

Livestock production and sustainable use of the global natural resource base.

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Introduction

Fueled by population growth, rising income and rapid urbanization, global demand for meat is expected to nearly double over the next two decades, from its current level of about 175 million tons to about 320 million tons per year by the year 2020. Growth will be especially strong in the developing world, where at the same time livestock will remain an important supplier of non-food services, such as traction, soil fertility inputs, and investments. In the year 2020, livestock production will be the most important agricultural sector on planet earth. With livestock production exerting both positive and negative effects on the environment, the way milk and meat is being produced over the next decades will therefore determine significantly the sustainability of our global natural resources.

In this paper, I will try to provide a global view of some key issues defining the sustainability of livestock production and processing. I will first provide an overview of important trends in global livestock demand and production modes and their environmental effects, then describe a number of general principles affecting livestock environment interactions, and finally provide an overview of the main instruments, which can be used to enhance the use of technologies, which promote sustainable livestock production. In doing so, I will take you on a journey through

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different production systems and parts of the world, and through technology, policy and economics. I hope that you stay with me on that journey.

Global trends in livestock production and their environmental impacts.

How livestock affects the natural resource base is mostly defined by the type of production system practiced. Production systems are agro-ecological systems, where similar combinations of market opportunities and resource endowment lead to similar production modes. We distinguish:

- (a) grazing systems, where animals get 90 percent or more of their feed from pasture;
- (b) mixed farming systems, where animals get at least 10 percent of their feed from crops and crop residues produced on the own farm.
- (c) industrial systems, where animals get less than 10 percent of the feed from the own farm.

Globally, mixed farming systems now produce more than half the meat, and 90 percent of the milk, but past trends show a strong growth of the industrial system. However, with globally little additional grazing land available, and also the opportunities for crop land expansion limited (the World Bank estimates that the world's arable farming area can be expanded with only about 25 percent (Crosson and Anderson, 1992)) the main effect of increasing demand for livestock products would be an increased pressure inside the grazing and mixed farming system. This is clearly shown already in the past trends. For example, over the period 1981 till 1993, the grazing system grew at a rate of 0.7 percent per year, the mixed system at about 2.2 percent, but the industrial system grew over that period at a rate of 4.3 percent per year. At the same time, the importance of some of the non-food services of livestock in the developing world, such as traction and saving, while still important, decreases as mechanization and more appropriate

rural finance institutions gain importance. These trends will have dramatic impacts on the environmental effects of livestock production:

First, the pressure in all production systems would increase. Three countervailing forces could affect that trend, and drive the balance back from the industrial system to grazing and mixed farming systems. First, recent experiences has shown that with rising feedgrain prices, especially feedlot producers will move quite rapidly out of the grain based feeding. Rising feed grain prices, will in particular affect the less efficient producers such as those in the former Soviet Union and North Africa. Second growing concerns about animal welfare is particular strong in Europe, and will affect the comparative advantage that the industrial system now has. And finally, environmental concerns could also affect this balance. That is the object of this paper. The latter two effects, plus the animal health concerns were clearly demonstrated in the last weeks in the Netherlands, where the government took the decision to reduce the pig population by one fourth.

Second, livestock production would become increasingly grain based. Still, with limited expansion possibilities of grazing land, it is most likely that livestock production is becoming increasingly dependent on concentrate feed. Livestock already consumes 32 percent of the global feed grain production, and this area is expanding at the rate of about 0.5 percentage point per year. The use of these arable areas for feed production has significant consequences on erosion, and water pollution with agro-chemicals. In Africa, the change in land use from grazing to cropping results in a rise in soil losses rise from up to 5 tons per hectare per year under grazing, to 10-40 ton per year under crops. Similar relationships, although at a somewhat lower level are the US. Chemical pollution can be demonstrated with the developments in China, where now extremely high Nitrogen levels (800 kg per ha) are being used.

Third, livestock production will move increasingly from closed to open production modes, with increasing production of waste, that can not be used within the system. Grazing and mixed farming systems are environmentally friendlier, as they are mostly closed systems, whereby the

waste products of one enterprise (manure, crop residues) are used in the same or the other enterprise. Industrial systems are, in principle, open systems, whereby the waste produced can not be used within the system. The industrial system already produces 8 billion tons of waste per year, and an increase of 4 percent per year will bring that to about 20 billion tons in the year 2020. Such enormous amounts of waste pollutes ground water and affects wild plant and animal habitats.

Fourth, the move towards more industrial production puts increasing pressure on domestic animal genetic resources. The demand of the industrial system for uniform genotypes puts great pressure on local breeds. Globally, it has been estimated that livestock breeds are at risk. Within breeds, the push for uniform genotypes also is reducing genetic variability. For example, calculates that by the year 2020 the genetic diversity of the Holstein Friesian breed has declined to 66 genotypes.

And lastly, livestock production will require greatly increased use of fossil fuels. The move from pure grazing systems to integrated grazing/feed lot beef production already leads to considerable increase in fossil energy requirements. For example, beef cattle in Australia and US use about 25-50 times more energy per kg protein produced than the herders in the Sahel (Breman and de Wit, 1983).

These are worrying trends, which will affect the sustainability of livestock production and global natural resources. I will not elaborate on the definition of sustainability. It is clear that it means different things to different people. However, if sustainable agricultural production is thought in terms of flexibility over time to produce enough food and fiber, the balancing of non-renewable resources, keeping use in equilibrium with the creation of new resources, and keeping the production of waste within the assimilative capacity of the local environment, then serious measures are necessary.

The basic principles

Some of the key general principles to consider in identifying these measures are:

- (a) *Removing the causes of the environmental degradation is often more effective than seeking to control the symptoms.* Removing the incentive to cause the problem eliminates the problem once and for all and requires no enforcement supervision. Thus, for nomadic herders in Africa, alternative employment generation, good pricing policies and the transfer of the responsibility for the stewardship of their land, through the reinforcement of their traditional users rights on rangelands in arid and semi-arid grazing systems, is more effective than trying to control, through outside authorities, the animal stocking rate of these lands.
- (b) *The way incentives are targeted is of overriding importance.* A key lesson from the past is that achieving social objectives (i.e. increasing farmers income) should not be coupled to mechanisms which determine market prices. For example, the input subsidies and price supports on meat and milk in the EU caused the concentration of intensive units in several OECD countries. Direct income support, or targeted subsidies on environmental friendly technologies would have better.
- (c) *Within a production system, economic policies and institutions define the relative prices of the inputs, and these relative prices, in turn, induce the type of technology which will be used to produce or process agricultural products (Hayami and Ruttan).* For example, phasing out subsidies on in-organic fertilizers, such as occurs now in many developing countries, favors the use of compost and manure to maintain soil fertility. In another example, the introduction of taxation or limitations on Phosphate or Nitrogen emissions through manure, such as being imposed in a number of OECD countries, induces the use of better balanced feed and enzymes such as phytase, to reduce the amount of N and P excreted. It is therefore our challenge to define the policy measures which induce more sustainable livestock production and processing technologies.

Specific instruments to mitigate the negative and enhance the positive effects.

Quite clearly, blanket approaches to mitigate the negative and enhance the positive effects of livestock are not possible. Two important reasons for a local focus are first, that the sustainability of livestock production is mainly a result of the local resource endowment, and prevailing policies and institutions. A thorough understanding of the local situation is therefore required. Even more importantly, second, certain societies, especially in the developing world, give a higher value to income generation and food security, and lower values to immediate environmental concerns. Any intervention needs therefore to be designed according to prevailing local conditions, balancing human needs and environmental concerns. Blanket approaches are therefore not appropriate.

Still, there are some general principles, to enhance the positive and mitigate the negative effects of livestock development:

The first step would be to increase emphasis on education and public awareness. This could include

- the promotion of greater awareness of the linkages between the consumption of livestock products, health and environmental effects. This is strongly advocated by environmental groups, although experience indicates that, up to a consumption level of about 60 kg meat and 100 kg milk per year, meat and milk products have a very high income elasticity of demand and restricting consumption in the developing world seems therefore highly unlikely. Assuming in our future projections that the developing world accepts to consume significantly less animal protein than we are currently doing in the developed world is therefore not justified.

- The promotion of environmentally friendlier technologies, such as organic farming and low external input sustainable farming certainly has a place, but the market share of its products seems to stagnate at 10-20 percent at best.
- For me the most effective opportunities lie in the promotion of greater environmental awareness at producers level. Farmers and especially young farmers education on the possibilities of more sustainable production forms has large pay-offs. For example, the introduction of farm level mineral accounting in the Netherlands, made farmers aware of nutrient loading and led to more targeted and lower fertilizer applications. Primary education inputs into village level natural resource management in Burkina Faso has also shown to be one of the key factors in successful land management activities.

Better education will not lead to more sustainable production, if based on poor information. And here the situation is rather shocking. Decision making is seriously hampered by the lack, or circulation of incorrect information on the size and direction of livestock-environment interactions. This has serious consequences, and has led to wrong decision making. For example, in “desertification”, which conveys images of advancing deserts, the focus has been on investments in arid areas, whereas it is now quite clear that the real problem is in the semi-arid and sub-humid areas. But also there is little information available on the positive effects of livestock on, for example land and bio-diversity. I have already mentioned the need to monitor resource use changes as a form of education.

Information is definitely lacking on the value of some of the environmental costs and benefits of livestock production. But unless we arrive at reasonable information levels on what the increase in BOD of 1 cubic meter water costs, or what the environmental benefits of breed conservation or 1 ton of carbon sequestered are, will it be difficult to establish the correct policies. This leads us to the next point.

The *introduction of realistic prices for inputs and products* would be a key instrument to induce more intensive and at the same time environmentally friendlier livestock production and processing. Ideally, the prices of meat and milk should reflect all direct and indirect costs that embody the proper valuation of environmental costs and benefits. We therefore argue, that environmentally the most appropriate balance between the different production systems and human needs is established, if all environmental costs are internalized and the environmental benefits are adequately shared. Internalization of environmental costs promotes efficiency of input use and therefore reduces the production of waste and saves non-renewable resources, and hence improves the sustainability of production. The use of price and other financial incentives are particularly effective where we have weak institutions to control and regulate waste disposal, such as exists in many developing countries. For the costs side this covers:

- the introduction of market pricing for all inputs for the intensive production systems, such as feed, AI, and veterinary treatments, but also for the more extensive systems, such as communal water and grazing. For example, the phasing out of subsidies on fuel and machinery in the Middle East, have reduced crop encroachment in critical dry-land grazing areas. Market pricing on AI shifts the emphasis of using introduced breeds and losing bio-diversity to the use of local breeds
- the abolition of price supports for meat and milk on the one end, and paying market prices on the other. In this respect, the recent reaction of Sahelian pastoralists to the livestock price increase following the devaluation of their currency and the reduction of EU dumping was interesting: It caused a strong increase in off-take, and hence a reduction in grazing pressure;
- introduction of levies and taxation on waste disposal: Acceptance of this “polluter pays” principle is getting more wide-spread (although certainly not yet universal) acceptance. A key issue is the appropriate valuation of these environmental costs. While some information is available on internalizing environmental effects of waste treatment in industrial production units (for example in 6-10 percent for swine

production in Malaysia and Singapore respectively and 6 percent for Australian feed lots), these valuations don't cover the other environmental costs of feed production, etc.. Cost valuations of meat and milk produced in grazing or mixed systems are even scarcer.

Even more difficult and controversial is the equitable distribution of environmental benefits, because of the lack of appropriate valuation techniques and the problems of distributing those benefits in an equitable fashion. Sharing of environmental benefits provides a direct interest in preserving that good. One of the most obvious examples of course is the benefit sharing of benefits coming from tourist and other forms of wildlife utilization by the users of the common grazing areas in Africa, where still major issues of valuation (how much) and equity exist. Similarly, over the recent year there has been substantial data showing the increased carbon-sequestration capacity of improved tropical savannas in South America. Redistributing the benefits of a reduction of global warming (estimated at about US \$ 5 per ton CO₂ sequestered) would greatly increase the attractiveness of such enterprise. But how to fund such a system?.

The creation of appropriate institutions is the other critical component of any effort to improve the environmental sustainability of livestock production and processing.

This means first, that we need clear and enforceable rules for access and ownership of land, water and Bio-diversity. For example pastoral development in Africa would be environmentally more sustainable if access rights to critical dry-season grazing areas were clearly established and enforced. Clear ownership rights on bio-diversity by local communities would help to promote a better livestock-wild life association. Land titling procedures also play an important role. One of the main driving forces behind the deforestation in tropical America, is the requirement that only cultivated land can be owned. You can own a ranch but not a forest. This is clearly a perverse incentive for deforestation. Clear and enforceable rules are therefore important.

The second main institutional requirement concerns the use of decentralized decision making and local empowerment in arriving at sustainable resource use. Decisions about local range or water use should not be made in a capital Nairobi, (as it should not be made in Washington). While experiences with pastoral associations and range management is not always a success, we have now several examples of pastoral groups who are mastering the internal discipline to improve the management of their rangelands. On the other hand we have also examples of environmental cooperatives in the Netherlands, who, through a self-imposed system of levies and subsidies, are reducing N and P emission in surface water.

Where will this lead us to the following global livestock and natural resource sustainability scenario, again, of course with the proviso, that this is a global view, which need to be adapted to local reality.

The *grazing systems* will remain a source of source of extensively produced animal products. There is some possibility of intensification in the higher potential areas, and diversification everywhere. Better benefit sharing mechanisms, and stronger institutions will lead to such diversification with tourism, carbon sequestration, etc... In this context, livestock's role can be to protect land and bio-diversity.

The *mixed farming* system will see continued intensification and growth. Small holder and family farms will remain important, and increasing demand and reduction of input subsidies in the developing countries and increasing restrictions on waste emission in the developed world will favor mixed farming. Within that system, the phasing out of input subsidies will induce improvements in the nutrient and energy cycle. Livestock's role will be enhance and substitute natural resources.

In that sense, also the industrial system will evolve into a mixed farming system, but seen from a regional perspective. Internalization of the environmental costs and stricter zoning will lead to a blend of resource saving technologies and a better distribution of industrial units, more in line

with the absorptive capacity of the land. These new mixed-industrial systems will be based on the absorptive capacity of the land, if nutrient balances are to be maintained and the environment's ability to absorb pollutants is to be respected. The systems purpose must be to produce efficiently at low costs, and in all our discussions, the main focus should be intensify, but do not concentrate.

If we achieve that, we can continue the international public good character of livestock development:

food and nutrition, particularly in view of a large portion of the world's population suffering from hunger and malnutrition

poverty alleviation, and the opportunities to use livestock for the generation of income of the poor

health, meaning human health but also animal health where it constitutes a human health hazard and the natural resources.

As we have seen in previous presentations, there are important trade-offs between these public goods.