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Impacts of dietary changes on global scale nitrogen losses to air and water

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Introduction

The expected population growth and economic growth, increasing people's demand of meat, implies an expected doubling of food productivity. This will imply a related increase in global scale nitrogen (N) fertilizer and manure inputs, with N related N losses to air and water, causing various negative impacts on both human health and environment. One approach to mitigate N emissions from agriculture is to reduce N demand by changing the consumption patterns including a reduction in meat consumption A simple fast calculation approach has been developed that gives insight in the overall effects of dietary changes on nitrogen (N) emission to air and water by 2050 for ten identified world regions.

Approach

The calculation procedure to assess impacts of changes in human diet on N losses to air and water was based on FAO databases on current crop and animal food production that were extrapolated to the future, distinguishing ten study regions (Figure 1.

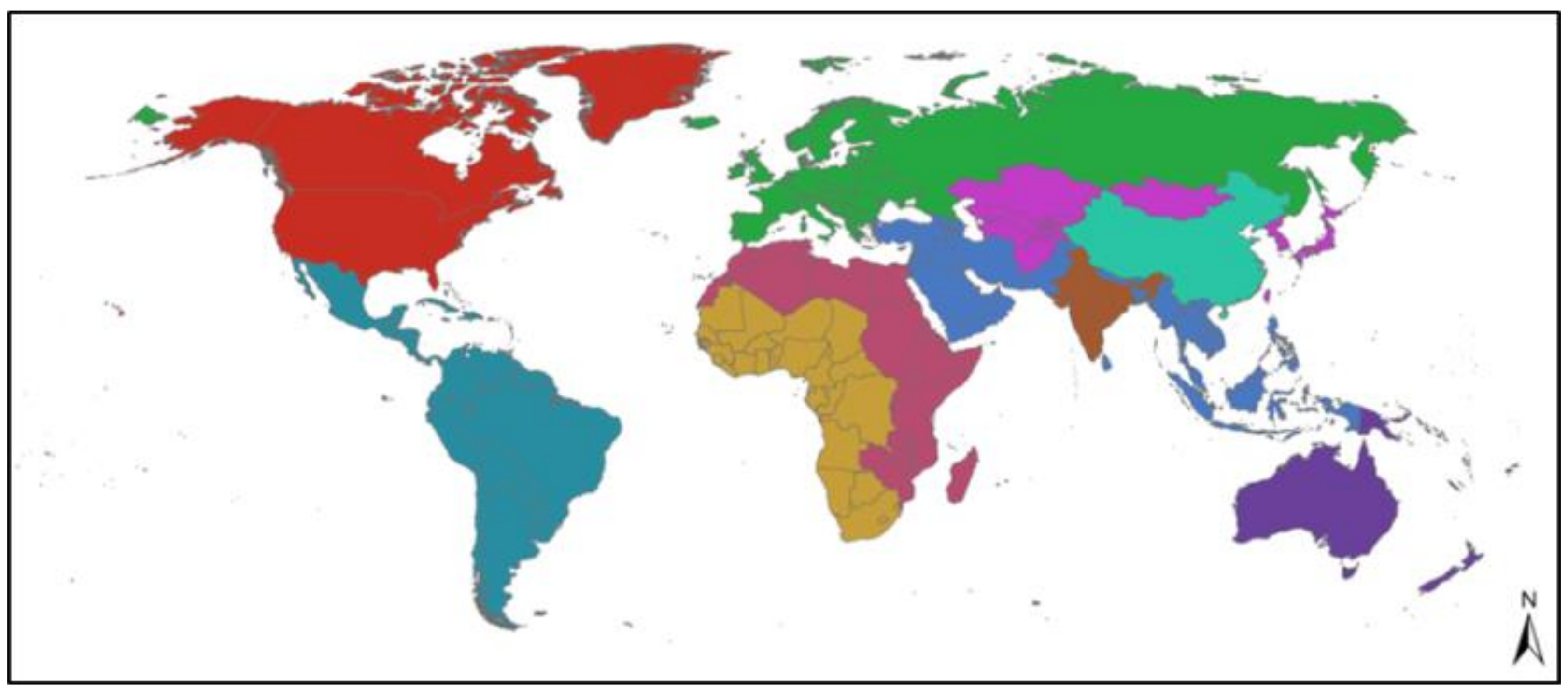

Figure 1. The identified ten study regions

The FAO food group statistics on nearly 200 food commodities were aggregated to ten food commodities. The overall calculation procedure consisted of eight steps, as shown in Figure 2.

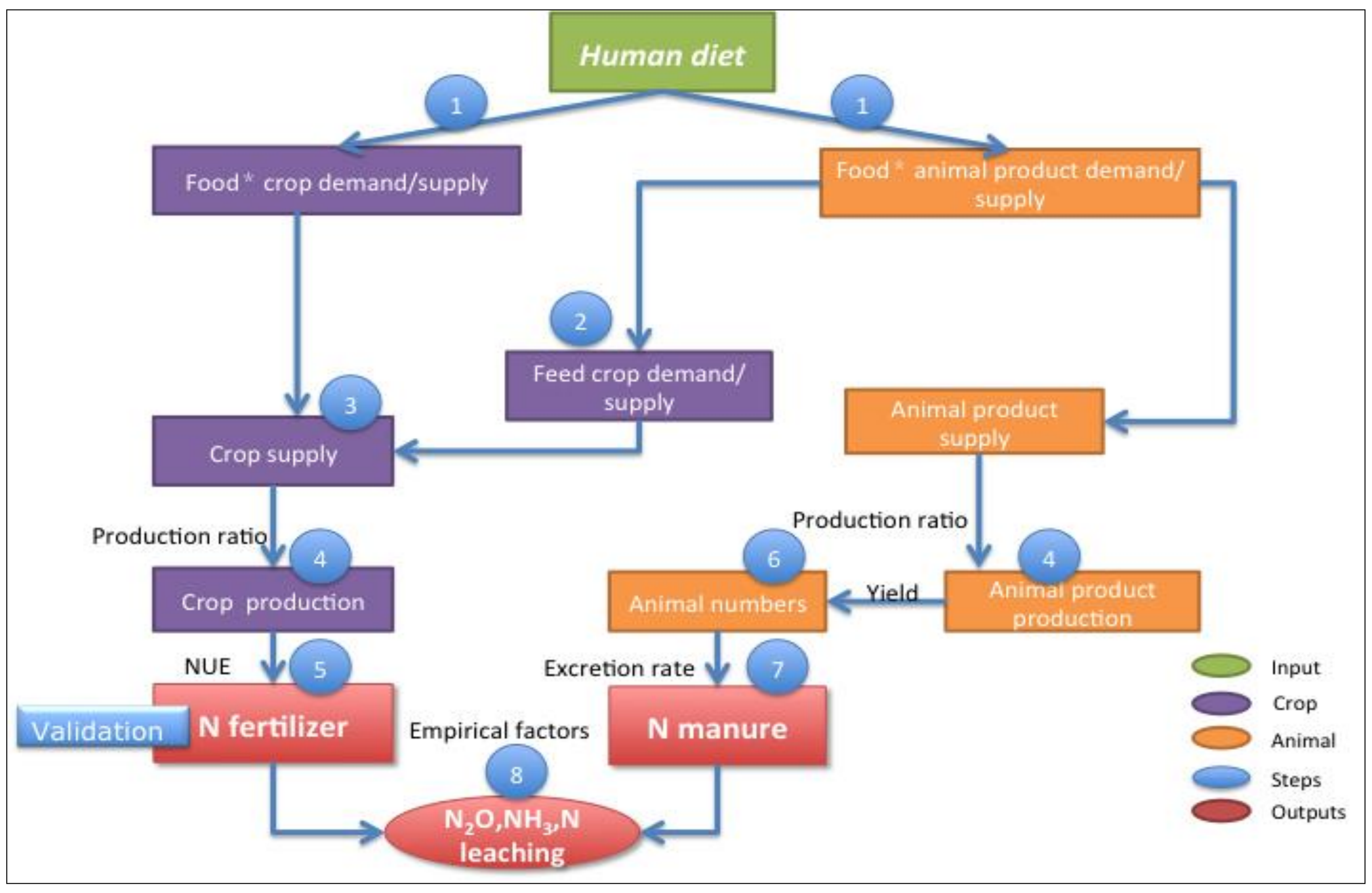

Figure 2. Nitrogen emissions calculation steps due to diet change. Food* includes food, seed, processing and other utilities.

- The future food supply in response to diet change was calculated by accounting for the combined effect of population change and diet change.
- Diet change was included by a scenario dependent trend in food supply, expressed as a change per capita per year, to extrapolate the diet pattern until 2050.
- Five diet scenarios were used to explore amount of fertilizer and manure from 2006 to 2050 i.e. Business As Usual (BAU), North American Diet (NAD), Same Diet (SD), Demitarian Diet (DD) and Vegan Diet (VD).

Results

Estimates of global N_2O emission, NH_3 emission and N leaching from fertilizer and manure for the current situation (Ref, year 2005) and the five diet change scenarios (2050) are presented below.

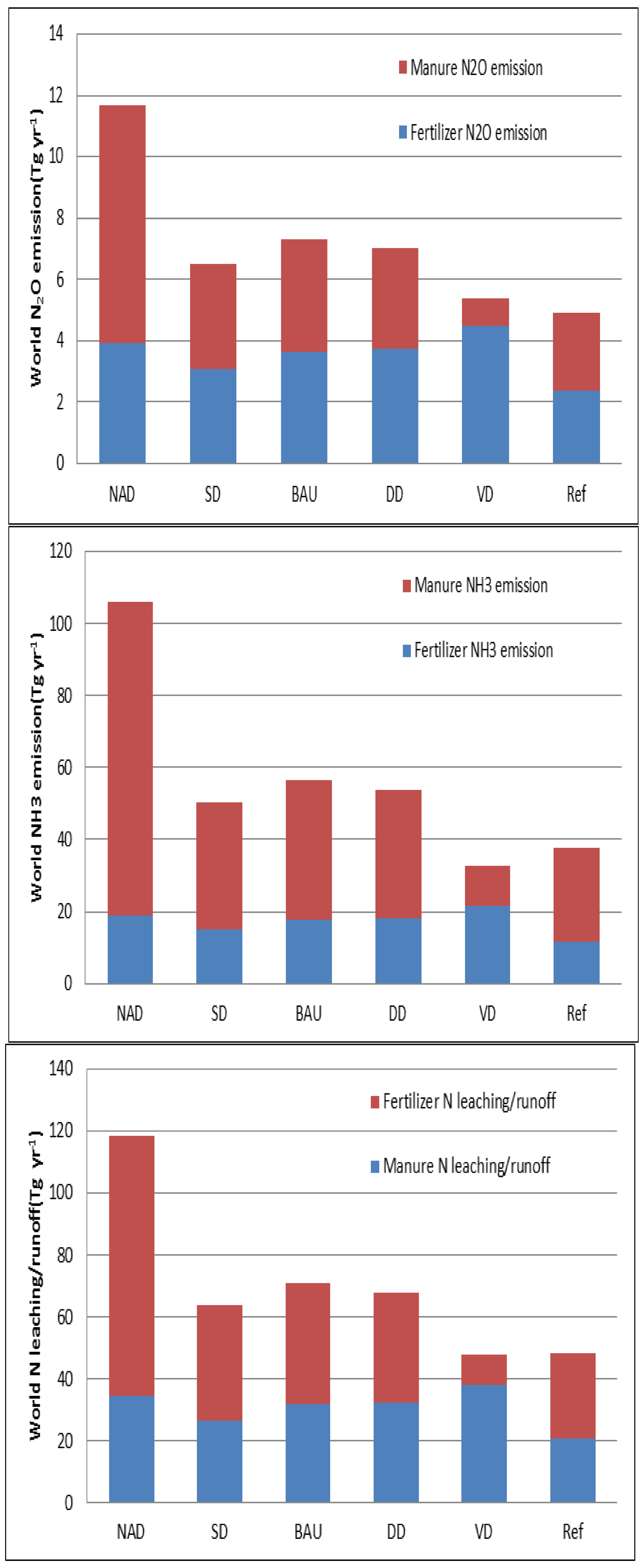

Figure 3. Global N_2O emissions (top), NH_3 emissions (middle) and N leaching/runoff (bottom) in 2005 and 2050 under five diet change scenarios

Dietary change affects most strongly NH_3 emissions, followed by N leaching/runoff and then N_2O emissions.

Only a severe reduction in meat consumption can reduce future NH_3 emission and N leaching/runoff

Even a vegan diet in 2050 is not leading to N_2O emission reduction. This is due to the expected population increase combined with higher N_2O emission factors from fertilizers compared to manure which increases in this scenario.

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