A new tool to assess nitrogen and phosphorus flow in agriculture

MITERRA-EUROPE\(^1\) is a new tool that models the amount of nitrogen and phosphorus, among other key pollutants, used in agriculture across all 27 Member States at regional, country and EU-27 levels. It can be used to calculate the effects of different strategies to minimise excess pollution.

Many regions in the EU-27 use more nitrogen and phosphorus in agriculture than is required. The main sources of nitrogen and phosphorus come from fertilisers and manure. They are typically removed from the ground by crops and animals which eat crops. However, any surplus can enter the environment, affecting both air quality and water systems.

Air pollutants from agriculture include ammonia, nitrous oxide and methane emissions, which arise from livestock, including non-grazing livestock such as pigs and poultry. They also come from the housing, storage and application of manure as fertiliser and from excess artificial fertilisers in soil. Water pollutants include nitrates, phosphates and organic bound nitrogen and phosphorus. They can leach from stored manure and from runoff from agricultural soils into groundwater and surface waters.

Funded by the EU, researchers developed MITERRA-EUROPE using information from existing models (GAINS and CAPRI) and a new nitrogen-leaching model. MITERRA-EUROPE applies a uniform approach, allowing comparisons to be made between different EU countries, such as the effects of different policies to reduce nitrogen pollution.

From their findings, the researchers concluded that a combination of measures to abate ammonia and nitrous oxide emissions and nitrogen leaching was the most effective way to reduce both nitrogen and phosphorus pollution.

Using the model, the researchers estimated for the EU-27 that:

- there are large differences within the EU-27 in nitrogen surpluses, ammonia and nitrous oxide emissions and nitrogen leaching from agricultural land
- the distribution of ammonia and nitrous oxide emissions and nitrogen leaching approximately matches the distribution of livestock across the EU-27
- intensive agricultural systems in northwest Europe have the highest emissions compared with lower emissions from non-intensive agricultural systems in South and Central Europe
- major sources of ammonia came from dairy cattle (27 percent), other cattle (26 percent) and pigs (25 percent)
- the largest sources of nitrous oxides are, in order, fertiliser application, grazing, manure housing, storage and application
- ammonia emissions are directly related to livestock density and manure management systems whereas soil type and application of fertilisers and other sources of nitrogen also influence nitrogen leaching and ammonia emissions

The researchers used the model to assess the efficiency of various policy measures, such as from the Nitrates Directive\(^2\), to reduce pollution from emissions of ammonia and leaching of nitrates. The study estimated the effects of measures to decrease single pollutants or a package of measures to reduce more than one pollutant. The results suggest that single measures to reduce ammonia emissions also increase nitrous oxide emissions and nitrogen leaching. But methods to decrease nitrogen leaching also decreases the emissions of ammonia and nitrous oxides.

1. MITERRA-EUROPE was developed under the service contract “Integrated measures in agriculture to reduce ammonia emissions” by Wageningen UR on behalf of the European Commission’s DG Environment. See: http://www.scammonia.wur.nl/UK/

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Additional information: For further information on reducing agricultural ammonia emissions in Europe, please see: The European Commission http://ec.europa.eu/environment/archives/air/cafe/activities/ammonia_en.htm