Nitrogen budget estimation in the East Europe: A case study for Dniester and Prut catchments

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Abstract

Development of N budget at regional scale seems to be a valuable tool for policymakers and stakeholders to distinguish concrete N source sectors/ sinks causing higher environmental impacts. This study goal is to assess N budget within Dniester and Prut catchments (transboundary region Moldova-Romania-Ukraine). Preliminary assessments showed cumulative N input of ~450 $GgNyr^{-1}$ (>30% from atmosphere) and total N-losses (NO_x+NH_3+N_2O) of ~160 $GgNyr^{-1}$ (~50% from agriculture).

Keywords: Nitrogen budget, River catchment, N losses, East Europe

1. Introduction

Agriculture, industry and other human activities have been altering Nitrogen (N) cycling leading to N imbalance at ecosystem and regional levels. This results at numerous environmental impacts on air, water and soil quality, GHG balance and ecosystem functioning (ENA, 2011). Quantification of N flows at district scale to build joint N budget is an efficient tool for identification of relevant domains to apply mitigation measures. This study aims to develop N budget for the transboundary region in East Europe to assess N flows contribution and impact on the Black Sea.

2. Approach and methodology

2.1 Study region

Dniester and Prut basins within Ukraine-Moldova-Romania.

2.2 N flow quantification

We used national statistics, environmental monitoring and research data. Estimates of EMEP, FAO, EDGAR, GRDC etc. and methodology described in ECE (2013) have been also taken into account.

3. Results and Discussion

3.1 Input

We found that ~44% of N came into region with N fertiliser applied, while manure contributed ~10% only. N deposited from atmosphere was the second largest source (~34%). N excretion from humans in rural areas with no sanitation was likely to be significantly higher than N discharged with wastewaters.

3.2 Horizontal transfer

We considered fodder crops transferred from plant growing system to animal husbandry and plant residues returned to fields both within internal N cycle.

3.3 Output

Most N was removed from the region with crop yield and animal products (quantification in progress). N losses (NO_x+NH_3+N_2O) to the atmosphere from land-based activities were comparable to crop production in Ukrainian part. Agriculture sector contributed ~50% of N-gas emissions. N discharge by Dniester to the Black Sea made ~25% of total N emitted to atmosphere. Lack of data, inconsistence and technical drawbacks in national statistics and reports were described. N_2O emission and N_2 losses (via denitrification and anammox) from water bodies are roughly estimated (in progress).

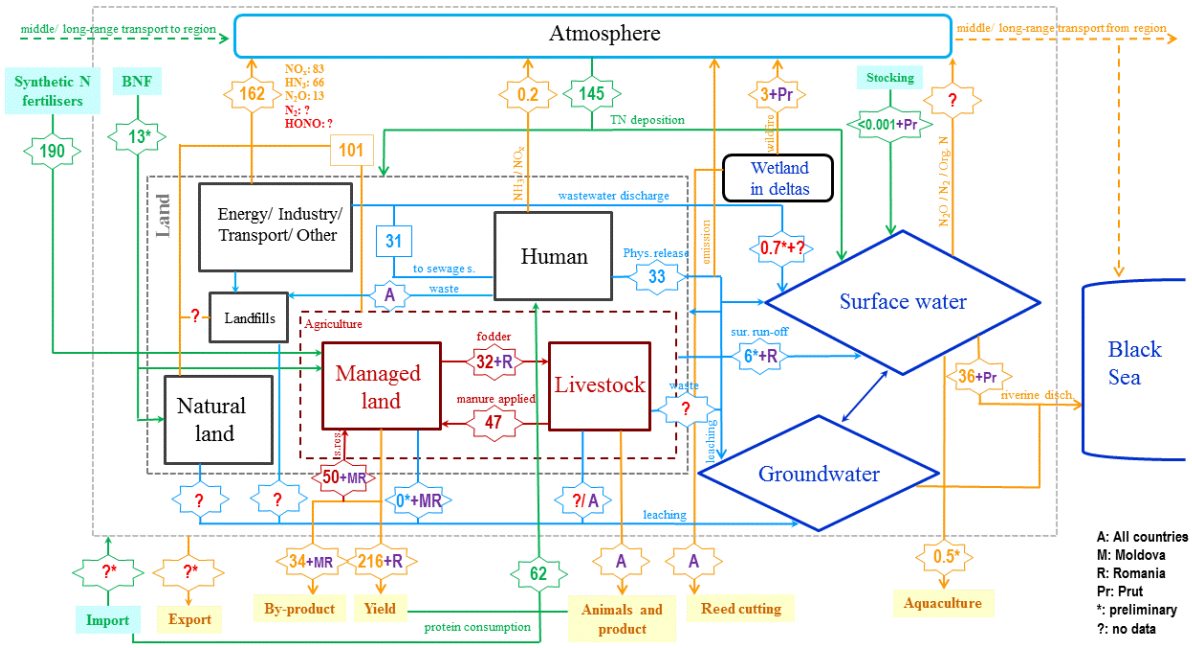

Fig. 1: Conceptual scheme of N budget in the study region ($GgNy^{-1}$)

4. Conclusion

The first N budget estimation within transboundary region in East Europe covering two watersheds in three countries showed total N input was assessed in a range of ~450 $GgNyr^{-1}$, where 1/3 derived from atmospheric N deposition. Though N output calculation is still in progress, N losses were assessed as ~160 $GgNyr^{-1}$.

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