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FOOD SYSTEMS AT RISK

NEW TRENDS AND CHALLENGES

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CHAPTER 2.2

CLIMATE CHANGE, ANIMAL PRODUCT CONSUMPTION AND THE FUTURE OF FOOD SYSTEMS

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SUMMARY

The livestock sector contributes around 14.5 percent of total anthropogenic greenhouse gas (GHG) emissions. Developing mitigation strategies is a serious challenge, especially if we anticipate a rapid growth in the consumption of animal products in Low-Income (LI) and Lower Middle-Income (LMI) countries. Across the planet, livestock systems are highly diverse and the livestock sector offers many possibilities for carbon sinking that can help to reduce emissions. In particular, carbon sequestration in grasslands, rangelands and feed crop fields and manure recycling are crucial in the assessment of the carbon efficiency of livestock value chains. Supporting sustainable livestock production systems, together with sustainable animal product market chains and consumption, requires the completion of GHG inventories based on landscape carbon balances.

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Livestock and GHG emissions: how the rise in demand for animal products is generating risks for food systems

Over the past 40 years there has been a huge increase in demand for animal products, driven by demographic changes, economic growth and urbanisation. Between 1977 and 2017, the world's population almost doubled and per capita consumption of animal products increased by 50 percent. This resulted in a leap in world meat production from 122 to 330 million tonnes and milk production soared from 317 to 811 million tonnes (FAO, 2019). The latest projections predict that these trends will continue at the global scale, in particular in emerging countries where household incomes are rising and increasing the demand for animal products.

Market growth has resulted in major environmental impacts. Throughout the world, intensive animal production and industrialised value chains have emerged (Steinfeld, de Haan, and Blackburn, 1997). This 'livestock revolution', together with cropland extension for feed and food, have exacerbated the human pressure on land and natural resources. Twenty billion animals make use of 30 percent of the terrestrial land area for grazing, 33 percent of the global cropland area for producing animal feed and 32 percent of freshwater resources (Herrero *et al.*, 2016).

These changes have had a big impact on the rise in GHG emissions, consequently accelerating climate change. The world's livestock sector generates around 7.1 $GtCO_2eq/yr$, which represents 14.5 percent of global anthropogenic GHG emissions. The GHG emissions depends on the regions of the World but are not fully correlated with livestock production volumes (Figure 13). The sector is associated with enteric fermentation (2.8 $GtCO_2eq/yr$), feed production, processing and transportation (3.2), manure management (0.7) and land-use change emissions (0.6) (Gerber *et al.*, 2013). These figures are still debated in the scientific community. In particular, the contribution of livestock in land-use change-related emissions and carbon sequestration is not yet properly assessed. Among all livestock related GHG emissions, fossil fuel consumption in itself (from production to distribution) accounts for a significant share, at an estimated 1.4 $GtCO_2eq/yr$.

Chemically speaking, about 44 percent of GHG emissions are in the form of methane (CH_4) and 29 percent in the form of nitrous oxide (N_2O). The rest (27 percent) is due to carbon dioxide (CO_2) (Gerber *et al.*, 2013).

Because of enteric fermentation, emissions per unit of protein produced are higher for ruminant meat and milk than for pork, poultry and aquaculture. In particular, beef and cattle milk

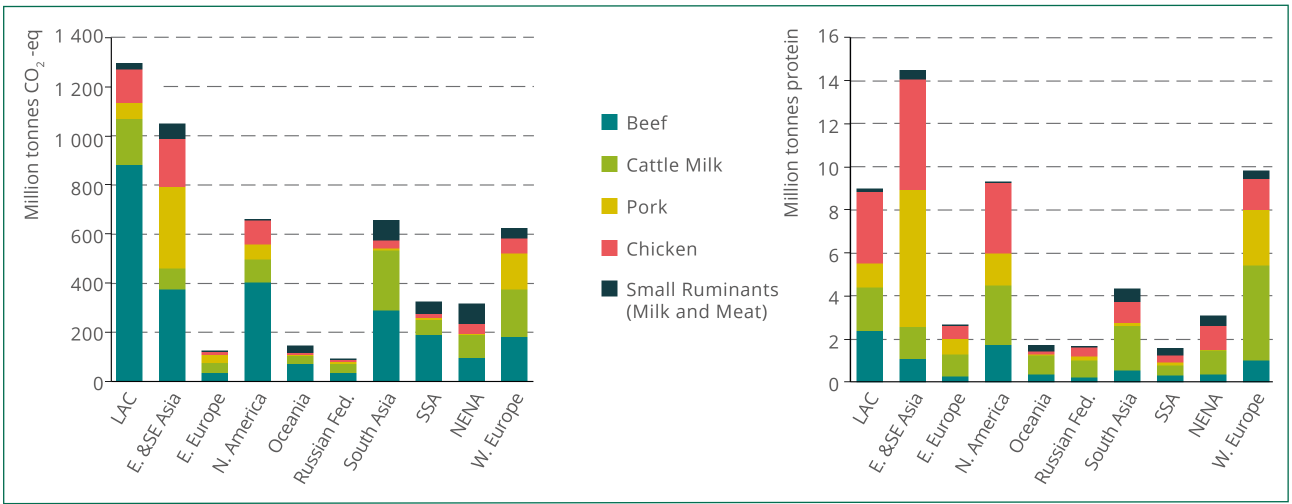

Figure 13: *GHG emissions from livestock and livestock production by commodity and regions. Source: Gerber, P.J.* et al.*, 2013.*

production account for 64 percent of the sector's GHG emissions, while pigs and poultry account for 9 percent and 8 percent respectively. Among the huge diversity of livestock sub-systems, some are less carbon costly. Grassland systems, based on the use of natural pastures and cultivated meadows, together with integrated crop-livestock systems, generally generate lower emissions than landless systems based on industrial feed (*cf.* Box 2). In order to manage the roles of these different livestock sub-systems, trade-offs must be made taking into consideration their multiple functions.

Multi-functionality of livestock systems requires an understanding of the trade-offs between climate mitigation and other ecosystem services

Livestock provides direct livelihood and economic benefits to at least 1.3 billion producers and retailers. As an economic activity, livestock contributes up to 50 percent of agricultural GDP globally (Herrero *et al.*, 2016). Animal breeding is well adapted to many areas with restricted resources or to harsh environments. It offers opportunities for a wide diversity of communities and social groups in nearly all ecosystems. Milk production, for example, contributes to the livelihoods of more than 121 million families throughout the world. Most of these are very small farms, with an average of three cows (IFCN, 2015).

Due to its multi-functionality, livestock plays an important role in the sustainable development of rural territories. It provides meat, milk and eggs which contribute to nutrition and balanced diets, particularly in LI countries though self-consumption. Livestock also provides energy for transportation and ploughing, and manure for organic fertilisation. Moreover, cattle and other livestock have an important role in household economics in LI and LMI countries as they often serve as a form of savings and a mechanism for managing economic risk, used by rural households to ensure survival and overcome periods of food insecurity (Alary, Duteurtre and Faye, 2011). This is at the core of some peoples' livelihoods, as illustrated in pastoralism. In addition, livestock has always played a crucial role in agricultural intensification processes (HLPE, 2016). In particular, livestock systems based on grazing have the ecosystemic capacity to store carbon in the long term in the form of organic carbon, which contributes to carbon sequestration at the global scale (Soussana, Tallec and Blanfort, 2010).

Animal products also have a high cultural value and significance in many LI and LMI countries, as demonstrated in many religious and cultural practices. They contribute to food security through their participation in local and international trade. At the same time, the consumption of animal products may result in nutritional disorders.

Designing low-carbon livestock systems that contribute to sustainable food systems

The serious challenges posed by global warming mean that we have to address both the transition to low-carbon livestock systems and sustainably satisfy the growing demand for livestock products in LI and LMI countries. These transitions must consider the various roles livestock plays in local ecosystems and communities and the importance of the carbon sequestration process (Vigne *et al.*, 2017).

On the production side, the carbon balance must improve at the landscape level. Understanding potential synergies between adaptation, activities designed to sustainably increase production and mitigation are important. Climate-smart agriculture (CSA) approaches will help to guide the actions needed to transform and reorient livestock systems (FAO, 2017).

In the humid tropics, where livestock systems have developed over forests, efforts to curb deforestation are a priority in order to preserve forest biodiversity and carbon stocks. Grasslands are good candidates to increase carbon uptake in soil while still ensuring basic food production in these ecosystems (Stahl *et al.*, 2017). Tropical pastures, often established after deforestation, can be exploited with CSA practices. Those include no fires and no overgrazing, grazing rotation plans and the use of mixtures of grasses and legumes to reduce nitrate use. A better integration of livestock activities in forestry and agricultural landscapes (agro-sylvo-pastoralism) can also be a source of carbon mitigation (Vigne *et al.*, 2016).

In drier tropical regions dominated by rangeland ecosystems, livestock plays an important role in the reorganisation of nutrient and carbon cycles through the recycling of dry matter to the soil in the form of manure. Harvesting surplus forage at the beginning of the dry season also has the potential to reduce the risk of bushfires and increase livestock productivity (Assouma *et al.*, 2019).

Downstream innovations must also be promoted. Several studies have investigated the large mitigation potential of dietary changes. For example, vegetarian or 'flexitarian' diets could substantially reduce the burden of livestock in carbon emissions. In LI and LMI countries, however, animal product consumption is on the rise. In this context, low-carbon labels, climate mitigation certification mechanisms or short value chains could be efficient tools for reducing GHG emissions. These market mechanisms require the completion of GHG inventories based on landscape carbon balances in order to inform consumers. ●

BOX 2

PASTORALISM IN THE SAHEL: A ZERO-CARBON LIVESTOCK SYSTEM?[1]

The environmental impacts of intensive and extensive livestock systems are highly debated in the scientific community. Extensive pastoral systems are assumed to be responsible for the highest rates of GHG emissions per unit of animal product, despite their small contribution to global GHG emissions. In fact, the carbon balances available for tropical agro-ecosystems are based on default emission factors provided by the IPCC, with high degrees of uncertainty due to the lack of in situ measurements in tropical systems.

To better assess the carbon balance of African pastoral systems, a study has been conducted in Ferlo, an open rangeland region in northern Senegal. The assessment took an ecosystemic approach. All the main sources of GHG emissions were considered, such as methane emissions due to enteric fermentation and emissions from manure, soil, surface water ponds, termites, bush fires and pump motors, and all sources of carbon sequestration were taken into account, including natural carbon sequestration by soil, trees and livestock. Carbon balance components were assessed monthly to account for the highly seasonal monsoon climate and the mobility of pastoral herds.

The study concluded that the annual carbon balance of the pastoral ecosystem was -0.04 $GtCO_2eq$/yr. This shows that total GHG emissions were mitigated by carbon accumulation in trees, soil and livestock. The carbon balance varied considerably with the seasons. This seasonality is explained by both pastoral practices and environmental factors. The negative carbon balance found in this study contrasts with the traditional reputation that African livestock systems have a major impact on climate change because of their low productivity per animal.

The other benefits of this ecosystemic approach are a better understanding of the drivers of the carbon balance, making it possible to identify appropriate and effective mitigation options with reference to the seasonal and between-year dynamics of the carbon balance. More widely, these new results call for more ecosystemic approaches to be applied to the analysis of carbon balances in agricultural systems worldwide. The challenge is to fully account for both negative and positive effects of agricultural activities on climate change.

1. Based on Assouma et al.*, 2019*

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