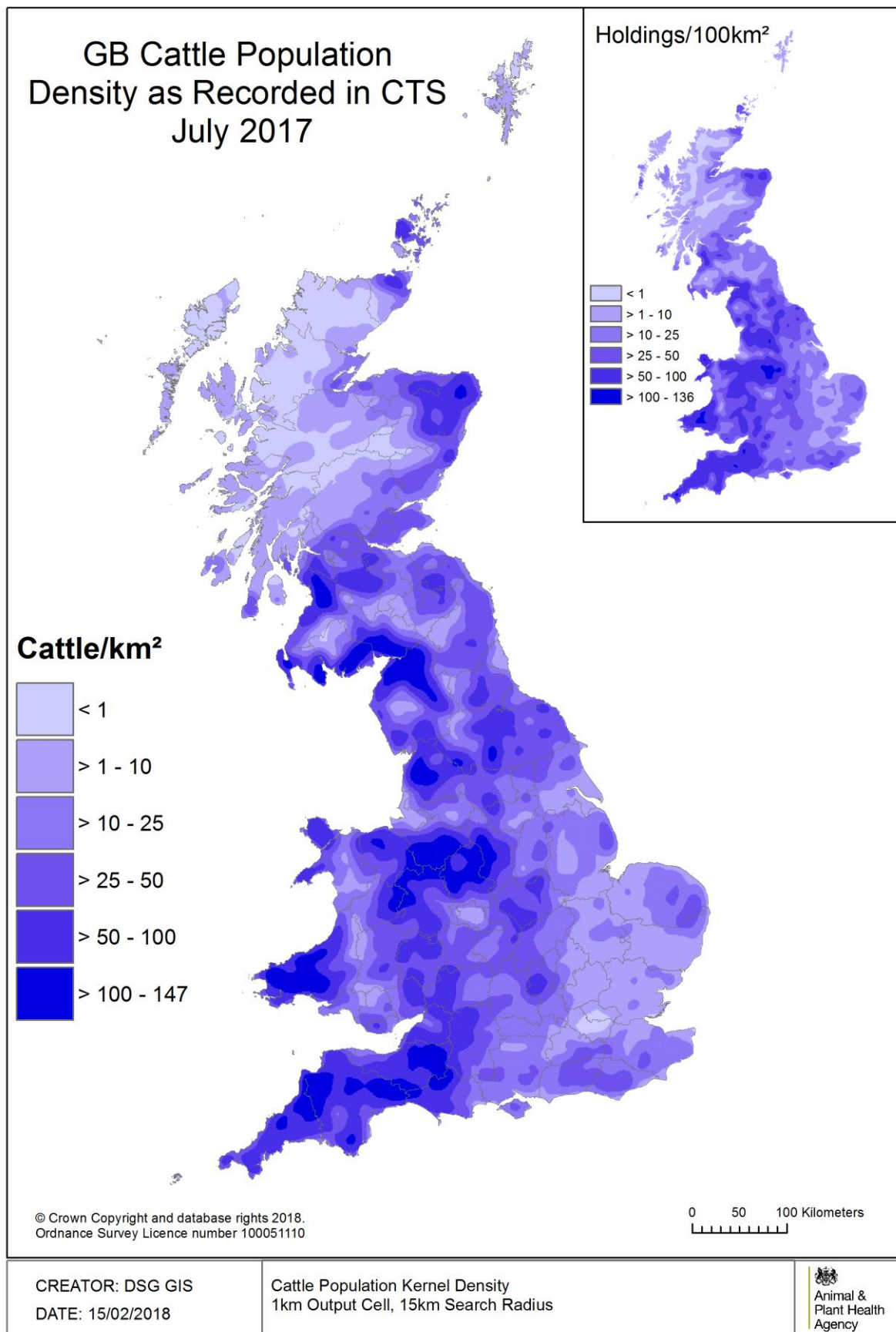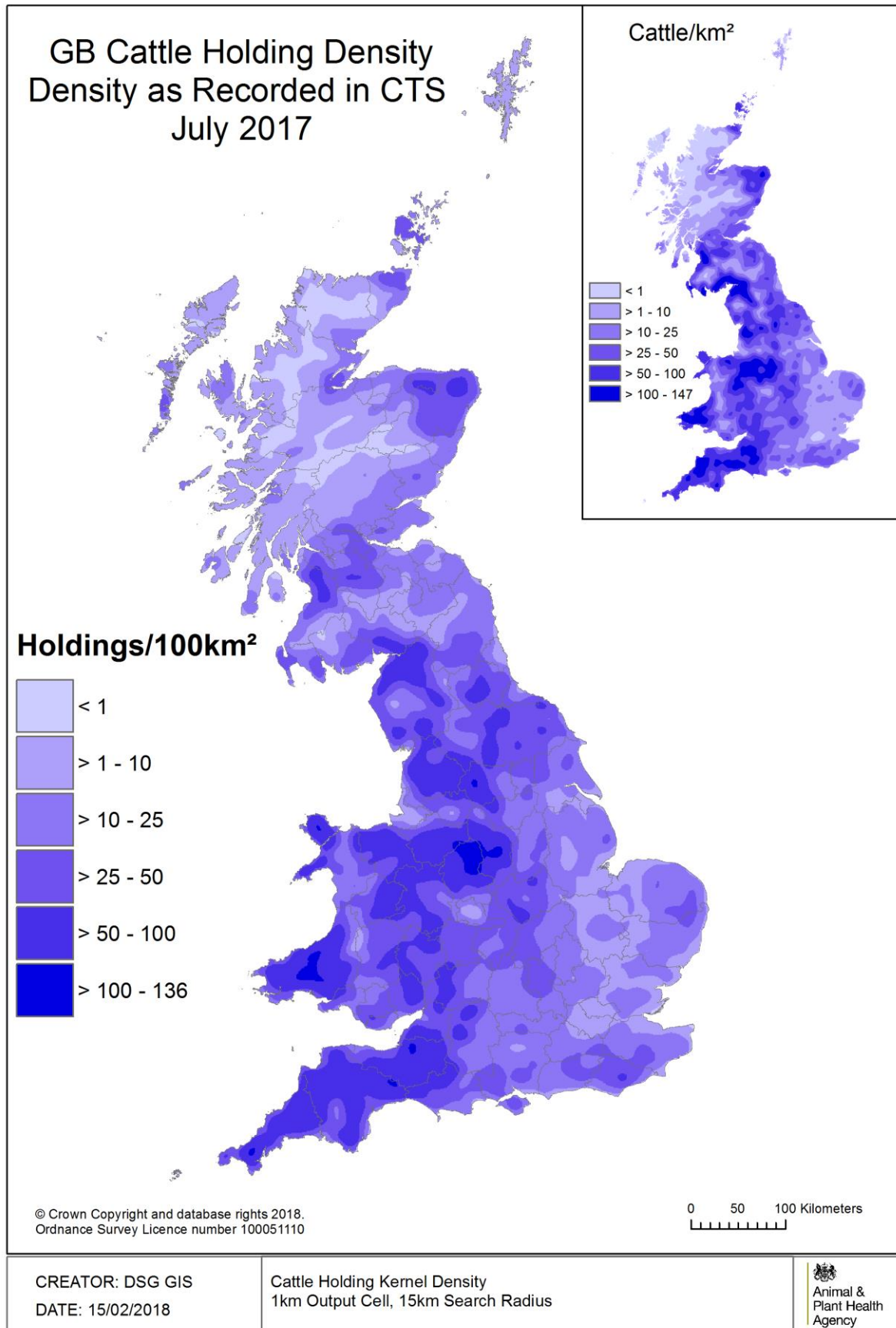Agency

Annex 1: Data quality statement for cattle (March 2018)

Introduction

This data quality statement provides an overview of the quality of the data used to underpin the kernel density holding and livestock figures. 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 of source data used

Data were supplied by the Data Systems Group (DSG), APHA Weybridge and sourced from the Rapid Analysis and Detection of Animal-related Risks (RADAR) data warehouse and from the Cattle Tracing System (CTS) database.

Overview and purpose of the source data

The CTS dataset describes cattle movement data within GB and is captured by the British Cattle Movement Service (BCMS). It includes further information including location data which can be used to estimate the number of cattle on holdings in GB.

Category [definition]	Quality description
Relevance of data *[degree to which data meets user needs in terms of currency, geographical coverage, content and detail]*	**Spatial coverage** The data cover GB. **Temporal coverage** The data presented are for July 1st 2017 and were accessed in Dec 2017. **Key data items available** The dataset includes births, deaths and movements for registered cattle. It can estimate the number and location of cattle at any one point in time based on these movement records. It also includes data on breed and sex.

Timeliness *[the degree to which data represent reality from the required time point]*	**How often are the data collected?** A continuous stream of completed movement forms are submitted to BCMS by farmers and entered into CTS. Location co-ordinates of holdings are uploaded from APHA's operational database called SAM only once per holding. Data are uploaded to RADAR monthly. **When does the data become available?** Data becomes available in RADAR up to one month after collection. **Data reference period?** The database is fed continuously but the population data is a snapshot extracted from July 1st 2017. This month was chosen because the cattle population drops approximately 4% over winter but is most stable during summer. **How often are the data updated?** CTS data is the most accurate in data reference periods that are over 3 months old at the time of extraction. This allows completion of all movement form submissions, data entry to be finalised and the database to be updated, although analysis shows completeness of the upload is over 98% for the most recent month. Holding location coordinates for a CPH are not updated in CTS, and if SAM does not have a record of that holding no coordinates are assigned. Gaps in the initial upload of SAM location coordinates into CTS are filled by the RADAR 'best co-ordinates' algorithm which imputes the location from other data including the address.
Accuracy and precision *[extent of data error and bias and how well data portrays reality]*	**How were the data collected?** Cattle population estimates on each holding are calculated from cattle movement information. Farmers are legally required to submit completed records of cattle movements on forms to BCMS. Separate movement forms are submitted as *movements off* and *movements on*; these are 'paired' by IBM prior to being made available, i.e. the *from* and *to* herd forms are combined into a single record. Location coordinates are assigned to a holding from SAM when a submitted form has a new location, but location data will be missing if SAM has no record at the time. SAM amendments to the location are not usually fed back

to BCMS. RADAR 'best' coordinates are also available which are calculated with additional information including the current address data for the holding.

Sample & collection size

There are approximately 380,000 CPH records within the CTS dataset, which includes all historical records and changes, of this there are 145,000 unique CPHs that represent individual holdings, and in 2017 70,000 of these were currently active premises. There are approximately 900,000 movement records per month which are used to calculate changes in the cattle population on each holding.

What steps have been taken to minimise processing errors?

DSG monitors the monthly CTS upload by checking that the file is complete and holds expected data. Checks are made monthly by IBM to ensure the data has loaded into RADAR correctly. BCMS have a form for staff to report movements and a group which investigates and resolves those issues which appear suspicious or inaccurate.

What are the non-reporting or non-response rates?

We assume very few farmers do not complete forms, as it is a legal requirement to do so, and we are aware of situations occurring where people have faced prosecution for not registering movements with CTS. Unrecorded movements may lead to incomplete data, so inferred movements are calculated when the animal next appears on a movement submission. These movements are expected to be within the same geographical area and are unlikely to impact the population counts significantly.

Are any parts of the population unaccounted for in the data collection?

Sole Occupancy Authorities (SOAs) consist of a group of holdings under the same farm management and control and movements between them do have to be reported, whereas linked holdings are land areas linked to one another so that a cattle keeper does not have to report movements between them. However, movements from external holdings *on to* SOAs and linked holdings *are* reported so population totals should remain accurate. If holdings are not further than ~10 miles apart, they are not considered separately, although exceptions do apply. Both SOAs and linked holding regulations are changing gradually so will have a

	decreasing effect with time.
Comparability *[how well these data can be compared with data taken from the same dataset and with similar data from other sources]*	**Within dataset comparability** Routine checks show that data extracted at different times are highly comparable. **Other dataset comparability** The CTS data appears to be the most accurate for placing cattle in a place at a point in time. SAM and RADAR may have more up to date information on location coordinates. This will have minimal impact on county level summaries or kernel density smoothed maps.
Coherence *[degree to which data can be or have been merged with other data sources]*	**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?** CTS Data are most complete and accurate since 2000. We are not aware of any change in collection methods during recent years but assume minimal bias has been caused. Current location details may be different from when location was first recorded, but should still be of similar geographic location. **Have any real world events impacted on the data since the previous release?** Slow data entry is anticipated during notifiable exotic disease outbreaks, but this has not affected the extract chosen. **What other data sources is this data comparable with?** Location data are comparable between CTS, SAM and RADAR. We are not aware of any other datasets that would hold information on cattle movements. SAM indicates the number of animals on a holding at each TB test, but this is not as accurate as calculating the population from CTS movement records.
Interpretability *[how well the data is understood and utilised appropriately]*	**Is there a particular context that this data needs to be considered within?** This dataset can be used to obtain information regarding animal movements and animal population counts. The cattle population peaks during the summer and dips during the winter. These data are from the summer peak (July 1st 2017). As registration of movements is legally enforced, we expect the data to be a near

	complete representation of cattle within the agricultural industry. **What other information is available to help users better understand this data source?** We have documentation of what the tables and data represent. IBM have technical documentation for the compilation of the data. **Are there any ambiguous or technical terms that may need further explanation?** The different types of holding/location present may need explaining for recipients of raw data.
Accessibility *[availability of relevant information and access to the data in a convenient and suitable manner]*	**What data are shared and with whom?** Addresses and coordinates of individual locations cannot be released without Confidentiality Agreements. However, summary cattle movement outputs and aggregated data can be shared. The dataset is very large, so provision of individual records would not be easy even with Confidentiality Agreements in place. Aggregated data are a better option. Data are stored within SQL tables on secure servers. **Contact details for data source queries** For further information on the data sources: lddg@apha.gsi.gov.uk