

N-print : a Tool that Links Resource Consumption to Critical Load Exceedances

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Introduction

There is a growing body of scientific knowledge on how humans influence the N cycle as well as how the altered N cycle then impacts both humans and ecosystems. However, advances in science are far ahead of the policy, stakeholder, and public's understanding of the importance of nitrogen issues. We present a tool called N-Print that can help bridge this gap. Here we will show the first results of N-Print and its potential role in raising awareness for nitrogen.

The overarching goal of N-Print is to encourage the more efficient use of nitrogen to decrease its environmental impact while maintaining its benefits. N-Print aims to raise awareness about nitrogen and to help consumers, producers, governments, and universities understand how they can reduce their nitrogen emissions. The intended uses include education for the general public, improvement of best management practices for producers, policy development for government agencies, and research for universities.

Objectives

- Calculate an entity's contribution to N losses through resource consumption
- Assess the resulting contribution to environmental impacts, such as critical load exceedances or biodiversity impacts
- Encourage the more efficient use of nitrogen

Methods

The N-Print tool is a modeling system that is made up of four integrated components: N Footprint Calculator Module (N Calculator), N Loss Module, N Dispersion Module, and N Exceedances Module. These modules together describe the sources of nitrogen, its flows to receptors, and its effects on the environment through threshold exceedances.

- 1) The N Calculator module is a nitrogen footprint model that shows an individual consumer how much nitrogen his or her activities release to the environment.
- 2) The second module, N Loss, uses the output from the N Calculator to spatially define where these nitrogen emissions are released and the form that they take, such as nitrous oxide or ammonia. This module includes N losses to ground and surface waters.
- 3) The third module, N Dispersion, employs modeling techniques to determine how the nitrogen emissions to the air, soil, and water may circulate through the environment and where they might be deposited.
- 4) The final module, N Exceedances, then makes the spatial connection between how much nitrogen enters the environmental system and the resulting ecological and human health impacts. An example of the latter is the critical load exceedance.

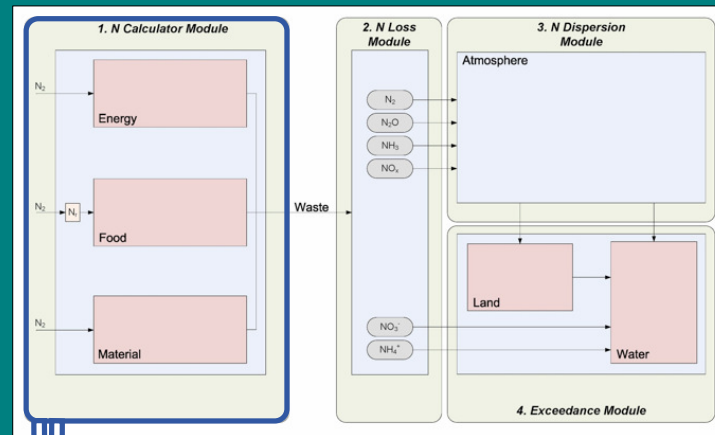
N Calculator

The N Calculator is the first module of the integrated N-Print tool, which is depicted in the figure to the right. This nitrogen footprint model asks users questions about their resource consumption in the following areas:

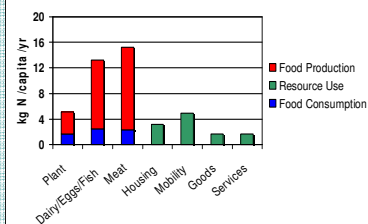
- Energy (housing, transportation)
- Food (consumption of food, N virtually released from food production)
- Materials (consumption of goods and services)

The tool then scales the user's footprint from the country average based on the answers to these questions.

The N Calculator has been completed for the United States and the Netherlands, and the average per capita footprint in each country has been found. These results can be found below.



USA Per Capita N Footprint



USA

Total N footprint: 46 kg N/yr
N footprint broken down by sector:
 Total N footprint from food: 35 kg N/yr
 N released before consumption: 28 kg N/yr
 N released after consumption: 7 kg N/yr
 Housing N footprint: 3 kg N/yr
 Mobility N footprint: 5 kg N/yr
 Goods and services N footprint: 3 kg N/yr

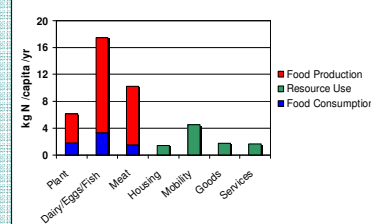
The graph to the left shows the contribution of each sector to the USA per capita N footprint.

Netherlands

Total N footprint: 44 kg N/yr
N footprint broken down by sector:
 Total N footprint from food: 35 kg N/yr
 N released before consumption: 28 kg N/yr
 N released after consumption: 7 kg N/yr
 Housing N footprint: 1 kg N/yr
 Mobility N footprint: 5 kg N/yr
 Goods and services N footprint: 3 kg N/yr

The graph to the right shows the contribution of each sector to the NL per capita N footprint.

NL Per Capita N Footprint



Conclusions

- Food consumption is ultimately responsible for more nitrogen emissions than any other sector. Food production releases much more nitrogen to the environment than food consumption.
- Of the different food types, meat is responsible for releasing the most nitrogen to the environment.

Next steps:

- Expand the N Calculator for other countries, including less developed countries like Brazil and India.
- Develop the fully integrated N-Print modeling system as a tool for individuals, producers, and policymakers to assess the impacts on exceedances of critical limits and biodiversity.

To reduce your nitrogen footprint, you can:

- Reduce your meat consumption
- Replace meat that is produced less efficiently (beef), with meat that is produced more efficiently (poultry)
- Use less electricity by using energy-efficient appliances and turning off unneeded lights and appliances
- Reduce your transportation needs by carpooling, using public transit, biking, or walking
- Reduce your consumption of goods and services by recycling and limiting unnecessary expenditures.

For more information and to calculate your own nitrogen footprint,

please visit our website:
www.n-print.org



Participating organizations:

