Methodology Note

A. Calculating emissions from global meat and dairy production based on business-as-usual growth projections in Figure 1

The projected emissions from meat and dairy production from 2016 to 2050 are based on the FAO's projections for global meat and milk production per category (beef, poultry, pork, milk, ovine and "other") and the FAO's most recent estimates (2013) for global emissions per category. The main FAO documents consulted were: Food Outlook June 2016; Tackling Climate Change Through Livestock.(2013); World Agriculture: Towards 2030/2050. The 2012 Revision.

This data has been compiled into a dataset by GRAIN/IATP at: http://bit.ly/20302050

B. Calculating corporate GHG emissions (listed in Appendix Table 1, cited on page 21 and in Figures 4, 5 and 9b)

The methodology for calculating corporate emissions involved a three-step process:

1. Determining the quantity of meat and milk processed in the year 2016 by each company, where possible. We utilised public company reports wherever possible, as well as data generated by WATT (Pig International, Poultry Trends), IFCN Dairy Research Network (formerly known as the International Farm Comparison Network) and Sterling Marketing (personal communication). All numbers are for 2016, except for dairy. Dairy volumes are based on the latest IFCN rankings which utilise 2015 volumes. For beef and poultry, we also determined the quantity of production per geographic region for each company, based on company reports.

2. Using the UN FAO's most recent GLEAM data (with a base year of 2010) to determine the GHG emissions per kilo of beef, pork, poultry and milk (emissions factors) for each company. The GLEAM data includes regionalised slaughter weights, carcass dressing percentages, and GHG emission intensity values on a per-tonne-of-product basis. For beef, poultry and milk, our calculation of emissions factors included a regional breakdown of production per company, given the available company data on geographic production and

the GLEAM model's significant differences in emissions factors between regions. For pork, we used global averages to generate emissions factors for each company, given the lack of available company data on geographic production and the small variations in emissions factors for industrial production provided by the GLEAM model for the relevant regions.

3. Multiplying the production quantity by the emissions factors to get the totals for each company.

A complete dataset of our emissions estimations based on this methodology can be found at: http://bit.ly/livestock-products-corporate-emissions-B

This file includes individual datasets for emissions of the top ten beef, pork and poultry companies respectively and the top 11 dairy companies. It also provides the most recent GLEAM data and emissions factors that we used to calculate company emissions.

C. Identifying corporate GHG emissions reporting and emissions reduction targets (as discussed in the report and cited in Figures 9a, 9b and 9c)

We investigated the emissions reporting and emissions reduction targets of the 10 largest beef, pork, and poultry processors by volume and the 11 largest dairy processors by volume. Given the overlap in these "top 10" lists, (e.g., Tyson appears on three lists: beef, pork, and poultry) the number of companies that appear on the four lists totals 35. A "top-11" list was chosen for dairy in order to include Danone because, although that company is ranked number 11 by milk intake volume (IFCN Dairy Research Network), it is in the top five when ranked by revenues (details in the Danone case study, Box 3, in the report). Further, Danone has published detailed and interesting emission-reduction targets and plans.

For each of the 35 companies, we attempted to obtain several types of information from sources such as companies' sustainability reports, corporate social responsibility reports, or similar documents or filings containing details on GHG emissions and/or emission-reduction targets and plans. The types of information sought included the following:

- the latest greenhouse gas inventory/information filings with organisations such as CDP
- estimates of 2016 emissions (2015 for dairy), in order to compare company estimates to the values we generated using UN FAO's GLEAM methodology and data;
- estimates of 2015 or 2014 emissions, to calculate recent year-over-year increases or decreases;
- information about how emission values were calculated, including system boundaries or scope, geographical area(s), corporate divisions included, time period, etc.
- details of emission-reduction targets, including base year, target year, scope of emissions covered, and whether the target is for absolute emission reductions or is intensity-based; and,
- where adequate emissions data and reduction targets existed, we examined how companies plan to reduce emissions and meet targets.

It is important to note that there exists no central public repository for the meat and dairy industries' corporate emissions data or targets. Some companies publish this information in annual reports, others in sustainability reports, others on web pages, and still others in filings with third parties such as CDP. Thus, it is sometimes difficult to determine whether a given company does or does not have an emission-reduction target, or if the company is reporting its emissions.

This situation is made more difficult by the fact that the majority of companies, when we contacted them by email with questions regarding emissions and targets, did not reply. This often remained the case even after multiple emails to multiple company-listed addresses.

We based our characterisations of corporations' emissions data and targets on extensive research of public websites and analysis of publicly available documents. Nonetheless, there remains the possibility that we may have listed a company as, for example, having no targets when in fact that company has published a target somewhere. As much as anything, this risk reflects the disorganised and dysfunctional state of corporate emissions reporting and the need for a central public repository for such data.

A full compilation of our data on the companies' reporting and targets can be found in our detailed table *A catalogue and systemization of emission reduction plans for livestock product corporations* at: http://bit.ly/catalogueemissions

For Figure 9b, we provide the precise numbers of our estimated emissions (based on FAO/GLEAM) of the nine companies listed compared to the companies' reported emissions at: http://bit.ly/ours-theirs

D. Calculating national production volumes, aggregate GHG emissions and corporate concentration (listed in Appendix Table 2 and cited in Figure 6 and discussed in Box 2)

National production volumes:

To determine the share of world production by the surplus protein countries compared to China and the rest of the world (figure 6) we used data for national and world production volumes of beef, pork, poultry (broiler meat) and liquid milk provided by the United States Department of Agriculture, Foreign Agricultural Service (USDA FAS PS&D database) between 2008 and 2018. The actual dataset is provided in Appendix, Table 2.

Aggregate GHG emissions of protein-surplus countries, China and rest of the world:

The USDA FAS PS&D national production volume data was multiplied by regional averages for emissions intensity determined by the FAO GLEAM methodology to calculate annual aggregate emissions for meat and dairy production for the selected countries. Annual world aggregate emissions for meat and dairy production were calculated using the FAO GLEAM methodology world averages for emissions intensity from meat and dairy production.

The full dataset can be found at: http://bit.ly/meat-and-dairy-country-numbers-production

Corporate concentration:

Calculations made by GRAIN and IATP of the levels of corporate concentration are based on USDA FAS PS&D national production volume data and carcass weight equivalent volumes for beef and pork determined by company-reported slaughter volumes for 2016 and FAO's GLEAM methodology carcass weight conversion factors. For chicken, volume is based on weight of slaughtered chicken as reported by companies for 2016. For milk, volume is based on milk intake as reported by IFCN for 2016.

A full dataset upon which these calculations were made can be found at: http://bit.ly/Concentration-2016

E. Do some countries matter more than others?

The USDA FAS PS&D database was also used for the year 2017 to determine the share of world production, export and import data for surplus protein countries plus China in the section of the paper, "Do some countries matter more than others?" See also, Endnote 14 and 17. The full dataset compiled by IATP/GRAIN can be found at: http://bit.ly/meat-dairy-production-export-import-psd

For specific questions about the datasets compiled and used, please contact devlin@grain.org