POTENTIAL FOR AMMONIA ABATEMENT USING AGROFORESTRY

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The potential and application of future farm woodland development to mitigate ammonia is being explored through targeted field measurements, mechanistic and atmospheric emission modelling. Atmospheric ammonia is a pollutant of environmental concern leading to impacts on forests, species composition of semi-natural ecosystems and soils. Ammonia is emitted from many sources (animal housing, slurry/manure stores, and fertilised fields) over large areas of the countryside. The increased recognition of the role of ammonia has led to its inclusion in international agreements to reduce air pollutant emissions, under the United Nations Economic Commission for Europe (UNECE) Gothenburg Protocol and under the National Emissions Ceilings Directive of the EU. A new critical level of ammonia (1µg NH_3 cm^{-3}) has recently been adopted by UNECE for sensitive vegetation, replacing the previous level of 8 µg NH_3 cm^{-3}. The control of ammonia emissions is not as straightforward as reducing many other air pollutants, where application of a single technology can bring large cuts in the emissions (e.g. catalytic converters, which reduce emissions of nitrogen oxides from vehicles). Levels of emissions are influenced not only by farm management practice but also by environmental factors such as wind speed and temperature; therefore, different options such as woodland recapture are needed to abate ammonia emissions.

Previous studies have shown that forestry can have a significant role to play to reduce the impacts of atmospheric ammonia on sensitive areas, for example, the potential capture or dispersion of ammonia theoretically was up to 15 % for sites downwind of a tree belt (Defra project: Impact of vegetation and/or other on-farm features on net ammonia emissions from livestock farms (AMBER) - WA0719). In the current work also funded by Defra, the science of ammonia abatement is being addressed in more detail. An initial assessment of the abatement potential of farm woodlands at the UK scale has been completed. UK modelling was carried out with woodland added to the UK land cover given a distinct land-cover classification 'mitigation woodland'. This allowed an analysis of how much ammonia is deposited to the 'new' woodland and conversely the reduction in deposition to existing woodlands. With the scenario of 50% more tree cover (extreme case but is for illustration) ammonia dry deposition increases in the UK due

to recapture by the additional trees. However, this increased deposition is to the additional 'woodland sink' meaning that deposition to sensitive habitats is reduced; Deposition to existing woodland decreased by 10% and deposition to moor-land decreased by 6%. It is noted that conservative recapture efficiency was used in this experiment therefore this is likely to be a lower limit to the woodland sink effect. A second phase of UK scale modelling work will take place after new ammonia recapture numbers have been derived from the experimental phase of the project.

Three sets of experiments are being undertaken:

i. Tree belt scenario: the controlled release of ammonia in a wind tunnel
ii. Silvopastoral under-canopy grazing proxy with the release of ammonia under a tree canopy
iii. Case studies at poultry woodland farms in Scotland and England over the summer and autumn 2009.

The results and outlook from these experiments will be discussed in terms of farm woodland futures and in particular the development, in collaboration with the project partners, of guidance through design tools (e.g. SCAIL screening tool and agro-economic case studies) for farm managers to optimise future farm woodland design.