

## How to define extensive livestock systems in relation to emissions to the environment:

Why the proposed assumption of “extensive production regimes” for livestock in the revised Industrial Emissions Directive is not appropriate and should be amended if the environmental goals of the directive are to be met.

Note submitted by the co-chairs of the Task Force on Reactive Nitrogen

**Summary:** This paper provides information to support deliberations of the Working Group on Strategies and Review of the UN-ECE Convention on Long-range Transboundary Air Pollution in relation to future actions following the review of the Gothenburg Protocol completed in December 2022. The document is intended to simultaneously inform Parties from the European Union involved in revision of the Industrial Emissions Directive (IED), in relation to proposed definitions of extensive production regimes for livestock.

Annex IX of the Gothenburg Protocol links directly to the Integrated Pollution Prevention and Control Directive, which has since been replaced by the IED. Proposed amendments to the IED are therefore relevant for discussion about the possible future revision of Annex IX. The Council of the EU proposes in its 'general approach' on the Commission proposal to review the IED an exclusion from mandatory requirements for livestock installations operating under “extensive production regimes”. Current proposals link this to a threshold of 2 livestock units/ha (LSU, i.e., dairy cow equivalents). The present paper, prepared by members of the Task Force on Reactive Nitrogen<sup>1</sup>, argues that this threshold is not appropriate if environmental goals are to be met.

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## Introduction

1. The EU Industrial Emission Directive (IED) is currently under revision. On 16 March 2023, the Council of the EU has agreed changes of the original Commission proposal<sup>2</sup>, according to which rearing of cattle or pigs under extensive husbandry is to be excluded, see Annex Ia of the draft of the new IED:

*'ANNEX Ia*

*Activities referred to in Article 70a*

*"Rearing of cattle or pigs in installations of 350 livestock units (LSU) or more, excluding rearing of cattle or pigs in installations operating under extensive production regimes, where the stocking density is less than 2 LSU/hectare used only for grazing or growing fodder or forage used for feeding the animals in the installation."*

This raises the questions: What does "extensive production regime" mean technically and is the specified stocking density of '2 LSU/hectare' technically justifiable?

### No commonly agreed definition of "extensive farming" available

2. Currently, there is no commonly agreed definition of "extensive farming"<sup>3</sup>. For a definition "extensive production regimes", it is argued here that **an agronomic approach should be used**. One possible definition of "extensive" livestock production could be that the farm's livestock feed consumption must be less than the farm's own crop production, where both terms are assessed in relation to their nitrogen (N) and phosphorus (P) content. This requirement implies that livestock excretion of nutrients will be less than crop uptake, and that the farm could be self-sufficient in feed, although in practice crop products may be sold and feed purchased.

3. *Remark: This approach of course means that the numbers will vary with geography which seems appropriate provided that the legislation can handle it.*

### A definition based on livestock N and P excretion compared to typical crop productivity

4. A pragmatic definition of "extensive production regimes" in line with the suggestion above could be based on livestock N and P excretion compared to typical crop productivity. However, care is needed if using LSU as an indicator of N and P excretion. One LSU is defined in the new IED proposal agreed by the Council as one dairy cow. The feed consumption of a dairy cow increases as milk yield increases. This means that 2 LSU/ha is much too high to sustain on local feed resources. **A livestock density of 1 LSU/ha of utilized agricultural area (UAA) or less would be reasonable, considering the crop productivity in most of the EU.** We demonstrate this using representative examples in the following paragraphs.

### An example calculation for required cereal yield for 1 LSU/ha

5. The N content in livestock feed consumption is typically 60–225 kg N/LSU/year, with a large variation between animal types and production intensities. For example, a dairy cow (1 LSU) producing 8,500–12,000 kg milk/year requires approximately 165–225 kg N/LSU/year in feed, of which ca. 45–65 kg N/LSU/year is recovered as milk and in body growth, and ca. 120–160 kg N/LSU/year is excreted

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<sup>2</sup> Download of the negotiation position ('general approach') of the Council under: <https://data.consilium.europa.eu/doc/document/ST-7537-2023-INIT/en/pdf>

<sup>3</sup> The milk production per head of organic dairy cows is very close their conventional equivalents. Since organic cows must be grazed for part of the year, there is less control over their feed quality. This implies that the N excretion is similar or higher than for conventional systems.

in manure<sup>4,5,6</sup>. Young cattle excrete somewhat less per LSU. By comparison, pig production consumes ca. 60–80 kg N/LSU/year in feed of which ca. 25 kg N/LSU/year recovered in body growth and 40–45 kg N/LSU/year excreted. These values are equivalent to an N use efficiency for livestock of around 25% for dairy cows and 35% for pig production<sup>7</sup>.

6. These examples demonstrate that cattle farms with 1 LSU/ha require very roughly 100–160 kg N/ha/year crop production. In terms of feed-quality small grains (feed wheat, barley, oats), this is equivalent to about 5–8 tonnes/ha cereal yield, which is close to the average cereal yield in EU agriculture<sup>8</sup>. In the case of pigs, 1 LSU/ha requires very roughly 80 kg N/ha/year crop production. In terms of feed-quality small grains (feed wheat, barley, oats), this is equivalent to about 4 tonnes/ha cereal yield.

### **Stocking density of 2 LSU/ha UAA normally cannot be fed with locally produced feed**

7. It should be noted that 2 LSU/ha UAA is in most places impossible to sustain based on feed produced on the agricultural holding. Applying the same calculation as in paragraphs 5–6: 2 LSU/ha UAA would require around 160–320 kg N/ha/year crop production, which in terms of feed-quality small grains (feed wheat, barley, oats) is equivalent to cereal yields of about 8–16 tonnes/ha/year. For reference, 10 tonnes/ha/y wheat yield is only attainable in good years on good soils, whereas 16 tonnes/ha/year is far above a realistic average.

8. If “extensive production regimes” are to have a solid foundation as being sustainable from the land-itself, without a net import of additional feed, then it is evident that a threshold of 2 LSU/ha is too high.

### **A range of 0.5–1 LSU /ha UAA is a reasonable value for ‘extensive production regimes’**

9. The N excretion of cattle varies considerably across Europe, so the use of a single livestock density for cattle is inappropriate. For example, the milk production per dairy cow in Europe varies between about 3500 kg/year up to over 10 000 kg/year, with an average milk yield per dairy cow in the EU in 2021 of 7682 kg/year<sup>9</sup>. This variation is reflected in around a two-fold difference in N excretion<sup>10</sup>. Based on these calculations, a range of 0.5–1 LSU / ha UAA would be a reasonable value for “extensive production regimes” in livestock farming. Ideally, the local value would depend on the milk and meat produced per animal, on the type and productivity of the crops and feed composition. **A pragmatic solution would be to adopt a limit of 1.0 LSU/ha for dairy cattle and their offspring, where milk yield is at or below 8 000 kg/year and 0.5 LSU/year above this yield.** To further limit the losses of N to the environment, the qualifying area could be restricted to the land cropped with permanent grassland (> 5 years).

### **Stocking density of 2 LSU/ha UAA for an extensive production regime leads to unacceptable NH<sub>3</sub>-emission, N-deposition and exceeds requirement of the EU Nitrate Directive.**

10. A definition of 2 LSU/ha for an extensive production regime can be considered as unacceptable from an environmental perspective, when considering its potential consequences on N pollution. For example, N excretion and emissions to the environment contribute to harmful effects on human health by particulate matter in air, as well as to eutrophication and acidification in ecosystems.

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<sup>4</sup> DLG (2014): Bilanzierung der Nährstoffausscheidungen landwirtschaftlicher Nutztiere. Arbeiten der DLG, Band 199, 2. Auflage, 120 Seiten, DLG-Verlag Frankfurt a.M.

<sup>5</sup> Velthof, G. L., Hou, Y., & Oenema, O. (2015). Nitrogen excretion factors of livestock in the European Union: A review. *Journal of the Science of Food and Agriculture*, 95(15), 3004–3014.

<sup>6</sup> Hou, Y., Bai, Z., Lesschen, J. P., Staritsky, I. G., Sikirica, N., Ma, L., Velthof, G. L., & Oenema, O. (2016). Feed use and nitrogen excretion of livestock in EU-27. *Agriculture, Ecosystems & Environment*, 218, 232–244.

<sup>7</sup> Refer to footnote 6.

<sup>8</sup> Eurostat. (2023). Annual crop statistics (apro\_cp). [https://ec.europa.eu/eurostat/cache/metadata/en/apro\\_cp\\_esms.htm](https://ec.europa.eu/eurostat/cache/metadata/en/apro_cp_esms.htm)

<sup>9</sup> [https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Milk\\_and\\_milk\\_product\\_statistics](https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Milk_and_milk_product_statistics)

<sup>10</sup> Refer to footnote 6.

11. We illustrate this conclusion by the following examples:

- a) Assume that 1 LSU (as an average for pigs and cattle) corresponds to approximately 80 kg N excretion/year in average (see paragraph 5). Assume also that 25% of excreted N is emitted as ammonia (NH<sub>3</sub>), then 2 LSU/ha UAA corresponds to NH<sub>3</sub> emission of 49 kg NH<sub>3</sub>/ha/year (i.e., =  $80 \times 2 \times 0.25 \times 17/14$ ). That will lead to **very high NH<sub>3</sub> concentrations and therefore, N deposition rates locally**, which when extended over wider areas is likely to be in excess of critical loads. (This calculation is based on the expectation that livestock are housed for at least part of the year, leading to associated emissions from housing, manure storage and manure spreading, in addition to direct emissions while grazing).
- b) Alternatively, a corresponding LSU/ha limit could be derived from critical levels or critical loads, e.g. below 10 kg NH<sub>3</sub>/ha/year emission (as being typical of a representative critical load): the maximum LSU limit following this proposal would be 0.4 LSU/ha UAA. (This is based on 49 kg NH<sub>3</sub>/ha/year / 2 LSU/ha = 24.5 kg NH<sub>3</sub>/LSU/year; thus, to reach 10 kg NH<sub>3</sub>/ha/year the maximum is 10/24.5 LSU/ha).
- c) By comparison, a threshold of 2 LSU in dairy farming can imply herd average excretion of around 200-250 kg N/ha, which is substantially larger than the 170 kg N/ha/year limit of the EU Nitrates Directive. (This is based on 1 dairy cow (=1 LSU) commonly excreting 100–150 kg N/head/year, and young cattle c. 100 kg N/LSU/year).

### About 60% of EU livestock live on farms below a threshold of 2 LSU/ha

12. Relative to the current distribution of farm structure, the proposed threshold of 2 LSU/ ha UAA is a higher-than-median livestock density for the EU (as can be seen from paragraph 13). Therefore, also in these relative terms it is unreasonable to call the limit 2 LSU/ha “extensive production regime”.

13. Figure 1 shows an estimate of the share of total EU livestock (including cattle, pig and poultry) found on farms below different livestock density thresholds. The figure shows that, about 60% of all livestock units are found on farms with < 2 LSU/ha UAA. The median EU LSU (including cattle, pig and poultry) lives on a farm with a density of ca 1.6 LSU/ha UAA. In other words, 50% of LSU are on farms with < 1.6 LSU/ha UAA.

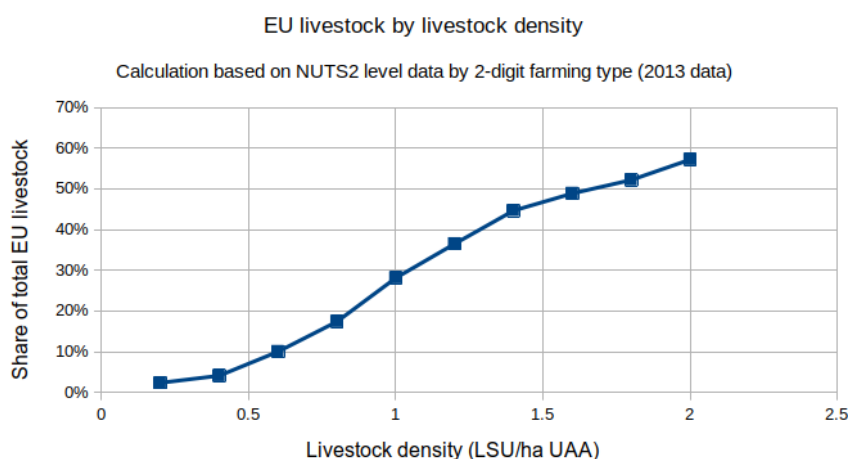


Figure 1: EU livestock by livestock density (source: Rasmus Einarsson, 2023)

## Conclusions

14. One of the stated objectives of the 'IED-Revision' is to reduce emissions of ammonia and nitrates thereby improving air, water and soil quality<sup>11</sup>. The current negotiation position of the Council, however, excludes the rearing of cattle or pigs in installations operating under extensive production regimes, where the stocking density is less than 2 LSU/ha (negotiation position of the Member States, General Approach, 16.03.2023).

15. It is concluded here that a threshold of 2 LSU/ha is too high, and not consistent with the environmental objectives of the proposed IED revision. According to such a threshold, a substantial share of non-extensive farms would be excluded from the new IED scope, with the result that N-excretion, ammonia emission and nitrate leaching are likely to be above acceptable levels for the environment.

16. These observations are particularly important as Parties to the Convention start to consider possible revision of Annex IX to the Gothenburg Protocol. Based on the current experience of linking Annex IX to existing EU legislation, in particular the former Integrated Pollution, Prevention and Control Directive, there is concern the present revision could lead to the possible inclusion of thresholds in a revised Annex IX that are not environmentally sustainable. Given that proposals to revise the IED are happening now, and are likely to precede possible revision of Annex IX, Parties to the Convention are here alerted to make the necessary links between these international agreements.

17. The following specific options may be considered to address these concerns:

- a) According to Article 70i (paragraph 2) of the general approach of the Council on the proposed IED revision<sup>12</sup>): *'the Commission shall adopt an implementing act to establish uniform conditions for operating rules for each of the activities referred to in Annex Ia. Such uniform conditions for operating rules (...) shall take into account the nature, type, size and density of these installations (...) and the specificities of pasture-based cattle rearing systems, where animals are only seasonally reared in indoor installations'*. This points to the simplest (preferred) option, which is to remove the exclusion from Annex Ia for rearing of cattle or pigs in installations operating under extensive production regimes.

*"Rearing of cattle or pigs in installations of 350 livestock units (LSU) or more, [Delete: excluding rearing of cattle or pigs in installations operating under extensive production regimes, where the stocking density is less than 2 LSU/hectare used only for grazing or growing fodder or forage used for feeding the animals in the installation.]"*

- b) If the proposal of excluding rearing of cattle or pigs in installations operating under extensive production regimes has however to be maintained, it requires amendment from the existing proposal (see paragraph 1, above) to meet the environmental objectives of the IED. The text of the proposed IED Annex Ia (paragraph 1) considering amendments proposed by the Council may be revised as follows:

*"Rearing of cattle or pigs in installations of 350 livestock units (LSU) or more, excluding rearing of cattle or pigs in installations operating under extensive production regimes, where the stocking density is less than [Insert: 0.5 LSU/ha for dairy cows with a production of 8,000 kg milk/year or more and 1 LSU/ha for dairy cows below 8,000 kg milk/year and other cattle, and for pigs less than 1 LSU/ha] [Insert: land with permanent grassland (>5 years)] used only*

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<sup>11</sup> E.g. recital 4 of 'Proposal for a Directive of the European Parliament and of the Council amending Directive 2010/75/EU of the European Parliament and of the Council of 24 November 2010 on industrial emissions (integrated pollution prevention and control) and Council Directive 1999/31/EC of 26 April 1999 on the landfill of waste', COM (2022) 156 final/3, 05.04.2022. The document can be downloaded under: [https://eur-lex.europa.eu/legal-content/EN/TXT/DOC/?uri=CELEX:52022PC0156R\(02\)](https://eur-lex.europa.eu/legal-content/EN/TXT/DOC/?uri=CELEX:52022PC0156R(02)).

<sup>12</sup> Refer to footnote 2.

*for grazing or growing fodder or forage used for feeding the animals in the installation . [Insert: A threshold of 0.5 LSU/ha shall apply for higher-yielding dairy cows; a threshold of 1 LSU/ha shall apply for the remaining cattle and a threshold of 1 LSU/ha for pigs, to take account of the higher efficiency of pig production)].”*

18. We need to be aware that the proposed amendments made by the Council to the initial Commission proposal for an amended IED is unambitious in relation to livestock. Even if the proposed options in relation to “extensive production” (see paragraph 17) were accepted, the size criterion of 350 LSU means that only around 25% all cattle in Europe (EU27) is included under the revised IED requirements (equivalent to 2% of cattle farms). This means that around 80% of European ammonia emissions from cattle would continue to be released without any requirements under IED regulations.

19. The initial Commission proposal for an IED revision of 05.04.2022 (size criterion 150 LSU) captured about half of the cattle. In order to be effective in ensuring low-emission measures for cattle, the IED would have to introduce a limit of around 50 LSU, in which case the majority (around 80%) of the ammonia emissions from cattle would be addressed.<sup>13</sup> Accordingly, if a threshold of 350 LSU is ultimately adopted, then further actions will be required to avoid the adverse effects of ammonia pollution on ecosystems and human health.

20. We note that there can be opposing views which would wish to exclude a substantial fraction of cattle farming (both extensive and medium size farms) from a pollution management regime associated with the IED. For example, it is sometimes said that the permit and other requirements of IED are burdensome and might have a negative economic impact on medium size farms. We consider that this is a relevant but separate issue from what constitutes ‘extensive livestock’. For example, different requirements could be applied for different sectors within IED. In this way, it could be possible for simple general rules to be applied for medium size farms within IED, which ensure that some basic requirements are met with a minimum administrative burden. The opportunity for such streamlining, maximizing the benefits for farmers and the environment, would benefit from further consideration.

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<sup>13</sup> Statistics to this effect have been reported previously by the Task Force on Reactive Nitrogen (ECE/EB.AIR/WG.5/2010/4, see Annex I to that document), where it was noted that 72% of EU cattle in 2007 were on farms with >50 LSU. Use of this threshold implied requirements on only 13% of cattle farm holdings. The exact numbers have changed slightly since then, but the broad picture remains the same.