Environmental issues associated with livestock production intensification in rapidly growing economies: problem statement and identification of policy needs in Asia

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1. Introduction

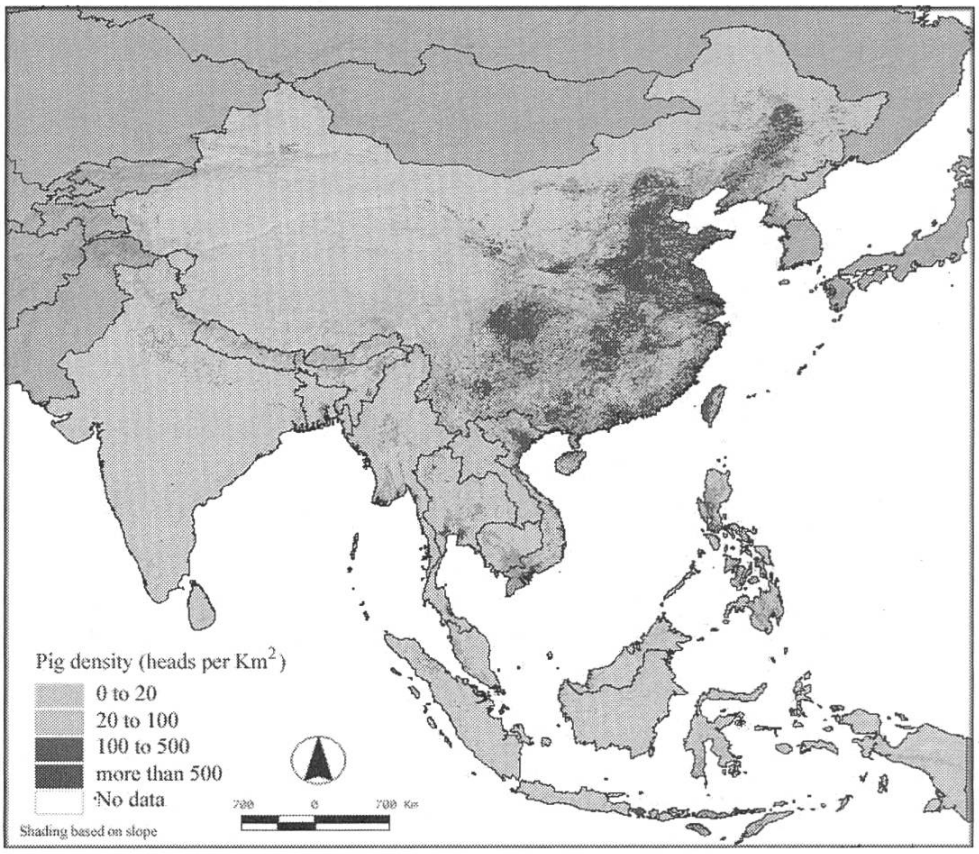
The term "Livestock revolution" has been used to describe the rapid expansion of livestock production in developing countries (Delgado et al., 1999). If trends in animal products production and consumption are rather similar, it is nevertheless proposed that the growth in production is driven by demand, the latter being mainly fuelled by population growth, urbanisation and income growth in developing countries (De Haan et al., 1998).

Globally, this growth trend is not uniformly spread. The annual growth rate for meat production between 1982 and 1994 was 5,4 % for the developing world and only 1,1 % in the developed world. Furthermore, among developing countries, Asia has the fastest growing livestock sector. Over the same period the annual growth rate for meat production was 8,4 % in China and 5,7 % in Southeast Asia. This can be attributed to the following factors: increasing urbanisation and population, and faster economic growth in these countries.

Recent analysis (Delgado et al., 2002) predicts that this trend will endure over the next 20 years, although the pace of growth may dwindle. Over the 1997–2020 period, annual growth of consumption is predicted to average 3,0 % in China, 3,3 % in Southeast Asia, and 2,8 % in the developing world.

The livestock sector is responding to this surge in demand for livestock products with some drastic transformations. These transformations basically take four different forms (De Haan et al., 1998). First, livestock production tends to concentrate in areas favoured by cheap input supplies (particularly feed), and by good market outlets for livestock prod-

ucts. Such conditions are found in the vicinity of large cities. In Asia, high concentration levels are indeed observed around urban centres such as Hanoi, Bangkok, Manila, Guangzhou, and in highly populated areas such as the south-eastern Chinese coast or the area between Shanghai and Beijing, cf. Map 1. Second, the proportion of livestock production met by specialised and intensive industrial systems is rapidly increasing, as those systems react faster to growing demand. The rapid growth in scale is general, and the new settlements directly compete with land-based, small-scale production, sometimes supplanting them. The industrialisation of production leads to a disconnection between livestock activities and cropping activities. This happens on a functional level (large-scale livestock production shifting to industrial type management), and on a spatial level (industrial livestock activities moving towards peri-urban areas). Third, the production is shifting from ruminants (e.g. cattle, sheep, goats), to monogastrics (e.g. pigs, laying hens, broilers, ducks), that have a better feed conversion ratio. Fourth, vertical integration along the land–livestock–food chain creates economies of scope.



Map 1: Estimated pig densities in selected Asian countries – 1998 to 2000, (Gerber et al., 2005).

2. Potential impacts of intensive livestock production

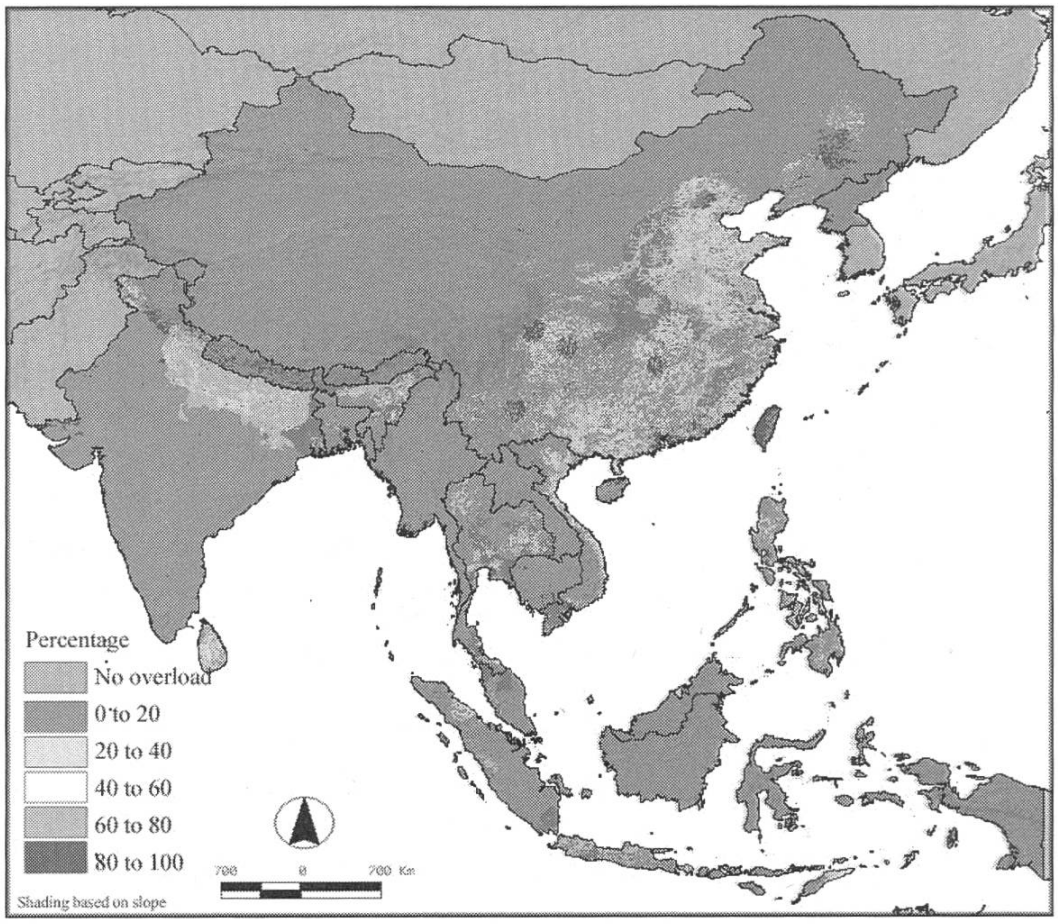
2.1 Environmental impacts

The geographical 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, over feeding of fish ponds, and improper waste disposal of agricultural (e.g. livestock) or industrial wastes. Nutrient overloads in the crop–livestock systems mainly occur when the nutrients present in manure are not properly removed or recycled. The major effects of animal waste mismanagement on the environment have been summarised by Menzi (2001):

- 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 (Correll, 1999; Zhang et al., 2003).
- Leaching of nitrate and possible pathogens transfer to the ground water from manure storage facilities or from fields on which high doses of manure have been applied. Especially nitrate leaching and pathogen transfer are threats for drinking water quality.
- Accumulation of nutrients in the soil if high doses of manure are applied. This can threaten soil fertility.
- Natural areas such as wetlands and mangrove swamps are directly impacted by water pollution, often leading to bio-diversity losses.

Gerber et al. (2005) have implemented comparative analysis of phosphate excreted by livestock and phosphate supplied by chemical fertiliser in Asia to assess the actual impact of livestock on nutrient fluxes. On average, livestock excretion accounts for about 40 % of the P_2O_5 load, however Map 2 shows a contrasted pattern: chemical fertilisers represent the bulk of the P_2O_5 load in lowlands where rice is the domi-

nant crop (FAO and World Bank, 2001): Ganges basin, eastern and southern Thailand, Mekong delta, and eastern China (Jiangsu, Anhui and Henan provinces). On the other hand, manure represents more than half of the phosphate surplus in north-eastern China (Liaoning and Jilin provinces), south-eastern China (Sichuan, Hubei, Fujian and Guangdong provinces), Taiwan, and at the periphery of urban centres such as Hanoi, Ho Chi Minh, Bangkok, and Manila. As shown above, pig densities are generally important in these areas. These observations suggest that there is high potential for better integration of crop and livestock activities. In overloaded areas, part of the chemical fertilisers could in fact be substituted by manure, thus substantially decreasing the environmental impacts on land and water.



Map 2: Estimated contribution of livestock to total P_2O_5 supply on agricultural land, in area presenting a P_2O_5 mass balance of more than 10 kg per hectare. Selected Asian countries – 1998 to 2000, (Gerber et al., 2005).

2.2 Other impacts

As a result of economies of scale, industrial livestock production generates substantially lower income per unit of output than smallholder farms, and benefits at production level occur to fewer producers. While cheap animal protein also indirectly favours poor consumers, the poverty and equity effects, as regards industrial livestock production, are on balance largely negative (De Haan et al., 2001).

There are also a number of animal diseases associated with increasing intensity of production and concentration of animals on limited space; many of them pose a threat to human health (zoonotic diseases). Industrial and intensive forms of animal production may be a breeding ground for emerging diseases (Nippah, Bovine Spongiform Encephalopathy, Avian Flu), with public health consequences. Finally, animal products from intensive production systems tend to have higher residue contents (Nardone and Valfre, 1999).

3. Need for environmental policies

Pilot studies conducted by the Livestock Environment and Development (LEAD) initiative based at FAO (FAO – LEAD, 2003) have shown that in Thailand, Vietnam and China, the negative externalities associated with the intensification are not properly addressed by the current policy frameworks. Indeed existing policy measures are mostly not adapted to a quickly changing livestock sector, nor are they properly implemented.

Ineffective enforcement of the existing regulations on livestock waste management is mainly caused by (a) absence of an effective policy framework clearly linking the environmental concerns to the operational considerations of livestock production; (b) poor enforcement and general disregard of the existing legislation; (c) lack of capacity at lower levels of government to monitor effluents, enforce regulations or advise farmers on appropriate management approaches; and (d) widespread ignorance of the cumulative environmental impacts, public risks and negative externalities associated with inadequately managed manure disposal (FAO – LEAD, 2004).

There is therefore need for decision-makers in livestock development and economic planning to obtain reliable information about the structural evolution of the livestock sector and its implications. There is also a

need for policies and techniques that can re-direct the livestock sector towards more sustainable development paths. In this respect, policies will have to balance four main objectives that are: food security, food safety, preservation of natural resources and poverty reduction (Schillhorn van Veen 1999; De Haan et al., 2001).

4. Preliminary review of environmental policy options for intensive livestock operations

Environmental policy options for intensive livestock operations may include (a) the commitment to master planning of livestock production (at national and provincial levels) needed to direct the geographical focus of future intensive livestock production; (b) the development of livestock waste recycling and discharge standards based on the polluter pays principle; (c) the reduction of subsidies for chemical fertiliser use and the fostering of safe manure recycling; (d) the development of best management practices; (e) the development of a replication strategy for the adoption of best practices including demonstration as well as training and extension programmes; and (f) the development of public awareness of the longer-term social welfare issues and the more immediate public health risks associated with current manure management practices (FAO – LEAD, 2004).

Pilot studies conducted by LEAD (FAO – LEAD, 2003) have shown that the spatial planning of livestock production could be the core measure to prevent various negative impacts related to livestock production. With regard to the environment, appropriate siting of the production unit is a key element to control damage to the ecosystem from nutrient losses, as well as to control odour issues. Regarding poverty reduction, the settlement of part of the production in rural areas, in combination with specific production management (e.g. contract farming, co-operation) could help the remote areas to profit from urban growth. Finally, zoning is often used to support disease control, in addition to techniques implemented on farms. This is especially the case with regard to highly contagious diseases whose control requires that farms are appropriately spaced (e.g. Foot and Mouth Disease). In addition, the location of farms affects directly the profitability of the production unit.

Although numerous environmental policy options for intensive livestock production have been identified, the decision maker is unable to implement the policy objectives in accordance with his/her assessment. A

preliminary review of past experiences in this field show that while various single aspects have been studied (e.g. optimisation of manure management at farm level, optimisation of nutrient loading and spatial manure allocation at watershed level, ex ante environmental and economic evaluation at national level), little has been done to test environmental policies with regard to their combined impacts on the environment, rural development and land use at local level (Gerber, 2003).

5. Conclusion

In South East Asia, livestock is reacting to a rapidly changing socio-economic context, which materializes in structural changes, and in particular in the development of a highly competitive livestock industry. In such a process, public goods are not properly accounted for; in particular, the environment and public health are often at risk. There is therefore a need for policies to bridge the gap between private and social interests.

Because the enforcement of new policies is often sensitive, and because environmental regulations can have wider effects than the strict environmental issue they intend to tackle, there is a need to test their consequences. In particular, environmental policies will affect farmers' income and labour demand, with some consequences on rural development. The objectives of the author's further research are to construct a conceptual framework and to implement on-farm models for the ex-ante evaluation of environmental policies for commercial livestock operations in developing countries.

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