GLOBAL AGENDA FOR SUSTAINABLE LIVESTOCK

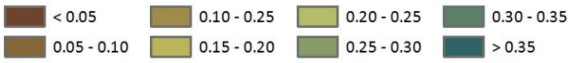
CLIMATE & CLEAN AIR COALITION TO REDUCE SHORT-LIVED CLIMATE POLLUTANTS

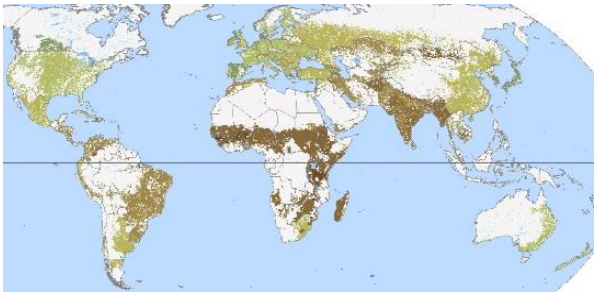
What is manure worth?

Good manure management starts with recognizing and understanding the value of manure as a resource. Livestock manure represents a valuable resource that, if used appropriately provides multiple benefits.

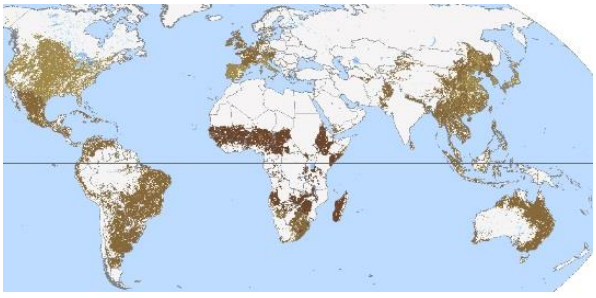
Manure contains the undigested fraction of the organic matter in the livestock diet. It contains i.e nitrogen (N), phosphorus (P), potassium (K), and sulphur (S) which are essential for plant growth. Most of the nutrients in livestock diets is excreted in dung and urine; generally more than 70% of dietary nitrogen and more than 65% of dietary phosphorus. The maps illustrate on a global scale how much of the nitrogen intake is retained in the animal products. Implicitly this also indicates the fraction that is excreted (100% uptake *minus* retention *is* excretion).

Nitrogen retention as fraction of the uptake
(source: GLEAM)

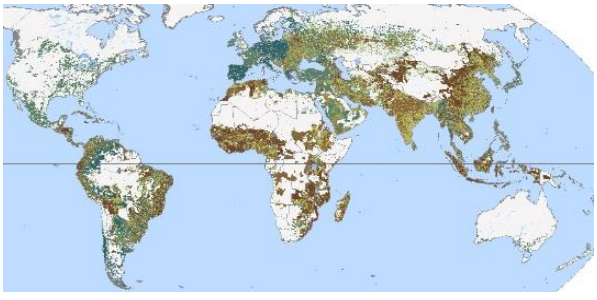




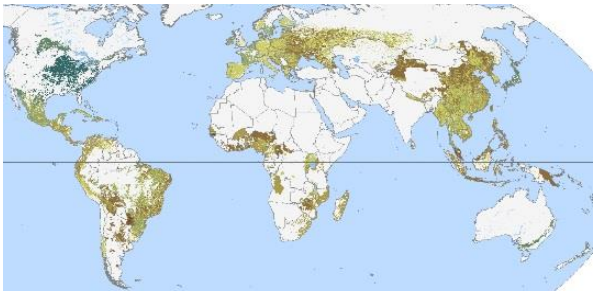
Dairy cattle



Beef cattle



Chicken



Pigs

Fertiliser

Manure is commonly used as a fertiliser and as an amendment to improve the quality of the soil. When manure is applied and managed properly according to the agronomic needs of crops, manure will improve crop productivity and reduce the demand for synthetic fertiliser. Hence, manure is an important source of organic matter for soils and can provide a major contribution to physical, biological and chemical soil quality. In addition, it is an important source of plant nutrients that facilitates plant growth and increases water-holding capacity of soils.

Energy

There is a great interest in using manure as a feedstock for energy production, driven by rising energy prices and growing concerns over the environmental risks associated with excess applications of manure nutrients. In some parts of the world, manure has long been used for heating and cooking and for the production of biogas. If properly handled, manure can be used to produce biogas that can be used as an alternative energy source. Animal manure e.g. poultry litter can also provide a source of fuel for heat and electricity generation.

However, unless manure is managed properly to minimise nutrient losses, odour, and emissions, it becomes a source of pollution, and a threat to public health. Manure can pose environmental and human health risks when applied in excessive amounts or when it is poorly stored and managed.

Nature of the problem

Over the last three decades, livestock has played and continues to play, a major role in agriculture, but the circumstances under which production of livestock products takes place have changed fundamentally. This can be noted especially where small-scale mixed farms have been replaced by modern, more intensive and specialized farms. These developments together with the utilization of improved and imported feedstuffs and the introduction of more specialized animal types, have led to a large growth in the production and the productivity of the livestock sector. This in turn has led to new pressures on the environment.

These trends have been driven by the increasing demand for livestock products particularly in the developing world. Most of the increased production has come from industrial farms clustered around major urban centres.

Concentration

Manure use and management has generally been influenced by the size, product-mix and location of crop and livestock production units. In recent decades, commodity production has become more specialized; with crop production decoupling from livestock production. Traditional mixed farming systems, in which farmers raise a few animals alongside their crops, have given way to large industrial operations with thousands of animals. In addition, production has shifted from cattle and other ruminant species that graze on grass and fodder to dairy, pigs and poultry feed on diets high in concentrate feed. And the centre of gravity for livestock production has migrated from rural, farming communities to peri-urban areas. Much of the new production has been concentrated in large, industrial pig and poultry operations located in and around major cities, where farmers have access both to cheap supplies of feed and markets for their meat and eggs.

Large-scale industrial layer hen operation in Costa Rica.

Scale

Livestock production has been shifting to larger operations, as economies of scale in production provide larger operations with lower costs and higher financial returns. Economic forces are key drivers in the shift towards large industrialized livestock operations. There are substantial economies of scale up to certain threshold sizes, and farms can operate efficiently at sizes that are much larger than the thresholds. In addition, tighter vertical coordination lowers costs and improves consistency for many products. Each provides strong financial incentives for producers to expand their operations and to enter into more formal contractual relationships with buyers and input suppliers. Changes in farm structure are intertwined with manure concerns because larger operations concentrate manure in a confined space.

Impact

Concentrated, large-scale livestock production often creates concentrated, large-scale environmental problems. Large industrial farms bring in massive quantities of nutrients in the form of concentrate feed. And they produce far more manure than can be recycled as fertiliser and absorbed on nearby land. Because industrialized livestock production concentrates manure on limited land areas,

producers tend to apply manure at intensities well above the agronomic needs of crops, thereby increasing the risk of pollution. High concentrations of animal manure can lead to increased air and water pollution, with adverse health and environmental consequences. Concentrated livestock can also create odours that are a nuisance to neighbours and reduce property values.

Manure transfer from surplus areas, where manure production exceeds potential use on arable land and pastures, to deficit areas may be an effective nutrient-management strategy. The separation of manure and crop production also raises the costs of using manure as a fertiliser since manure must be transported off the livestock farm for application on crops. The greater the distance between livestock and crop producers, the higher the costs of transporting excess manure.
Impacts related to manure management are poised to grow, as confined livestock production expands particularly in developing regions. Pig and dairy production are the main concern as they generate liquid manure or slurry which is more difficult to manage.

Impacts of poor manure management

The concentration of livestock in areas with little or no agricultural land leads to high impacts on the environment (water, soil, air and biodiversity), mainly related to manure and waste water mismanagement. Nutrient overloads can result from several forms of mismanagement amongst which are over-fertilisation of crops and improper disposal of manure.

In the crop–livestock systems, nutrient overloads mainly occur when the nutrients present in manure are not properly recycled. Even if cropland is available for manure recycling, environmental impacts can only be prevented if manure is managed properly to reduce nutrient losses and if the amounts of nutrients in the applied manure do not exceed the nutrient requirements of the crops.

The major effects of mismanagement of livestock manure include:

- Animal manure is an important source of anthropogenic greenhouse gases (GHG). Main GHGs emitted by manure are methane (CH_4), which is emitted during the anaerobic (without oxygen) decomposition of organic matter during storage and nitrous oxide (N_2O), which is emitted during storage and soil application. Additional gases emitted from manure include: ammonia (NH_3) and nitrogen oxides (NO_X), which contributes to odour and are indirect sources of nitrous oxide. These greenhouse gases can be produced and emitted at each stage of the 'manure management continuum', being the livestock building, manure stores, manure treatment and manure spreading to land. On a global scale, manure management contributes

10% to total livestock emissions of N_2O and CH_4, however emissions do vary across productions systems.

- Eutrophication of surface water. Deteriorating water quality, algae growth, damage to fish etc. due to input of organic substance and nutrients if excreta or waste water from livestock production get into streams through discharged, run-off or overflow of lagoons. Surface water pollution threatens aquatic ecosystems and the quality of drinking water taken from streams. Nitrogen and phosphorus are both nutrients often associated with accelerated eutrophication of surface water.

Eutrophication of surface water in Ethiopia.

- Leaching of nitrate and possible pathogens transfer to the ground water. They leach from manure storage facilities or from fields on which high doses of manure have been applied. Both are threats for drinking water quality.
- High concentrations of heavy metals in runoff water. Animal manures, particularly poultry and pig manure, contain relatively high concentrations of heavy metals, such as arsenic, copper and zinc. These metals are normally high in manure because concentrations in the diets are high. High concentrations of heavy metals have been documented in runoff water from soils fertilised with animal manure.

Constraints to sound manure management

A wide range of proven technologies exist – all of which have a role in diverse situations. Different intensities of production are likely to require different solutions in terms of manure management systems and technologies.

In many parts of the world, sound manure management is hindered by the fact that manure is considered a waste rather than a source of nutrients and energy and by the lack of effective institutional and policy framework as well as the absence of incentives that clearly link the environmental concerns to the operational considerations of livestock production.

The disregard of the nutritive value of manure has also been a key obstacle to promoting good manure management. In many countries, government policies continue to subsidize synthetic fertiliser hence providing a disincentive for farmers to efficiently utilize manure. Other constraints to sound manure management include the: high costs associated with good manure management across the manure continuum; the uncertain effect of manure on crop yields where farmers overdose manure to avoid risk of lower yields; and labour constraints and a lack of education on how to best harness nutrients from manure.