Study on

Future of EU livestock: How to contribute to a sustainable agricultural sector?

Executive Summary

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The United Kingdom withdrew from the European Union as of 1 February 2020. During the transition period, which ends on 31 December 2020, Union law, with a few limited exceptions, continues to be applicable to and in the United Kingdom and any reference to Member States in Union law shall be understood as including the United Kingdom.

Importance of livestock farming

- The physical and financial scale of EU livestock production means that it has far-reaching environmental, economic and social consequences. Livestock production is an important part of the economy in many regions including some marginal rural areas. The livestock sector contributes substantially to the European economy. In 2017, the value of livestock production and livestock products in the EU-28 was equal to 170 billion euros, representing 40% of the total agricultural turnover. The EU-28 is a net exporter on the world market and the international trade surplus in livestock commodities has steadily increased since 2000, reaching 3.7 billion euros in 2019.
- Livestock is present in almost all regions of the European Union and its social importance extends beyond employment; many of the valued landscapes and cuisines of the EU have evolved along with livestock production.
- General conclusions about livestock need to be drawn with care. Many of the contributions of livestock farming depend on the farming systems implemented and the territories in which they operate. Environmental impacts can be significant in areas of intensive farming, whereas in marginal zones maintaining livestock farming is a challenge for the conservation of many heritage ecosystems of high ecological value. In territories of mixed farming, the environmental benefits depend on the extent to which crops and animals are integrated.

Effects of livestock farming on the environment

- The livestock sector has negative impacts on the environment, through the consumption of resources and the production of physical flows (such as nutrients and greenhouse gases) that can affect biodiversity, human health and ultimately the functioning of the ecosystems upon which we depend for food production. The consequences of nutrient losses on the quality of surface and ground waters brought attention to the environmental impact of livestock farming in the 1990s. This was followed by concerns about the sector's contribution to global warming and the extent to which production might exceed so-called 'planet boundaries' notably biosphere integrity, land system change, fresh water consumption, nitrogen and phosphorus flows.
- In 2017, the EU-28 agricultural sector generated 10% of the region's total GHG emissions, which is less than industry (38 %) or transport (21%). However, further emissions arise outside the EU as a result of EU agricultural activity, through the production of inputs such as feed and fertiliser. Almost half of the agricultural emissions arising within the EU come from enteric fermentation (mainly from ruminants) and the management of manures (all livestock). Once emissions related to the production, transport and processing of feed are included, the livestock sector is responsible for 81-86% of the agricultural GHG emissions. EU-28 agricultural GHG emissions decreased by 24% between 1990

and 2013, driven by reductions in cattle numbers and improvements in productivity. Further reductions in emissions may be achieved via measures such as increased use of legumes, smarter use of manure, improved herd management, improved livestock health and changes to feeding practices. Methane emitted into the atmosphere is rapidly removed; about half will remain after a decade whereas N_2O and CO_2 remain several centuries. Reduction in methane emission intensity is therefore a powerful lever to slow down global warming but we need also to keep a strong focus on N_2O and CO_2.

- The regional concentration of animal production causes diffuse pollution of air and water. More than 80% of the nitrogen of agricultural origin present in all European aquatic environments is linked to livestock farming activities and livestock farms are the principal emitters of ammonia. Public policies such as the Nitrates Directive and the Water Framework Directive have been developed to tackle this issue. Much progress has been achieved by reducing protein supply and using synthetic amino acids to match the ration to the animal requirements. A major path for preserving nitrogen and reducing purchases of synthetic N fertilizer is the control of the entire manure management chain as losses vary from 30 to 75% of nitrogen excreted by animals at this stage. Technical measures and innovations are now available to limit emissions, in particular ammonia inside livestock housing, during storage and manure application to land.
- The role of European livestock on deforestation is hotly debated. A recent evaluation showed that the EU27 consumption was responsible for 10% of the global deforestation embodied in products such as soy, palm oil, meat, cocoa, maize timber and rubber. European soy imports are decreasing in line with the EU ambition to identify and promote deforestation free commodities.
- Livestock, especially ruminants, can have a positive impact on biodiversity and soil carbon via the maintenance of permanent grassland and hedges and optimized use of manure. These effects have been recognized within Europe. Permanent grassland area is protected by EU and national legislation and livestock seems to be concomitant with most of the High Natural Value agricultural areas, notably in grassland based ruminant systems. The social value of grasslands extends far beyond their direct economic value for animal production systems; about 50% of the endemic plant species of Europe are dependent on the grassland biotope, 50% of bird species depend on grassland habitats for food and reproduction and vegetation provides habitats for arthropod populations. These positive effects are modulated by practices. In general, intensification of grassland management negatively affects C sequestration and the specific floral richness and associated animal biodiversity (insects) in grassland decreases with the increase in the intensity of their use. At the landscape level, the conversion of permanent grassland to arable land remains the first factor explaining the decrease in the carbon content of soils and biodiversity losses in Europe. Drug treatment residues in manures contribute to affect the soil fauna and can be transferred to water and could

contribute to the dissemination of antimicrobial resistance. However, there is still very little information and much uncertainty about the soil fate of antibiotic resistance genes carried in manure and the potential human health risk.

Assessment of livestock systems

- The assessment of livestock farming systems is often carried out using life cycle analysis (LCA) and life cycle thinking is increasingly seen as a key concept for ensuring a transition towards more sustainable production and consumption patterns. Recent studies have concluded that (per unit of protein): (a) ruminants have much higher impacts in terms of greenhouse gas emissions and land use than other livestock commodities, (b) within ruminant production, dairy has a lower impact than suckler beef or lamb, (c) trends within livestock for other impacts are less marked, (d) grains have a lower impact than livestock for all impacts except water use.
- While LCA is a useful analytical approach, it has some weaknesses when applied to food and further improvements are needed to fully reflect the provision of services by livestock and farming systems and to ensure robust support for decision-making.

Effects of livestock farming on health and animal welfare

- Europeans consume large quantities of animal products per capita. Protein of animal origin covers over 50% of the total protein intake of European diets and per capita consumption is more than twice the world average, though still less than in North America. The potential negative health impacts linked to overconsumption of meat/animal products should be weighed against the nutritional benefits. Animal-based food are rich in several micronutrients and various bioactive components, which can offer nutritional benefits.
- As humans and animals share the same pharmacopoeia, it is important to reduce the use of antibiotics in livestock farming to reduce the risk of antibiotic resistance. The EU banned the use of antibiotics as growth promoters in 2006 and decided to ban their prophylactic uses from 2022. The overall decline in sale of antibiotics between 2011 and 2017 was 32%.
- Today many European citizens attach importance to animal welfare. Livestock farming systems should evolve in response to this by (a) minimising pain, fear and frustration and (b) promoting positive emotions and the expression of natural behaviours. Science can inform the debate by proposing objective indicators of animal welfare based on their internal emotional state.

Evolution of the sector

- Since the Second World War, the policy drive to ensure stable supplies of affordable food has profoundly changed traditional livestock farming.

Agriculture has been engaged in a vast process of modernization and intensification notably based on mechanization, land consolidation, farm enlargement, the use of synthetic inputs and other innovations developed by research.

- Since 1992, the successive reforms expanded the CAP objectives to environment and climate but with limited success. Linking payments to compliance with measures such as the Nitrates Directive (Council Directive 91/676/EEC) has made it possible to reduce eutrophication, while providing some GHG benefits by reducing N_2O emissions. The agri-environment-climate measure (AECM) encourages C storage practices but other measures (such as those seeking to support disadvantaged areas by maintaining ruminant systems), are not always compatible with the reduction of GHG emissions. The protection of biodiversity was present in the CAP but positive effects are still limited by a low level of ambition. The conditionality of greening, maintenance of areas in permanent grasslands and AEM correspond to growing ambitions but to decreasing importance in terms of budget.

Looking to the future

- The negative impacts of livestock farming on environment and biodiversity must be reduced. The European Union will probably not be able to meet its commitments made at COP 21 and achieving carbon neutrality in 2050 is very ambitious. Agriculture and in particular livestock are partly responsible for this as they represent an important source of greenhouse gas. The negative effects on water and soil are equally worrying: the recovery of water quality is far from being achieved despite the efforts made and progress remains to be made in reducing losses of N and P and the use of pesticides; soil carbon losses from the conversion of grassland and forest to cropland are important and fast, while the gains generated by the reverse conversion takes several decades and soil erosion affects 13% of the arable land in the EU. Global warming will affect production while the pressures exerted by irrigation on water resources are still significant, especially in the southern MS.
- The challenges go beyond the livestock sector, which is too often considered independently of other agricultural sectors. Matching economical and societal expectations regarding sustainability of our agri-food system, a conversion of the agricultural sector is required that targets nearly every aspect and requires the deployment of technology and new business models with supportive policies and legislation. As a part of the agri-food system, livestock farming should reduce its own impacts but it is also part of the solution. Re-connecting livestock and crop production offer tremendous opportunities to develop more efficient agri-food systems, to eliminate losses by recycling biomass between sectors, to reduce GHG emissions and contribute to removing CO_2 from atmosphere, to regain the quality of ecosystems while ensuring resource security and adaptation to climate. Livestock can also provide some valuable services more easily than the cropping sector (employment in marginal rural areas, landscape

management, and soil fertility). These provide new responsibilities for the livestock sector to achieve synergies.

Pathways to improved livestock sustainability

- By "improving livestock sustainability", we mean maintaining (or increasing) commodity production while reducing the net environmental impact associated with that production and increasing the ability of the sector to withstand physical or financial shocks. What livestock sustainability means in a specific situation will depend on a range of the factors, but could include increasing productivity, improving price and non-price competitiveness, enhancing ecosystem services and the improvement of quality of life for the animals and the people working with them.
- Broadly speaking, the sustainability of livestock could be improved in three ways: (a) through efficiency gains, (b) substitution of high impact inputs with lower impact alternatives, and (c) via more fundamental redesign of agricultural systems involving shifts from linear approaches to circular approaches.
- **Improving efficiency** can lead to reductions in the physical flows into and out of the production system, and the associated negative impacts that arise from these flows. We need animals with better balance between productivity and other production traits than in the past. In dairy systems, genetic merit for milk production remains an objective but cow fertility rate, the number of lactations per cow and the absence of diseases need to be considered. In beef systems, cow fertility, calf mortality, calf growth rates and precocity are important traits. In pig, broilers and eggs systems, the rate of genetic improvement of feed conversion rate might be lower in the future than in the past because of biological limits and animal welfare issues. Reducing piglet mortality and developing precision feeding will contribute to efficiency. For broiler and eggs systems the consequences of trends (slower growing birds, moving from cages to free range) must be evaluated. Efficiency should be considered at the animal/herd level but also at the level of the system considering recycling of biomasses. Improving efficiency should not compromise the resilience of production systems to climate or health hazards or their ability to restore the quality of ecosystems and secure resources.
- A second option is the **substitution** of one input with a lower impact alternative. The use of resource efficient N-fixing legumes and a well-managed return to the soil of livestock manure can significantly reduce the amount of synthetic fertiliser applied, thereby reducing the pre-farm and on-farm emissions (ammonia, nitrate and N_2O flows) while contributing to closing the nutrient cycles, reducing fossil energy use and increasing soil C content. Livestock manure is also a source of P. Another option is to replace protein rich feeds associated with land use change with alternative protein sources. Management of microbial communities to improve health through preventive

approaches along the food chain based on microbial ecology will allow further reductions in the use of antimicrobials.

- A third option is to identify **synergies** that can arise from integrating processes. There are a range of ways in which livestock can contribute to increasing the "circularity" of the food systems. This includes the ability of livestock to use a diversity of plants and recycle non-edible plant material in the food chain. This allows for diversification of crop rotations with benefits in terms of reduction of pest pressure and chemical inputs, closing of nutrient cycles, improvement of soil fertility, enhancement of biodiversity, reduction of specific crops for feed. Agroforestry is part of this approach. This also includes the development of exchange of manures between livestock and arable farming regions with expected benefits in terms of reduction of mineral N fertilization, increase of soil C sequestration, and reduction of nutrient losses. Manure bio-refineries will allow producing normalized bio fertilizers. Biogas production will generate renewable energy at farm level or for other sectors of economy.
- The future CAP should facilitate the sustainable transition of the livestock sector, for example by fully rewarding farm systems for the public goods they provide. The Eco-Scheme could vary support according to the lifespan of grassland as ecosystem services and floristic diversity increase with age (notably after 5 years). Supporting livestock farming in marginal areas for the maintenance of living territories must continue to be ensured by means of compensation for the additional costs linked to location and natural handicaps. Setting up a tax on gross emissions of the main determinants of agricultural GHG sources would be more efficient to foster innovation than taxing meat. Alternatively, development of "Certified emission reduction units" could advantageously replace a tax by facilitating on-farm implementation of GHG mitigation projects.

Conclusions

- Much can be done (via improved efficiency, employing low impact inputs and exploiting synergies) to reduce livestock's negative impacts and maximise its positive impacts. The Farm-to-Fork strategy opens the way towards a rejuvenated agriculture that stays within planetary boundaries; the goal is to arrive at a low carbon, resource efficient agri-food system that provides a wide range of environmental goods and services (such as healthy soils, biodiversity and an attractive landscape).
- Improving sustainability requires a systemic approach. There is a scientific consensus for more healthy diets partly rebalanced toward higher consumption of fruits and vegetables, less proteins of animal origin and less sugar. A reduction in EU livestock production is often proposed as a way of simultaneously tackling environmental and dietary issues. However, it should be noted that simply displacing production (and the associated impacts) from the EU to other parts of the world is not a solution. In many cases, the EU has

relatively efficient livestock production, so simply reducing European production while global demand for livestock products is increasing, may lead to net increases in environmental impact. Furthermore, different production systems have quite different environmental and economic performances that need to be factored into decision-making. Finally, the net environmental impacts of reducing livestock will depend on the subsequent land use change. Conversion of pastures to arable crops could lead to soil carbon losses and increased pesticides use, while conversion of pasture to woodland will provide benefits in terms of carbon storage, but may have negative impacts on, for example, rural vitality or wildfire risk.

- We should move away from simplistic plant v animal or extensive v intensive positions to promoting systems well adapted to the diversity of EU agriculture. It is clear that some countries would have difficulties in adopting extensive and grassland based systems while some others have more open choices for the future. At the same time, farmers have to produce food that meets consumer preferences, at prices they are prepared to pay. In this context, it should be noted that livestock are essential because they are recyclers by nature, which enables them to contribute to a more efficient agriculture by utilising non-edible biomass and by providing organic fertilizers. Furthermore, livestock farming is about more than food production; it contributes to many of the sustainable developments goals. The question should therefore not be "How can we reduce livestock production?" but rather "How can we increase the net social benefit of livestock, while ensuring the costs are distributed equitably?" In all case, we should remember that maintaining the competitiveness of the sector is essential.
- To fulfil its roles, livestock systems should evolve to provide a range of goods and services, rather than be guided by the single goal of commodity production. In doing so, the livestock sector will contribute positively to the main ambitions of the European Green Deal, Farm to Fork Strategy and Biodiversity Strategy.

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