

# Queensland technical methods - Intensive livestock

## Australian Biomass for Bioenergy Assessment

May 2018

This document is part of a series describing the technical methods used to publish the Queensland based data for the Australian Biomass for Bioenergy Assessment (ABBA) <[arena.gov.au/projects/the-australian-biomass-for-bioenergy-assessment-project](http://arena.gov.au/projects/the-australian-biomass-for-bioenergy-assessment-project)>. All documents in the series are available to view and download at <[publications.qld.gov.au](http://publications.qld.gov.au)>.

### What is the Australian Biomass for Bioenergy Assessment?

ABBA provides detailed information about biomass resources across Australia. This information will assist project developers make decisions for new bioenergy projects, and provide linkages between potential biomass feedstocks—through the supply chain—to end users. To achieve this, ABBA collects datasets, on a state- by-state basis, about the location, volumes and availability of biomass, and publishes them on the Australian Renewable Energy Mapping Infrastructure (AREMI) platform <[nationalmap.gov.au/renewables](http://nationalmap.gov.au/renewables)>. ABBA is managed by AgriFutures Australia with funding support from the Australian Renewable Energy Agency (ARENA).

### Why intensive livestock industries?

Intensive livestock industries include cattle feedlots, chicken farms and piggeries. Operations such as these are an attractive potential source of feedstock for bioindustries because:

- residues<sup>1</sup> from livestock production are often very rich in nutrients and potential energy
- individual intensive livestock operations can generate very large quantities of residues and are often geographically concentrated
- intensive livestock industries are required to manage residues which when they accumulate can have undesirable environmental and social impacts, and the disposal of which can be expensive and technically demanding.

Intensive livestock industries are also large consumers of energy and of grain and other agricultural products (such as hay and silage) the production of which may also be a user of residues (through soil application of animal residues or composts derived from animal residues).

Australia's Clean Energy Finance Corporation (CEFC) identified intensive livestock industries as one of three significant opportunities for investment in bioenergy and energy from waste in Australia (which they see as potentially up to \$5 billion dollar industry) (CEFC 2015).

### What data about intensive livestock industries is published by ABBA?

Data about cattle feedlots, piggeries and chicken (broiler and layer) farms only are included in this release. Other intensive livestock industries, e.g. aquaculture, and other types of poultry (such as squab and emus), is available, but these industries are generally small and scattered, and the available data is of limited quality (e.g. it generally contains no information about animal numbers) so these industries are not a priority for mapping by ABBA at this stage. Data about other intensive livestock industries such as these may be included in future releases.

Data is only presented for animal manure in this release. Animal bedding is not reported because it is highly variable, depending on the nature of the operation and the type of material available, and there is limited site data from which quantities can be estimated. Further, most animal bedding comprises other forms of biomass (e.g. sawdust, straw etc.) which have already been accounted for in the data published by ABBA about those feedstock

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<sup>1</sup> In this context residues are considered to be organic materials (such as manures) created through the production process other than the principal product (e.g. meat or eggs). Residues are generally considered a waste although they may still be in beneficial use.

types. Similarly data about other residues from intensive livestock operations such as animal carcasses is not included because of its variability and limited availability. Information about residues from processing (e.g. meatworks) which includes components of animals raised in intensive livestock industries is presented in other ABBA datasets.

Data is aggregated at a local government area (LGA) scale.

## Methods

### Infrastructure

Datasets showing the location of intensive livestock operations were derived by combining data already in the public domain published by the Department of Agriculture and Fisheries (DAF) - Agricultural Land Audit (ALA) <[daf.qld.gov.au/environment/ag-land-audit](http://daf.qld.gov.au/environment/ag-land-audit)> and the Queensland Land Use Mapping Program (QLUMP) <[qld.gov.au/environment/land/vegetation/mapping/qlump](http://qld.gov.au/environment/land/vegetation/mapping/qlump)> (both of which map locations by animal type). These were combined and supplemented with Agricultural Property mapping, the Digital Cadastre, and GoogleEarth as follows:

- where several locations in close geographic proximity had been mapped by ALA and/or QLUMP and attributed with the same animal type and operation name and they were located on the same (or adjoining) parcel and/or the same property and a check on GoogleEarth confirmed that they were linked (e.g. connected by internal roads) - a single point approximating the centroid was chosen from either the ALA or QLUMP data to represent the whole operation.
- where both datasets identified a site of the same type in close proximity the attributes from the ALA dataset were attached to the location in the QLUMP dataset and the location was mapped as per QLUMP.
- where either dataset identified a site that was remote from any identified by the other this was checked in GoogleEarth and if presence of an intensive livestock operation was confirmed this point was preserved in the dataset.

Site data is published by ABBA only as locations by animal type (cattle, pigs, poultry). For poultry farms the type of operation (layer, breeder, broiler) is also displayed. Sites where it is known that residues are already in beneficial use are also labelled accordingly.

### Manure production

#### *Step1: Determine number of animals for each LGA*

In Queensland intensive livestock operations are required to obtain Development Approval (DA) from the relevant Planning Authority. The DA specifies a maximum operating capacity in terms of standard animal units for each approved operation. The most current information regarding these approvals is held by the Queensland Department of Agriculture and Fisheries. For sites contained within the ALA published datasets the Development Approval (DA) approved operating capacity (in terms of standard animal units for cattle and pigs and in terms of total number birds for chickens) are allocated to each point. These animal capacity numbers were updated with current information to reflect any recent changes to the approvals.

The approved capacities relate to the DA under which the operation is approved. In instances where multiple sites operating under a single DA were aggregated through the process described above the approved capacity was assumed to not be additive. Where these numbers were presented as a range the maximum value was used. For operations not contained within the ALA dataset (i.e. site mapped only by QLUMP) the capacity was estimated by visual comparison with nearby sites of the same type for which capacity information was available.

Animal numbers were then aggregated to LGA level based on the location of the operation as mapped in step 1. Where only a single operation of any particular type was located within an LGA the animal numbers (and manure production figures) were not published (to protect confidentiality).

For cattle, the numbers were then adjusted to reflect the current actual number of animals using the most recent data of numbers of animals on feed published quarterly by the Australian Lot Feeders Association (ALFA) <[feedlots.com.au](http://feedlots.com.au)>. As the ALFA data is published only at a whole of state level it was necessary to apply the same proportional adjustment to each LGA (even though it is likely that the variation would differ across the state).

### Step 2: Calculate a manure production factor for each animal type

#### Feedlot cattle

For feedlot cattle this calculation was based on an 'industry rule of thumb' of: 1 standard cattle unit (SCU) produces 1 tonne of fresh manure per year at an average of 30% moisture content (Skerman 2005).

#### Poultry

For farm chickens, bird numbers were first converted to standard bird units (SBU) where 1 SBU was set as equating to 1000 broilers (or 666 layers). A general industry average (based on values published in a range of sources) that, 1 SBU produces 30 tonnes of fresh manure per year and fresh manure is on average 70% dry matter, was then applied. Where birds were of an unknown type a conservative assumption was made that they were all broilers. Also, breeder and hatchery birds were assumed to be already counted in either layer or broiler numbers.

#### Pigs

For piggeries an established 'rule of thumb' was also applied. This is that a grower pig (representing 1 standard pig unit or SPU) produces 108 kg of total solids per year (Tucker et al 2010).

### Step 3: Calculate gross manure production for each LGA

The aggregate number of animals by type per LGA determined from step 1 was then multiplied by the appropriate factor for the animal type from step 2 to determine the total manure dry matter produced per year. Where only one operation of any particular type was located within an LGA the manure production figures for that type and LGA were not published (to protect confidentiality).

Manure production figures published are gross totals by LGA and are not discounted to account for existing reuse or for the estimated potential recovery (e.g. losses during scraping or other removal process).

The final data is rounded to the nearest 10 by the following rules:

- Data at the midpoint is rounded up (e.g. 35 has been rounded to 40)
- Data less than five is given a value of zero
- Data five or larger (but less than 10) is given a value of 10.

## Current use of manure

Sites that are known to host a biogas generation facility or where the manure is known to be utilized in commercial compost production are attributed accordingly in the facilities or infrastructure data. No attempt has been made to otherwise estimate the proportion of the total manure produced that may already be in beneficial use.

## Outputs

- Intensive livestock infrastructure - location of feedlot cattle, piggeries and chicken farms attributed with the type of animal, type of operation (for chickens only) and existing beneficial use type (where known)
- Manure production - a table of estimated annual manure produced (dry matter) by LGA for feedlot cattle, pigs and poultry.

## Assumptions

The assumptions made when calculating residues for intensive livestock industries include:

- A single manure production factor was applied for each animal type across the whole dataset. Manure production rates will vary within animal types depending on husbandry e.g. rations, housing etc. Information at this detail for individual operations is not readily available so no attempt has been made to adjust for this.
- Where data on current animal numbers is not available (i.e. for poultry and pigs) the upper limit of the DA approved animal numbers has been used. Both industries have experienced rapid growth over recent decades. This pressure to expand, combined with community resistance in many areas to the development of new sites, makes it likely that existing sites will have expanded to operate at close to their approved capacity.

## References

CEFC (2015) The Australian bioenergy and energy from waste market, Clean Energy Finance Corporation, Sydney.

Skerman A. G. (2005) Feedlot Assessment Spreadsheet, Version 7A, Department of Primary Industries and Fisheries, QI05054.

Tucker R.W., McGahan E.J., Galloway J.L. and O'Keefe M.F. (2010) 'National Environmental Guidelines for Piggeries – Second Edition', APL Project 2231, Australian Pork Limited, Deakin ACT, Australia.

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