

Considering an ecosystems approach as a way forward for the regulation of ammonia emissions in the UK

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Aims of talk

- Defra's approach
- Focus and objectives of feasibility study
- Multi-disciplinary Team
- Approach to valuing ecosystem services
- Comparison with existing approaches
- Concluding Remarks

Defra's key underpinning principles in line the UK Sustainable Development Strategy 2005:

- More holistic approach to policy making and delivery with focus on maintaining healthy ecosystems and ecosystem services;
- Ensuring value of ecosystem services is fully reflected in decision-making;
- Ensuring environmental limits are respected in the context of sustainable development, taking into account ecosystem functioning;
- Taking decisions at the appropriate spatial scale while recognising the cumulative impacts of decisions
- Promoting adaptive management of the natural environment to respond to changing pressures, including climate change.

Focus and objectives

The specific technical objectives are:

1. To test the feasibility of an ecosystems approach to make a meaningful holistic assessment of the impacts, value of services and links to human well-being of different abatement options for ammonia emissions to the air at national level in the UK;
2. To compare the ecosystems approach with current conventional air quality management approach to determine the relative strengths and weaknesses;

Focus and objectives

The specific technical objectives are:

3. Identify potential barriers, and their causes, to the implementation of an ecosystems approach for air quality policy development at national level in the UK;
4. Consideration of the type of short and long-term changes to the policy /regulatory framework, and research and development needs, that may be needed to address barriers identified.

Potential important advantages over existing approaches:

- (i) Holistic assessment that considers the whole range of ecosystem services as a starting point;
- (ii) Inclusion of regulatory services, such as ecosystem controls on fluxes of pollutants in land-water-air systems, which are currently under-represented in UK policy;
- (iii) Identification of negative externalities, ancillary benefits and trade-offs of policy measures;
- (iv) Insight into the true costs of policy measures.

Project Team Expertise

Air Quality Management

Water Quality Management

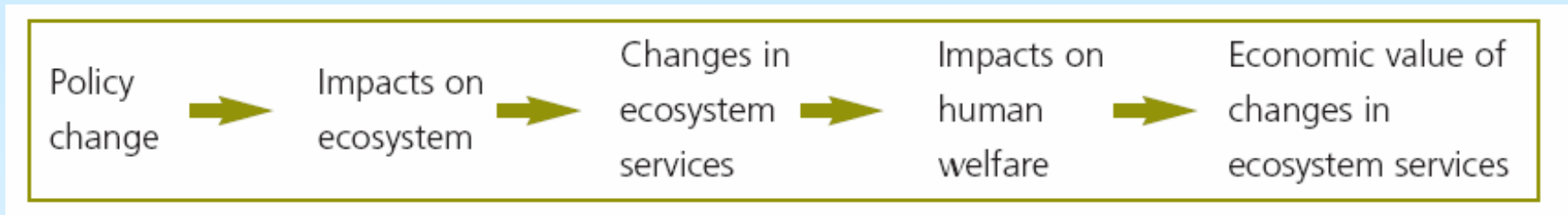
Nitrogen and carbon cycling in soils

Ecosystem Services

Environmental Economics



The Impact Pathway Approach



- Marginal changes reflecting the types of changes that take place in the quality and quantity of ecosystem services as a result of policy decisions.
- In the context of cost-benefit analysis, typically, the changes in the value of ecosystem services between the baseline option (no change) and the other policy options would be assessed.
- Changes in ecosystems and the provision of ecosystem services resulting from policy options and valuing these changes rather than giving an assessment of all services currently provided by the ecosystems in question.

See: *Defra's Introductory Guide to Valuing Ecosystem Services*

Table 2 – Categories of ecosystem service and examples of related services, based on Table 2.2 (p. 33) in the Millennium Ecosystem Assessment (2005)

Type of service	Service
Provisioning services	Food
	Fibre
	Genetic resources
	Bio-chemicals, natural medicines, etc.
	Ornamental resources
	Fresh water
Regulating services	Air quality regulation
	Climate regulation
	Water regulation
	Erosion regulation
	Disease regulation
	Pest regulation
Cultural services	Pollination
	Cultural diversity
	Spiritual and religious values
	Recreation and ecotourism
	Aesthetic values
	Knowledge systems
Supporting services	Educational values
	Soil formation
	Photosynthesis
	Primary production
	Nutrient cycling
	Water cycling



Services will need to be adapted for ammonia problem

Qualitative Assessment e.g. Flood and Coastal Erosion Risk Management

Option	Do nothing	Do minimum	Improve	MR vision	MR unconstrained
<i>Supporting services</i>					
Soil formation	+	+	0	+	+
Primary production	+	+	-	+	+
Nutrient cycling	+	+	-	++	++
<i>Provisioning services</i>					
Ecosystem goods	+fish/-agri	+fish/-agri	-fish	+fish/-agri	+fish/-agri
Fresh water	0	0	0	0	0
Biochemicals/genetics	?	?	?	?	?
<i>Regulating services</i>					
Air-quality regulation	0	0	0	0	0
Climate regulation	+	+	-	+	+
Water regulation	+	+	-	+	+
Water purification	+	+	-	+	+
Pest regulation	?	?	?	?	?
Disease regulation	?	?	?	?	?
Pollination	+	+	-	+	+
Erosion regulation	+	+	--	++	++
<i>Cultural services</i>					
Recreation and tourism	-	-	0	++/-	++/-
Aesthetic	+/-	+/-	+	+	+
Educational	0	0	0	+	+
Cultural heritage	--	-	0	-	-

Source: eftc (2007), Wareham Managed Realignment Case Study.

Key: '+' likely positive effect, '-' likely negative effect, '0' likely no effect or insignificant, '?' uncertain effect

- Varying degree of uncertainty about size and importance of impacts
- Structures systematic discussion and consideration of service impacts

Quantify the impacts of policy options on specific ecosystem services

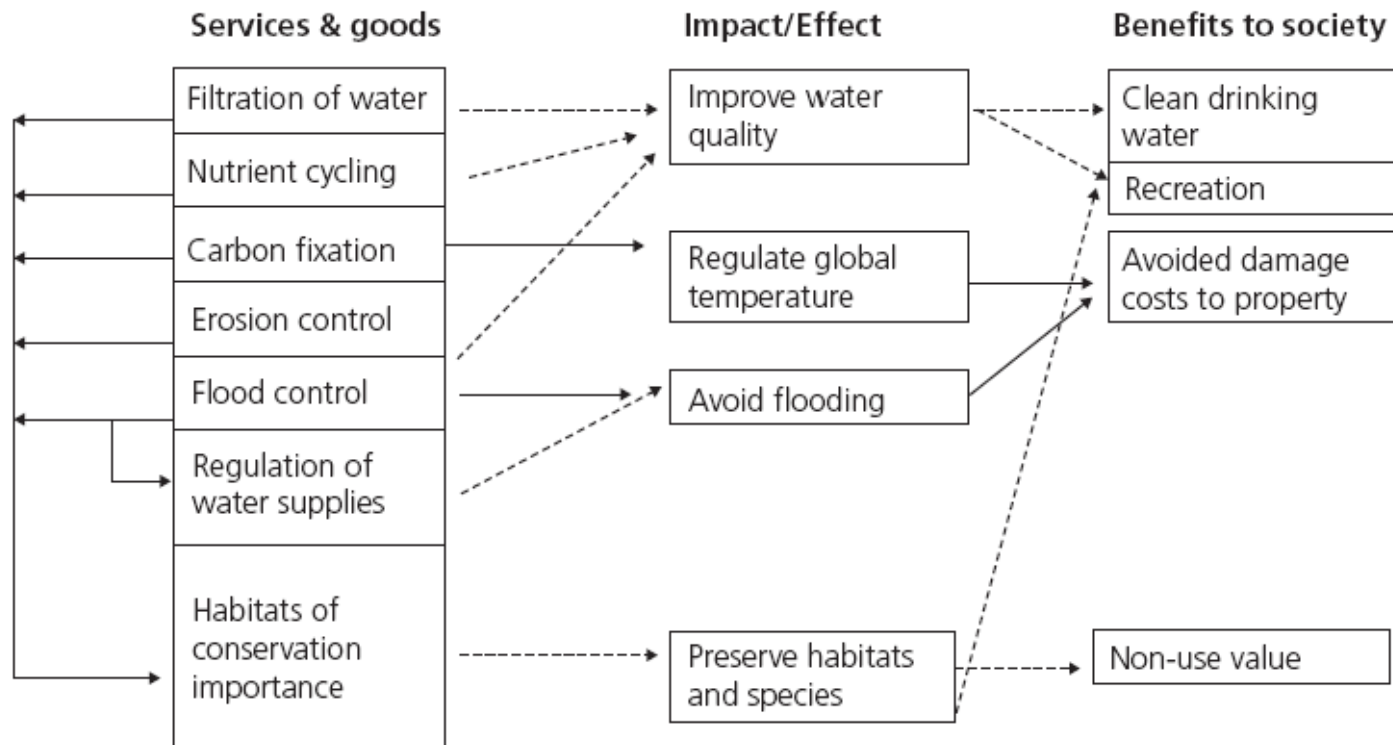
For identified important ecosystem services:

- determine whether sufficient information is available in principle to quantify the effect of changes to these services resulting from abatement measures;
- or whether this would need to rely on expert judgement, based on modelling or past experience;
- this process will start to identify some of the barriers to implementation.

e.g. some regulating services may be very hard to measure in biophysical terms and, in many cases, a quantitative assessment may not be possible as there is an adequate evidence base.

Assess effects on human welfare

Figure 3.2: Wetland function interactions



Spatial and double counting issues will be addressed

Value the changes in ecosystems services

The marginal change in the value of services will be based on:

- standard market valuation, non-market valuation (including contingent valuation methods where appropriate) techniques;
- exploring the potential of non-monetary values for cultural, aesthetic and recreational services.

Benefits transfer approaches will be employed as much as possible, as it will not be feasible to carry out an independent formal monetary valuation for each management choice within the timeframe

The assessment will recognise the requirements and guidance of all relevant government departments.

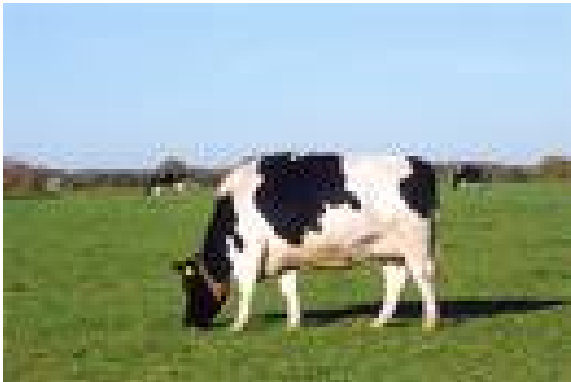
Promising areas for emission reduction being considered by Defra will be included in scenarios used in analysis:

Spreading

Storage

Housing

Fertilizer



Comparison with existing regulation of ammonia emissions

Will include:

1. Direct comparison of the ecosystem approach with the current ecological assessment of the effects of elevated nitrogen deposition and gaseous ammonia concentrations on sensitive ecosystems;
2. Other ecosystem services for these sensitive ecosystems which have not been specifically identified as a consequence of critical load exceedance;
3. Other positive and negative externalities of specific technical abatement measures which are not considered by the current air quality management framework.

Feasibility of implementation

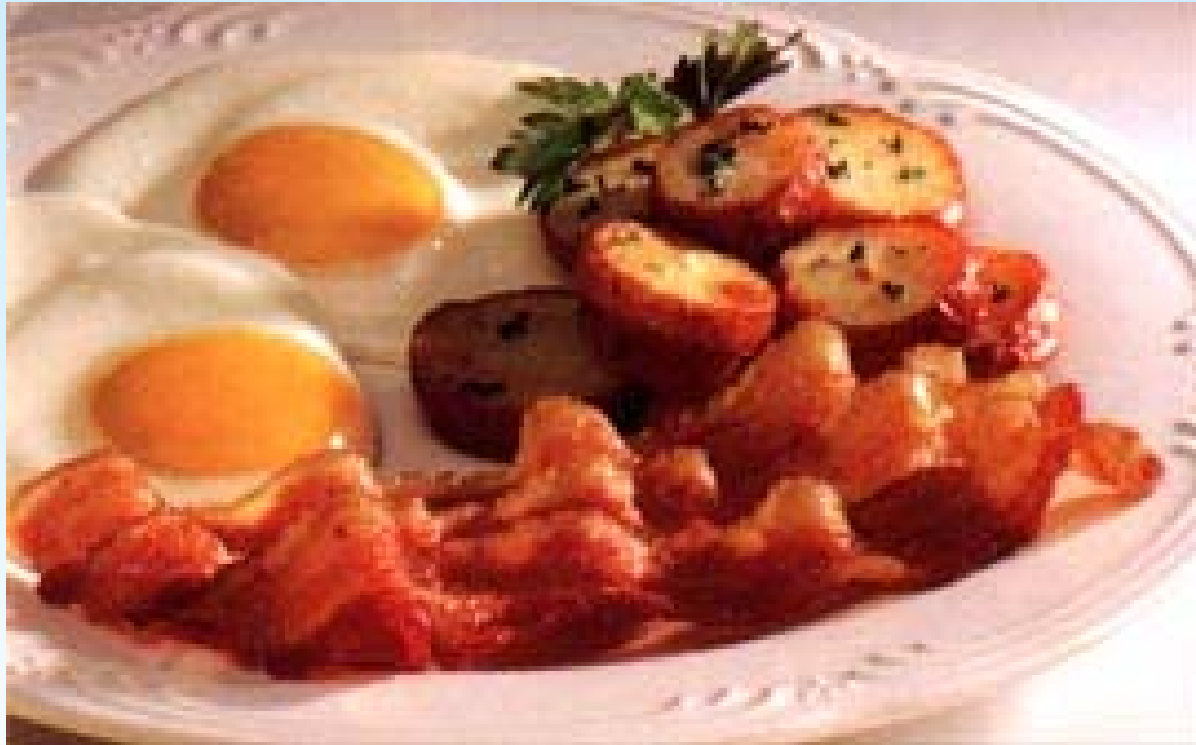
- Barriers to implementation will be identified throughout the study and via stakeholder engagement where appropriate;
- Consideration of the type of short and long-term changes to the policy /regulatory framework, and research and development needs will be made.

Project will run from now until the end of September...

...please get in touch if you are interested in the results:

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Remember, the chicken is involved....



...but the pig is committed

Thank you

Impacts of Ammonia Emissions

- *Decrease of human health, due to NH_3 induced formation of particulate matter ($\text{PM}_{2.5}$) and smog;*
- *Plant damage through high NH_3 concentrations near sources of NH_3 ;*
- *Decrease of species diversity of natural areas due to nitrogen enrichment through atmospheric deposition of NH_3 and ammonium;*
- *Acidification of soils because of transformation of deposited of NH_3 and ammonium to nitrate and its subsequent leaching;*

Impacts of Ammonia Emissions

- *Pollution of ground water and drinking water due to nitrate leaching;*
- *Eutrophication of surface waters due to nitrogen enrichment, leading to excess and possibly toxic algal blooms and a decrease in faunal and floristic species diversity;*
- *Global warming because of emission of nitrous oxide (N_2O) and methane (CH_4) and formation of ammonium sulphate aerosols contributing to negative radiative forcing.*