

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 Fridolin Krausmann for his general appreciation of our work and for his comments and remarks. We address these comments below.

“Amidst all the empirical results, it remains somewhat unclear what the authors consider the major findings of their work. The paper could be a bit more specific and focused here; in this context, the introduction and the discussion/conclusion section should be better matched.”

Answer: the introduction and discussion/conclusion sections have been substantially changed. Among changes, we added at the end of the introduction section precisions

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on the main objectives of the paper and we repeat at the beginning of the discussion/conclusion section the main findings of the work. This latter section has been reorganised and amended with cross-paper comparisons on N losses from livestock systems.

“In its current version the abstract focuses very much on methodological issues. It should, on the one hand mention the N-food print (and also N cascade) as the key concept used in the paper and on the other also address why such a perspective on urban consumption is relevant and provide a sentence concerning the most important finding.”

Answer: The abstract will be restructured according to suggestions.

“The paper introduces the concept of the Nitrogen food print. This concept is obviously based on a method referred to as food print (1974/13). This concept is not generally known and it should briefly be introduced in the introduction section: What does it allow to capture, why is this approach chosen for investigating N-flows; what is the basic principle in its calculation? Based on this the concept of the Nitrogen food print can be introduced as a refinement or specific adaptation of this method.”

Answer: A specific paragraph is now added in the introduction section giving the origins and definition of the footprint and food-print concepts and the way the indicator serves the objectives of this paper.

“The introduction should outline more specifically which research questions will be tackled in this paper and by developing and applying the N food print method in a way that matches the findings discussed in the discussion and conclusions section. This should specify the more general introduction into the significance of urban consumption and global Nitrogen flows which is provided in the current version. This could also help to focus the paper, which now presents a large amount of empirical results and addresses several different issues (differences between N-efficiency of different food products; spatial aspects of urban supply and the location of environmental pressures; how to

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optimize N flows in production systems in order to minimize losses; optimizing urban consumption patterns: : :..)"

Answer: This comment has been addressed in the introduction section at the same time as the general comment.

Ã It is not always clear if the calculations presented in the paper rely on region specific information or if national averages were used: It is, for example, unclear if per capita consumption ratios in Paris are derived from national averages (e.g. from national food balances) or if these are data specific for Paris. Also for milk yields it is unclear if region specific yields (1977/3) have been used or if only a national average (Table 2) has been applied! What are the limitations of using average values instead of region specific values that take into account differences between intensive or extensive production systems?"

Answer: Consumption in Paris is derived from national statistics reporting average food availability per capita. Consumption data specific to Paris are not available. This is now clearly stated in the beginning of the methods and data section. In contrast, dairy rations are modelled with respect to regional yields. This is now clarified in table 2 as well as in the text and precisely in the paragraphs starting "For milk production, we admitted annual" (1977/1) ... and ending "used to simulate nutrient requirements" (1977/10). For pig and beef meat production, no region specific data on biomass production rates exist and thus average values had to be used in the simulations of nutrient requirements. However, region specific data for crop and fodder production and N-fertilisation are used in all calculations thus differences between intensive and extensive production systems are taken into account.

"After all the empirical results it remains somewhat unclear what the most important findings are! Conclusions mainly address improvements of N losses in the production side (feed rations, crop production, manure management). These are important findings, but they would actually not necessarily require the effort to link urban con-

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sumption with production in an N-food print. Are there any conclusions to be drawn with respect to urban consumption and supply patterns?"

Answer: Indeed, in the initial version most focus was on agronomic issues rather than on the links between consumption and production. In the new version, we better stress these links both in the introduction and discussion/conclusion sections. The N food-print concept allows allocating to cities N losses from their food supplying hinterlands which are indirect urban N losses that can be compared to per capita N pollution load in urban wastewater. The paper shows that the later is comparatively the top of the iceberg.

"Title: The title features "N cascade" – a term which needs to be explained in the introduction."

Answer: We changed the term "N cascade" in the title for "N losses". But we also added a more complete explanation of the N cascade in the introduction. Next to its definition (1972/4) we added information on the consequences of the n cascade: "The N cascade is now recognized as a major crosscutting theme over all environmental problems and global-change issues such as climate change, biodiversity losses, groundwater pollution, eutrophication, tropospheric ozone generation and stratospheric ozone depletion with severe effects on ecosystems and human health (Sutton et al., 2011).

"1974/3: This is the only methodological reference on how consumption in Paris was calculated. This issue should also be addressed in the methods and data section; were national per capita averages used to calculate food consumption in Paris? Which concept of consumption is used here (apparent supply vs. final consumption!)

Answer: Consumption in Paris is calculated from national average apparent consumption data (see our previous answer).

"1974/10: feed imports either from crop farms in France or from abroad; unclear what is meant by : :results in livestock systems being spatially clustered: : : Please explain!"

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Answer: Sorry for that. The right term is spatially scattered. It is now changed in the text.

"1974/12: we specify these systems? Which systems does this refer to? E.g. In a third step we quantify the size and the geographic location of the food supplying crop production systems using data on national and international feed trade and crop yields" Answer : We changed the sentence to : "In a third step, we determine the size and the geographic pattern of the livestock systems supplying Paris using data on national and international feed trade and crop yields."

"1972/17: to what densities livestock is reared. Unclear what this means!"

Answer: The sentence is changed to : "to what stocking rates the livestock are reared".

"1972/24: what does Nr stand for? Please provide explanation"

Answer: Nr refers to reactive nitrogen. This is now explained in the introduction section.

"1978/18: I would not use the term "carrying capacity" in this context. The term is used in different ways in ecology and sustainability science and is confusing. Rather say something like "feed production capacity""

Answer : Indeed, changed to "feed production capacity".

"1979/2: Does it make a big difference if the main and by-product allocation is done on the basis of energy content or on the basis of product price (value of soy oil vs. value of soy meal)?"

Answer: It does make difference in the case of rapeseed. For further information see the paper Chatzimpiros and Barles, 2010

"1979/20: What does BNF stand for?" Answer: BNF stands for "Biological Nitrogen Fixation". Explained in the text.

"1980/11: "manure is" instead of "manures are" (several times in the text)"

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Answer: OK

"1980/11 ff: As far as I understand it, manure output was calculated on the basis of information on the area where manure is applied and an average application rate per ha and NOT on the basis of livestock numbers and annual manure production per head. This is a bit confusing and it is not fully clear why an approach independent of livestock numbers has been chosen. Maybe the notion of "output to crop agriculture" is what is not clear enough!"

Answer: Manure output is calculated by combining regional data on crop land availability for manure application with data on livestock loadings using livestock units to allocate available land among different livestock. The manure output per livestock is then calculated using the allowable rate of manure application (170 kg N/ha)".

"1983/13: : : : contribute in manure being produced: : : not proper English"

Answer: Changed to: "cause manure to be produced at rates that exceed the allowable rates for manure disposal".

"1983/15 lost to the environment"

Answer : OK

"1983/20: It is argued that one unit of animal protein sustains the production of 1.7 units of vegetal protein. This is an interesting (and also confusing) finding which is hidden here. It requires more explanation and deserves some discussion."

Answer: This established ratio shows the fertilisation capacity of livestock farming within a context of mixed (crop + livestock) agrarian systems". Added in the text.

"1985/5: ..are on crop farms: : :"

Answer: OK

"1985/10: : : : Brazil: more this dependence is high and more..: : : Sentence unclear,

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not proper English"

Answer: Sentence changed to: "especially in Brazil - with possible contribution to the Amazon's deforestation. Possible competition for land with natural ecosystems is thus currently higher for the swine and dairy sectors than for the beef sector."

"1985/25: I would not use the term "underestimate" here (the differences in results are due to different system boundaries chosen); better e.g.: as a result, Jarvis arrives at much lower loss to product ratios compared to this study: : .; Interestingly the deviation is quite similar for beef and dairy production, but very high for pork; is this due to the high dependency of pork on feed concentrates?"

Answer: Sentence changed to : "As a result, losses to product" ratios in that study are partial as they overlook N losses outside the perimeter of the livestock farms. The oversight concerns in particular the pig and dairy productions for which most of the nutrients are imported from crop farms external to the livestock farms."

1987/11: Why are "social factors" mentioned here explicitly; "taste for manure" sounds strange; reformulate the sentence! Terminology of feed and fodder: It should be mentioned that the term fodder is used in an inclusive sense, including roughage, grazed biomass and market or concentrate feed (e.g. feed grains, soybean meals).

Answer: The term "social factors" is deleted. Taste for manure is changed to "choice for manure". In the new version we mention that fodder includes roughage, grazed biomass and concentrate feeds.

"Table 2: units are wrong. Should be l or kg/day and not year! "

Answer: Sorry for that. We corrected units in table 2 to kg and lt/day.

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