The N-Footprint of the agricultural research station at Aarhus University in Denmark utilizing an N-Institution calculator

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Abstract

The exponential use of reactive nitrogen and it's dramatic increased usage in the 20th century, has led to negative cascading environmental effects that need to be identified and quantified. The N-Footprint is a calculation tool that has been designed to quantify the impact of the N-cycle. Recent focus from universities to become more proactive regarding their N-Footprint is one such an initiative. The goal of this paper is to calculate the N-Footprint of Aarhus University, Agricultural Research Center in Denmark. The goal is to understand the magnitude of the N-footprint and how to improve N use efficiency.

Keywords: N-institution, sustainability, awareness raising

1. Introduction

Increased Nitrogen (N) loading has severe effects on the natural environment (Galloway et al., 2003). Thus, the Nitrogen Footprint (N-Print) was envisioned to quantify the amount of N released to the environment via an entity's resource consumption pattern. The first N-Print model was created to asses an individual N-Footprint per capita (Leach et al., 2012). The continued awareness of the concept of sustainability has led to educational institutions to start assessing their own contribution to the N-cascade effect. This led to the creation of the N-Institution calculator (Leach et al., 2015). This paper will focus on Aarhus University, Foulum Research Center (AU Foulum) in Denmark to calculate a preliminary N-Footprint.

2. Methods and data

The calculation methodology of the entity AU Foulum's N-Footprint will be calculated, utilizing a combination of the first two scopes and calculations as described in Leach et al. (2012); Leach et al., (2015) and Leach et al., (2013).

3. Results and discussion

Table 1 represents the total N-Footprint from each sector calculated with the N-Institution calculator.

Table 1. Total N released to the environment from all sectors and the resulting N-Footprint per capita.

Total Nitrogen Released from all Sectors			
Sector	Total N Released in kg	% of Total	N-Footprint/Capita kg
Fertilizer	70683,25	92,62%	141,37
Food Production	2025,58	2,65%	4,05
Research Animals	1718,49	2,25%	3,44
Utilities	1095,03	1,43%	2,19
Transportation	543,86	0,71%	1,09
Food Consumption	249,49	0,33%	0,50
Agriculture	90,91	0,12%	0,18
Total	76406,62		
N-Footprint per capita	305,63		

As displayed in Table 1 fertilizer is the largest contributing factor in the N-Footprint at AU Foulum. The second largest contributing sector is food production. Research animals have the third largest N-Footprint. In this paper, the food consumption and food production calculation were calculated on a much higher resolution than any of the other sectors. Calculating the food N-Footprint with such detail has shown that it decreased the overall N-Footprint. Thus, improving the calculation method with more detailed analysis, can identify better methods to decrease an institutes N-Footprint. Thus, if more complete and accurate data can be collected via using more Danish parameters the N-Footprint of AU Foulum will be significantly decreased. It would also contribute to improved decision-making choices in regards to reducing the N-Footprint of AU Foulum.

4. Conclusions

The total metric tons of N released to the environment was calculated to be 76407. The N-Footprint per capita was calculated at 306 kg N. The most prominent conclusion to this study of the N-Footprint of AU Foulum is the fact that even when using the same set of calculation methods, no one institution is similar. This leads to the need to use more on-site-specific production parameters and to use a more versatile method of calculating the N contribution from all sectors. Thus, the next step to improving the N-Footprint calculation for AU Foulum is to increase the level of detail in data collected and to utilize Danish standards for all calculation parameters. This would lead to a probable decrease of the current N-Footprint of AU Foulum and assist in improving the strategies used to lower the N-Footprint of AU Foulum.

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