

Appendix I

Further guidance

The following sources of information can provide further guidance:

Ammonia: Options for Ammonia Abatement: Guidance from the UNECE Task Force on Reactive Nitrogen. Available at <http://www.clrtap-tfrn.org/content/options-ammonia-abatement-guidance-unece-task-force-reactive-nitrogen>.

Ammonia: United Nations Economic Commission for Europe Framework Code for Good Agricultural Practice for Reducing Ammonia Emissions. Available at <https://unece.org/environment-policy/publications/framework-code-good-agricultural-practice-reducing-ammonia>.

Nitrates and nutrient cycles: Recommendations for establishing Action Programmes under Directive (2012) 91/676/EEC concerning the protection of waters against pollution caused by nitrates from agricultural sources. Available at <https://ec.europa.eu/environment/water/water-nitrates/studies.html>.

Global Overview of Nutrient Management: Our Nutrient World: The challenge to produce more food and energy with less pollution (see especially chapter 6: Practical options to reduce adverse effects by improving nutrient use). Available at <http://nora.nerc.ac.uk/id/eprint/500700/1/N500700BK.pdf>.

Region-specific leaflets on best practices: "Resource efficiency in Practice – Closing Mineral Cycles". Examples from: Brittany (France) [EN, FR], central Denmark [EN, DK], Lombardy (Italy) [EN, IT], Murcia (Spain) [EN, ES], North-Brabant (Netherlands) [EN, NL], southern and eastern Ireland [EN], Weser-Ems (Germany) [EN, DE], Wielkopolskie (Poland) [EN, PL]. Available at <https://ec.europa.eu/environment/water/water-nitrates/studies.html> including project report: <https://ec.europa.eu/environment/water/water-nitrates/>

[pdf/Closing_mineral_cycles_final%20report.pdf](https://ec.europa.eu/environment/water/water-nitrates/pdf/Closing_mineral_cycles_final%20report.pdf) (see p. 87 onwards).

Baltic Sea Action Plan: Helsinki Commission for Baltic Marine Environment Protection, HELCOM, Available at <https://helcom.fi/baltic-sea-action-plan/>. See pp. 86–96 for agricultural measures.

European Union River Basin Management Plans: including recommendations, Available at https://ec.europa.eu/environment/water/water-framework/impl_reports.htm.

Climate change: Mainstreaming climate change into rural development policy post 2013: Final report European Commission 2014. Available at https://www.ecologic.eu/sites/default/files/publication/2015/mainstreaming_climatechange_rdps_post2013_final.pdf (see table 3 therein for list of measures).

Nitrogen use efficiency: European Union Nitrogen Expert Panel (2015). Nitrogen Use Efficiency (NUE) - an Indicator for the Utilization of Nitrogen in Agriculture and Food Systems. Wageningen University, Netherlands. Available at <http://www.eunep.com/reports/>.

Nitrogen use efficiency: European Union Nitrogen Expert Panel (2016). Nitrogen Use Efficiency (NUE) - Guidance Document for Assessing NUE at Farm Level. Available at <http://www.eunep.com/reports/>.

National fertilizer recommendations: for example, UK RB209, available at <https://ahdb.org.uk/nutrient-management-guide-rb209>.

National codes of good agricultural practice: including national ammonia codes of good agricultural practice, as required for signatories to the Gothenburg Protocol.

Appendix II

Glossary of key terms³⁶

Abatement – strategies or methods to reduce nitrogen losses to the environment, and thereby reduce the direct and indirect effects.

Afforestation – establishment of a forest or stand of trees in an area where there was no previous tree cover.

Agroforestry – cultivation and use of trees and shrubs with crops and livestock in agricultural systems.

Ammonia stripping – physicochemical process used to remove ammonia from sewage, slurry, wastewaters, etc.

Anaerobic digestion – series of biological processes in which microorganisms break down biodegradable material in the absence of oxygen.

Anthropogenic processes – processes derived from human activities, as opposed to those occurring in natural environments without human influence.

Biobased fertilizer – naturally occurring substances rich in nutrients, such as manure, urine, bird guano, compost.

Biochar – charcoal-like by-product of the process of pyrolysis, or the anaerobic thermal decomposition of organic materials.

Biofilters – a filter bed in which exhaust air or liquid is subjected to the action of microorganisms that assist in its decomposition.

Biological nitrogen fixation – a process in which N_2 from the atmosphere is converted into NH_3 and other N_r forms mediated by specialist bacteria.

Biotricking filters – a combination of a biofilter and a bioscrubber. They work in a similar manner to biofilters, except that an aqueous phase is trickled over an inert packing. The trickling solution contains essential inorganic nutrients that are usually recycled.

Carbon sequestration – the capture and removal of carbon dioxide from the atmosphere and its storage in an alternative carbon-related reservoir; for example, soil organic matter, charcoal, tree growth.

Catch crop – fast-growing crop that is grown between successive plantings of a main crop, and helps to reduce N losses during fallow.

Circular economy – an economic system aimed at reusing and recycling resources (hence “circularity”).

Co-benefit – a coincidental benefit that arises for a secondary issue as a result of addressing a primary issue (for example, employing a technique to mitigate pollution which is also more cost effective).

Companion crop – planting of different crops in proximity

for a number of different reasons, including pest control.

Compost – material resulting from the process of composting, an aerobic method of decomposing organic solid wastes.

Constructed wetlands – treatment systems that use natural processes involving wetland vegetation, soils and their associated microbial communities to treat wastewater.

Crop rotations – the practice of growing different types of crops in the same area over several growing seasons.

Deep-injection – The application of liquid manure or digestate by placement in deep, vertical slots, typically about 150 mm deep, cut into the soil by specially designed tines.

Deep-litter – an animal housing system, based on the repeated spreading of bedding material in indoor or outdoor contexts.

Denitrification – the reduction of nitrate (NO_3^-) to dinitrogen (N_2). Nitrous oxide (N_2O) may be produced as an intermediary, depending on conditions.

Dietary Measures – measures consisting of changes in the type, amount and quality of animal feed or human food.

Drainage management – practice that allows farmers to have more control over drainage, by using a water control structure drain to bring the drainage outlet to various depths.

Drip irrigation – a type of crop irrigation involving the controlled delivery of water directly to individual plants through a network of tubes or pipes.

Dung – animal faeces.

ECE – Economic Commission for Europe, one of the five regional commissions under the jurisdiction of the United Nations Economic and Social Council: includes Europe, Eastern Europe, the Caucasus, Central Asia and North America.

Ecosystem services – the benefits people obtain from ecosystems. These include: provisioning services, such as food and water; regulating services, such as flood and disease control; cultural services, such as spiritual, recreational and cultural benefits; and supporting services, such as nutrient cycling, that maintain the conditions for life on Earth.

Emissions abatement – technology applied, or measure taken, to reduce emissions and its impacts on the environment.

Enteric methane – methane that is produced in the first stomach (rumen) of ruminants. Ruminants are mammals that acquire nutrients from microbially mediated enteric

³⁶ This glossary draws in part on the *RAMIRAN Glossary of terms on livestock and manure management*. Recycling Agricultural, Municipal and Industrial in Agriculture Network (eds. B. Pain and H. Menzi), 2011.

Appendix II

Glossary of key terms

fermentation of their food, such as cows and sheep.

Eutrophication – the enrichment of the nutrient load in ecosystems (terrestrial and aquatic), especially compounds of nitrogen and/or phosphorus.

Ex ante assessment – evaluation of the potential success of an operation before it occurs.

Ex post assessment – evaluation of an operation after it has occurred.

Exceedance – The amount of pollution above a “critical level” or “critical load”. It may be expressed in different ways, such as accumulated area of exceedance.

Faeces – dung, solid fraction of animal excreta.

Fertigation – addition of water-soluble products into irrigation systems, with the purpose of fertilizing.

Housed livestock – animal breeding systems involving animals being kept in different housing types.

Hydrolysis – chemical decomposition in which a compound is split into other compounds by reacting with water.

Immobilization – the conversion of nutrients in the soil into an inaccessible or immobile state. The opposite process is mineralization, in which decomposition releases nutrients, which are then accessible to plants.

Inorganic fertilizers – manufactured inorganic and organo-mineral fertilizers, often referred to as “synthetic” fertilizers. This includes all mineral N fertilizer types such as ammonium nitrate and ammonium sulfate, and also urea (and urea-based fertilizers).

Integrated – combining or coordinating separate elements to provide a harmonious, interrelated whole process.

Intercropping – farming method that involves planting or growing more than one crop at the same time and on the same piece of land.

Leaching – the washing out of soluble ions and compounds by water draining through soil.

Legumes – a group of plants, many of which are able to extract N₂ from the atmosphere using specialized “nodules” that contain symbiotic nitrogen-fixing bacteria.

Litter – excreta mixed with variable portions of bedding material. The term can also refer to decomposed fallen plant material (for example, leaf litter).

Manure – organic materials used as fertilizer in agriculture. Animal manure is composed of faeces and may contain bedding material and urine (when it may be referred to as “farmyard manure”). “Green manure” is a crop grown with the aim of being incorporated into the soil.

Manure management – collection, storage, treatment and utilization of animal manures in an environmentally sustainable manner.

Manure processing – processes to transform a variety of manure types and sources into value-added products. This includes forming them into pellets.

Manure treatment – a range of different processes that can be applied to manure and may add value. Examples include concentrating nutrients, odour reduction and volume reduction.

Mineralization – the decomposition of organic matter, releasing the nutrients in soluble inorganic forms that are then available to plants (the opposite of “immobilization”).

Mini-wetlands – constructed wetlands with biofilters used to reduce nitrogen and phosphorus emissions from field drains to aquatic environments.

Mitigation of nitrogen – reducing the adverse effect of any N_r compound, such as the atmospheric pollutants NH₃ and NO_x, the aquatic pollutant NO₃⁻, or the greenhouse gas N₂O.

Mixed farming – type of farming that involves the growing of a variety of crops (for example, annual, multiannual and permanent crops) and livestock breeding.

Multi-actor – group of partners with complementary types of knowledge – scientific, practical and other. They join forces in project activities from beginning to end.

Natura 2000 – a network of core nature conservation sites across the European Union designated under the European Union Habitats Directive and the Birds Directive.

Nitrification – biological oxidation of ammonia to nitrite followed by the oxidation of the nitrite to nitrate.

Nitrification inhibitors – synthetic or natural chemicals used to slow the process of nitrification.

Nitrogen budget – calculation of inputs and outputs of nitrogen across the boundaries of a system defined in time and space.

Nitrogen cascade – sequential transfer of N_r through environmental systems. It results in multiple environmental changes as N_r moves through, or is stored within, each system.

Nitrogen-fixing crops – crops colonized by bacteria in the root system that are able to convert N₂ into a plant-available nitrogen (for example, legumes).

Nitrogen retention – difference between N inputs and N outputs. The term is typically applied to freshwater catchments but can be used in other contexts.

Nutrients – elements present in food and feed that are indispensable for life and health.

Paludal cultures – crops grown in a marshy habitat, predominantly in water-logged conditions.

Perennial crops – crop species that live longer than two years.

Permanent grassland – land used for growing, continuously, forage or fodder.

Pollution swapping – occurs when a mitigation measure introduced to reduce levels of one pollutant results in increased levels of another pollutant.

Ramsar sites – wetland sites designated to be of international importance under the Convention on Wetlands of International Importance especially as Waterfowl Habitat (Ramsar Convention).

Reactive nitrogen – Collectively, any chemical form of nitrogen other than dinitrogen (N₂).

Rhizobia – soil bacteria aiding in the nitrogen fixation in leguminous plants’ root nodules.

Riparian buffer strip – a vegetated strip of land between

agricultural land and a river or stream. It may be forested, created with the aim of reducing the impact of the adjacent land-use on the water quality of the stream.

Rotational land – agricultural practice of growing a series of different crops on the same land in successive seasons.

Run-off – portion of water on the soil surfaces that reaches the streams with suspended or dissolved material.

Set-aside – the policy of taking land out of production to reduce crop surpluses.

Shallow injection – the application of liquid manure by placement in shallow, vertical slots, typically about 50 mm deep, cut into the soil by a tine or disc.

Sprinkler irrigation – irrigation method to simulate natural rainfall.

Struvite – a compound consisting of magnesium ammonium phosphate. It can be precipitated from liquid slurry and wastewater, forming a solid fraction allowing the nutrients to be recovered.

Toothed scraper – tool with a variable number of teeth used to run over grooved floor of cattle houses, both to obtain a cleaner floor surface and to prevent slipping inside the house.

Trailing hose – a type of band spreader using an array of hoses to spread liquid manure close to the ground, thereby reducing ammonia emissions and odour.

Trailing shoe – a type of band spreader comprising an array of “shoe” units that follow the surface of the soil. The shoe-shaped units part the foliage and place liquid manure in bands on the soil surface, thereby reducing ammonia and odour emission.

Ultrafiltration – water-treatment process through membrane filtration.

Urease – enzyme that catalyses the hydrolysis of urea.

Urease inhibitor – compound used to slow down the hydrolysis rate of urea by reducing enzymatic activity.

Volatilization – transfer of a compound dissolved in water into the gaseous phase. Typically used to describe emission of ammonia into the air from substances containing ammonium.

Welfare-economic cost-benefit analysis – study of the impact on social welfare from the allocation of resources through a cost-benefit and social analysis.

Woodlands – habitat where trees are the dominant plant form.

Yield – amount of agricultural production harvested per unit of land area.

Zeolite – mineral from volcanogenic sedimentary rock having the ability for adsorption and ion exchange.

Appendix III

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Abbreviations: EECCA, Eastern Europe, Caucasus and Central Asia.

