

Interactive comment on “Nitrogen food-print: N use and N cascade from livestock systems in relation to pork, beef and milk supply to Paris” by P. Chatzimpiros and S. Barles

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We thank referee S. Nonhebel for her comments and suggestions on our paper. We address these comments below:

“Does the assumed food pattern for Paris deviates from the average food pattern in France? As a consequence can we use the data calculated here also for Marseille or do we have to do the analysis again for every city in France?”

Answer: The data on milk, pig and beef consumption used in the paper are average apparent consumption data for France. No specific data for Paris (or any other city) exist. Consequently, results for Paris are based on consumption data that are similar

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to those of any other population in France. Note that the use of average consumption data is not annoying because since two decades regional differences in human diets are very low.

“The figures 1 and 2 provide information on production for Paris, if we study impact of another city do we get a different picture or is Brittany actually producing all the pork for France? ”

Answer: Figure 1 shows the spatial distribution of consumption in Paris under the assumption that each region supplies meat in proportion to its gross production. Thus, the geography of Paris meat supply is a snapshot of the geography of French gross meat production. No data exist for determining the true geography of pig and beef supply to Paris. Pig production in Brittany accounts for about 60 % of total pig production in France. Figure 2 provides an estimation of the milk supply area for Paris in particular on the basis of FREIGHT statistics (not available for meat). Milk supply areas of other cities will probably deviate from this shown in figure 2 (see 1974-1976).

“If the largest share of the milk/pork/beef comes from one region why not use the data from this particular regions/ livestock system instead of using a lot of assumptions for areas hardly contributing to the total?”

Answer: Only in the case of pig production, does the largest share (~60%) originate from one specific region (Brittany). Milk and beef production are scattered on the French territory. Our results reflect in all cases weighted averages among meat and milk supplying regions. Assumptions are only used when data were unavailable.

“Is there difference in N use efficiency in the various regions of France: so should we get the meat from somewhere else? Are these differences due to the climate or due to the different production system? ”

Answer: There are regional differences in the N use efficiency of crops but it is difficult to tell which factors lay behind these differences. Differences depend on agronomic

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characteristics of the crops such as the length of the cropping period or the density of the canopy as well as on factors such as climate, fertilisation and tilling practices, good/bad timing between N supply and crop N demand, soil characteristics etc. Physical and social variables are thus all combined. It is very difficult to draw conclusions about which region should be privileged to supply meat and which should be avoided. Our calculations simply provide information on the rates of N losses per crop and ration type (without identifying the reasons) and on how stocking rates in pig, cow and beef farms affect the efficiency of N reuse in crop agriculture. Nonetheless, physical factors such as climate also play significant role but are not assessed here.

“Are the nitrogen emissions in Brittany due to the consumption in Paris solely or do other cities also play a role?”

Answer: Brittany’s production supplies other cities as well (in France and abroad), so observable N losses in Brittany are not solely due to the consumption in Paris. This paper calculates N losses in Brittany due to Paris supply alone.

“The questions emerge because the paper is unbalanced. Just a few examples: The title mentions that it is about consumption in Paris; however, the results only mention per capita emissions. In the methodology section a lot of attention is paid to the spatial variability. It is mentioned that for all regions in France nitrogen balances of livestock production systems are made. However, results are only expressed as average data and there is no discussion on the observed spatial variability. Further the introduction is about nitrogen but half way the paper land requirements are mentioned and they emerge in the results and in the discussion, but it is not clear what they have to do the nitrogen question”

Answer: Our paper addresses consumption in Paris. The results are presented per capita and per hectare of livestock acreage because absolute numbers (e.g. tonnes of N losses) are not interpretable and do not allow for comparisons with other products, consumers or production systems. When working on scales other than the global

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scale, it is necessary to express N losses per unit of something: product, consumer or land area. This is why results are presented per capita and per unit of land. Total supply of milk, pig and beef to Paris are given once in the methods (1975/13 for pig and beef and 1976/3 for milk). Concerning spatial variability, we calculated N balances and N losses per French region according to the composition of animal rations, stocking rates, fertilisation rates etc, however, spatial variability is taken into account only in order to allow for good estimates of average N losses per livestock sector. The paper does not focus on spatial variability but on differences among livestock sectors. This is the main reason why we do not comment on spatial variability in the discussion section, another reason is because such a comparison would require long discussions on uncertainties and the paper would deviate from its main purpose. The objectives of the paper and the major findings are reported more clearly in the introduction and the conclusion/discussion sections of the new version. Last, the calculation of land requirements serves at expressing N losses per unit of land. To better introduce land requirements in the paper, we changed the title of the 2.2 methods section (1976/10) to “Animal rations, feed origins and land requirements”. The calculation method for land requirements is explained in that subsection.

“According table 2 it seems that it is assumed that the production systems in France are the same (all cows produce 18 liter of milk per day) and beef and swine grow at the same rate. In the actual situation this is not the case, in areas with intensive farming systems production values with respect to production and feed needs will deviate from results in extensive production systems. The assumption with respect to dairy production in France deviates from the present available data (up to 9000 liter per cow per year, while the paper mentions 4000- 6700 liter). So it seems that data from a low input system are used for milk, while for pork data from intensive farming systems are used. From research in this field is known that the environmental impact of low input system deviates considerably from the intensive farming systems. Since for milk data from a low input system are used and for pork a high input system it is not obvious that the results obtained are due to the different livestock types or due to different production

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techniques.”

Answer: Data shown in table 2 are average production rates in France. For dairy production, data are derived from milk yields at the regional scale which vary from 4450 to 6800 litres per cow per year in 2004/2006. Milk yields of 9000 l/cow/year are only reported in a single French département with negligible share in the national milk production. Note that metropolitan France is administratively divided into 95 départements which combine into 21 regions. Dairy rations are modelled with respect to regional variability of milk yield. This is now clarified in table 2 where average regional yields per cow and day are given and in the text: “Milk yields per lactation day vary from 13 to 22 l/day at the regional scale (Statistique agricole annuelle, 2004). Dairy rations are simulated with respect to this variation.” National average milk yield per cow and lactation day is 19 l/cow/day instead of 18 l/cow that had previously mentioned in table. For pig and beef meat production, no region specific data exist on rate of biomass accretion and thus national average growth rates had to be used in the simulations of nutrient requirements and animal rations. We now give a better explanation for that in the text: “For cattle meat production, rations are in contrast simulated for average steady growth rate from birth to slaughter of 1.1 kg/day (Statistique agricole annuelle, 2006) because no data on spatial variability are reported in the agricultural statistics.” “Swine rations only produce meat and are modelled on the basis of the energy and protein requirements of growing pigs (NRC, 1998) for average steady growth rate of 0.6 kg/day (Agreste, 2006). As for cattle, no data on spatial variability of pig growth rates are available in the agricultural statistics.” Given these data, we do not compare extensive cattle systems with intensive swine systems but average systems in all sectors. However, differences in terms of input intensity inevitably exist between swine, beef and dairy as the fodder inputs are different in each sector. In order to avoid uneven comparisons in terms of N intensity among the three livestock sectors we have reported N losses per unit of N in livestock products (table 4). This shows the N efficiency per product.

“What is known from studies to environmental impacts of food is that large variation

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is calculated impacts exist. This has to do with the large differences in climate and production techniques that can be found over the globe. The exact determination of emissions related to a certain food product is of limited interest since for another production system results can be quite different. For scientists in this field information on how and why the calculated values deviate from the existing knowledge makes the paper of far larger interest than just presenting data. The authors do this in the discussion where they refer to data published by Jarvis. However, their way of addressing this is not neutral; phrases like: "results are underestimated and should be interpreted with caution" should be changed in the free from value observation that the choice for different system boundaries had large impacts on emissions calculated."

Answer: We definitely agree with the referee's suggestion and we changed the sentence to: "As a result, "losses to product" ratios are severely underestimated in that study especially for pig and dairy productions because most of the requirements of swine and cows are met through feed imports to the livestock farms." Note that additional cross-study comparisons on N losses factors are provided in the new version of the manuscript.

"I think that authors should bring the paper in balance. Based on the material provided in the text this can be a paper on locating the environmental impact of consumption in Paris, but then the spatial variability should obtain more attention. And discussion whether environmental impact of consumption in other cities in France will deviate from this. Or a paper focusing on the differences in nitrogen emissions between beef, pork and milk and the importance of the choice of the system boundaries. Including a discussion on the consequences for the choice of a certain production system (high input/low input), but in that case the consumption of Paris does not play a role, nor the spatial variation. Both options are scientifically interesting and worthwhile publishing."

Answer: Indeed, the paper focuses on the differences in nitrogen emissions between beef, pork and milk production and on the necessity for defining system boundaries that encompass all locations of fodder production. In addition, the paper constructs and im-

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plements an indicator that measures N losses in agrosystems due to food consumption in cities. This provides a way to show the relative significance of the direct N pollution load of cities (known as habitant pollution load) compared to indirect losses from food supply hinterlands. The main objectives and findings of the paper are reported clearly in the new version.

“Finally: Food-printing is not a clearly described scientific methodology, if auteurs want to use this term they have to introduce this.”

Answer: A discussion of the concepts of footprint and food-print is not given in the introduction section.

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