Environmental Effects Of The Beef Industry

Liu Fang
Institute of Agricultural Economics
Chinese Academy of Agricultural Sciences

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School of Natural and Rural Systems Management
University of Queensland
St. Lucia 4072
Australia

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ABSTRACT

Environmental pollution caused by livestock industries has become a problem faced by countries worldwide. Since the 1990s, the cattle and beef industry in China has developed rapidly. Based on a study of the beef industry in the 'Zhongyuan (or Central Plains) Beef Belt', particularly in Henan, Shandong and Hebei provinces, this paper surveys the present state and the causes of the environmental pollution caused by the beef industry—cattle raising, slaughter and tanning—in this region. It concludes with some policy recommendations.

Introduction

Accompanying the policies of openness and economic reform, the Chinese livestock industry has developed rapidly over the past twenty years. From what was once a traditional albeit extensive sideline of rural economic activity, the industry has become a mainstay of many rural areas. The development of the industry has been particularly aided in the 1990s by the 'straw for ruminants' program, aimed at utilising the 600 billion tons of crop straw produced each year. The industry has changed from a traditional mode of production (in which cattle are raised mainly for draught purposes) to a commodity-based mode of production (in which cattle are raised mainly for meat and milk). As part of this change the centre of beef production has transferred from pastoral areas to crop-producing areas and the 'Zhongyuan Beef Belt' that now extends over the crop-producing provinces of Henan, Shandong Hebei and Anhui.

With the rapid development of the beef industry, the intensity of raising beef cattle has also increased. On the one hand this has had a positive impact on the sustainable development of agriculture, bringing both ecological and social benefits. Ruminants use a large quantity of crop straw and their manure is returned to the soil. This utilisation of manure can increase the content of organic matter in the soil, and reduce the need to use chemical fertiliser thus alleviating fertiliser pollution. Furthermore, since it builds up the organic matter in the soil, it improves the structure of soil. It also decreases the air pollution that results from burning large amounts of crop stalks.

On the other hand, with the increasing scale of production, more and more wastes are produced by the beef cattle industry. According to a report of the Henan Environmental Protection Administration, there were more than 200 lawsuits caused by cattle and beef industry pollution in Nanyang City of Henan province in 1998 alone. Waste produced by the beef industry has become a new source of pollution in China, that has implications for the health of the human population.

1 The Effect of Beef Cattle Raising on the Environment

1.1 Review of Beef Cattle Industry Development

Traditionally, most households in China raised one or two cattle typically in courtyards. The main aim of raising cattle was for draught purposes, so the cattle were generally not culled for slaughter until they were too old for draught work. But in recent years, with improving living standards and changing food consumption patterns, the demand for beef has increased. The development of commerce and the tourist industry has also boosted beef consumption. Moreover, the demand has increasingly been for beef obtained from cattle fattened with grain over a short period.

The fattening of beef cattle requires a considerable financial commitment not only to buy feeder cattle but also for veterinary products and to build sheds and silos. The funds required are often beyond the capacity of small households.

At the same time, the fattening of beef cattle involves certain commercial uncertainties. Because the feeders constitute a large proportion of the final production, if the market falls away feed-lotters will sustain losses. Only when the feedlots, slaughterhouses and packing factories are integrated can the uncertainty be minimised. This factor also places the activity beyond the capacity of small households.

Specialised feedlots – rather than small households – are not able to meet the market demand for quality beef. Accordingly, the increasing demand for high-quality beef has resulted in the increasing scale and intensity of the cattle and beef industry. In recent years, a large number of specialised beef feedlots have appeared in addition to the number of cattle raised by households. This is illustrated in Table 1.

Table 1: The Number and Scale of Specialised Feedlots in Typical Counties

Province name	County Name	Year	Cattle inventory 0000 head	Cattle turn off (10000 head)	Number of specialized feedlots	Scale of the specialised feedlots (head)				
						50-100	101-500	501-1000	1001-2000	> 2000
Shandong		1997	1460.8	479.1	2942	2700	224	12	5	1
Shandong	Caoxian	1996	65.5	21.9	61	38	19	2		2
	Pingdu	1995	44.8	15.9	58	20	33	4		1
	Yucheng	1996	22.0	11.0	40	17	16		6	1
Anhui	Mengcheng	1995	60.0	21.0	31	28			2	1
	Lixin	1995	51.2	20.5	15		12		2	1
Henan	Huaiyang	1995	39.1	15.6	37	37				
	Shangqiu	1995	35.6	14.9	2		1	1		

Source: 5th Symposium on the Development of Chinese Livestock Husbandry in Agricultural Areas.
Survey data from Shandong Province.

Table 2: The Changing Scale of Cattle-Raising in Typical Counties

Name of county		Number of different size feedlots (or households)	1985	1990	1995	1997
Yucheng County of Shandong province	The distribution of different size of beef raising in the whole County	<3	62404	61422	56968	53778
		3-10	41602	48030	53580	58500**
		<50	0	2234	3420	4680
		50-100	0	8	15	22
		>100	0	4	17	23
		Cattle inventory at the end of year (10000 head)	0.12	0.34	7.43	10.22
Weichang county of Hebei province	The distribution of different size of beef raising in the whole County	<3	55000	58000	60000	61000
		3-10	1500	1800	3120	4240
		<50	4	40	300	500
		50-100	5	4	20	30
		>100	2	2	12	20
		Cattle inventory at the end of year (10000 head)	4.325	4.9873	6.3	7.609

Source: Shandong and Hebei Livestock Husbandry Bureau.

The scale of raising beef cattle also tends to be larger and larger in the Zhongyuan Beef Belt which includes Hebei and Shandong provinces. From Table 2 it can be seen that in these provinces the number of households which raised less than three head increased little from 1985 to 1997 and actually decreased in Yucheng County. On the other hand the number of households which raised three to fifty cattle went up more than three times. Furthermore, the number of large feedlots also increased: the number of feedlots with a capacity of more than 100 cattle increased from zero in 1985 to twenty in 1997 (with seven feedlots having more than 500 cattle.) These changes were typical of the rapid development of beef cattle husbandry in the Zhongyuan Beef Belt.

- **Analysis of the Effect of the Beef Cattle Industry on the Environment**

In the following analysis, different aspects of beef cattle production that affect the environment are distinguished and evaluated. The (+) and (-) sign(s) indicate the nature, and magnitude, of environmental effects in the absence of controls.

1) The use of crop residues to recycle the waste produced from the farm production to avoid smoke pollution caused by burning overstock crop straw (+ +).

A number of factors caused low, and significantly reducing, use of crop stalks:

a) With the development of the rural economy and the increase in farmers' living standards, new rural energy sources such as charcoal, coal gas, sludge gas and electricity have been utilised. Formerly, there was heavy reliance on crop stalks. Thus the amount of straw used as fuel has reduced significantly.

b) Chemical fertilizer is very convenient to use and the yield of farm produce can increase remarkably. Chemical fertilizer is thus used in a large quantity.

c) Chinese agriculture is based on small-scale households. The mechanisation of agriculture is still at a very low level. So it has been difficult to return crop straw into the soil directly. Moreover if crop residues are returned to the soil directly, a lot of plant diseases and insect pests will also be returned into the soil, and that can do great harm to agricultural production. For these reasons the amount of residue returned into the soil is

very small.

d) Before 1995, there were many straw pulp paper mills all over the country. Most of them used wheat straw and rice straw. At that time, farmers could sell the surplus of crop residues to the local paper mills. But in 1995 the State Environmental Protection Administration (SCPA) closed down all of the medium and small-sized crop residue pulp paper mills as all these mills polluted seriously and were unable to treat the pollution. This also caused more overstocking of surplus crop residues.

As a consequence, in each autumn harvest, farmers burnt away large quantities of crop residues in the field or at the edge of it. This has a number of effects. Firstly, it causes a reduction in the organic content of the soil. As a result the soil is hardened and becomes impervious, and is unable to retain water as before. It also causes air pollution and leads to poor air visibility. According to a May 1997 report, as a result of the burning of crop residues (wheat straw), Shuangliu airport (Chengdu City, Sichuan Province) was badly affected by smoke and the visibility was so poor that it was below the limit at which aeroplanes were able to take off and land. In one instance, Shuangliu airport had to be closed for four hours, with 22 scheduled flights diverted and eight cancelled. In addition, accidents also occurred at Shijiazhuang airport in Hebei province and on the Jinan-Qingdao highway. As a consequence, each province successively instituted strict regulations to prohibit the burning of crop residues.

The crop residue contains abundant quantities of nitrogen (N), phosphorus (P) and potassium (K), (see Table 3). As a result, because about 40-50 per cent of crop residues were burned as fuel or were burned at the edge of field each year, more than 120 million tons of nitrogen, 28 million tons of phosphorus and 280 million tons of potassium was burned out. The Agriculture Circumstantial Protection Bureau (ACPB) estimated that in 1990, about 105 million tons of crop residue was burned with about 0.33-1.64Tg CH_4 and 0.0082-0.0297Tg N_2O produced.

Thus, the burning of crop residues not only wastes an energy resource but also pollutes the environment.

Table 3: The Composition of Crop Residues Nutrition

year	**the amount of crop residues** (hundred million tons)	**N** (10000tons)	**P** (10000 tons)	**K** (10000tons)	**The percentage of N, P, K contained in straw in chemical fertilizer used in China** (%)
1997	6	300	70	700	25

A large quantity of crop residue was burned because the peasants were unable to find a good way to use it. However, in light of the fact it was a rich resource, the Chinese government established its 'straw for ruminants' project in several main agricultural provinces such as Shandong, Henan, Hebei and Anhui. The implementation of the 'straw for ruminants with manure return to soil' project established a new way to use the surplus crop residues and made it possible to prohibit burning. Within the last few years, this project has been very successful. With the spreading of techniques such as silage and ammunition, more and more crop residues are being used to feed, the amount increasing from 20 per cent in 1992 to 28 per cent in 1996. At the same time, the proportion of straw treated for feed increased from 4.2 per cent to 9.5 per cent. In 1996 alone there was about 85 million tons of silage and 80 million tons of ammunition produced. This meant that more than 20 million tons of grain had been saved (the protein content of 5kg ammunition maize straw and of 2.5kg ammunition wheat straw is equal to that of 1kg maize).

Table 4: The Condition of Crop Straw Used for Ruminants in Typical Counties

Region name	Year	Area of cultivated land (10000 mu)	Cattle inventory (10000 head)	Turn off (10000 Head)	Output of crop straw (10000t)	Amount of feed straw (10000t)	Amount of silage and ammunition (10000t)	Percentage of feed straw in the output (%)
Yucheng	1997	80.33	22	12	100	40	33	40
Sanhe	1998	53	11.13	17.19	66	34.5	20	52.3
Huaiyang	1992	95.11	22.6	6.45	118.4	54.4	1.32	46

Source: Yucheng, Henan and Sanhe Livestock Husbandry Bureaus.

- **There are a lot of trace elements such as N, P, and K in cattle manure and urine. If this waste is treated effectively, more organic fertilizer could be supplied, the use of chemical fertilizer reduced, the soil pollution mitigated and the quality of soil increased (+ +).**

One standard head of cattle can produce 20kg manure and 10kg urine each day, or 7300kg manure and 3560kg urine each year. According to expert analysis, in fresh manure there is about 20.3 per cent organic materials, 0.34% N, 0.16% P_2O_5 and 0.4% K_2O. So 1000kg cattle manure and urine is equal to 7.4kg urea, 7.6kg calcium superphosphate and 6.6kg potash chloride.

Table 5: Amount of Manure and Urine in a Typical Feedlot

Type	Head	Stan-dard cattle	Waste (kg/day)		Waste (ton/year)		Chemical fertilizer that can be instead by waste (ton/year)		
			manure	urine	manure	urine	Urea	calcium	potash
Breeding cow	1	1	20	10	7.3	3.65	0.08	0.08	0.07
Calf	1	0.5	10	5	3.65	1.83	0.04	0.04	0.04
feeder	1	0.75	15	7.5	5.48	2.74	0.06	0.06	0.05
household	2	2	15	10	10.95	7.30	0.135	0.14	0.12
	3	3	15	10	16.43	10.95	0.202	0.21	0.17
	10	10	15	10	54.75	36.5	0.674	0.70	0.58
feedlot	100	100	15	--	547.5	--	4.05	4.17	3.47
	200	200	15	--	1095.0	--	8.10	8.34	6.94
	300	300	15	--	1642.5	--	12.15	12.5	10.4
	400	400	15	--	2190.0	--	16.20	16.7	13.9
	500	500	15	--	2737.5	--	20.25	20.9	17.4

Source: Environmental impact assessment report on the development of small-scale beef cattle project.

Table 6: Annual Discharge of Manure and Urine and the Amount of Fertiliser It Can Replace

Province	Cattle No	waste (10000 ton/day)	Amount of fertilizer can be instead (10000 ton/year)	Cropland area the waste can be used in (10000 hectare)

name	(10000 head)	manure	urine	urea	calcium	potash	high product land	low product land
Sandong	773.1	3675.9	1838	40.74	41.98	34.98	73.5	183.8
Hebei	618.7	2941.8	1470.9	32.6	33.6	28	58.8	147.1
Henan	1298.2	6172.6	3086.4	68.4	70.5	58.7	123.4	308.6

Source: Provincial yearbooks.

Note: Because there are no the statistics of the year average number of beef cattle, the figure is estimated according to the inventory of the end year. Normally, the number of the inventory at the end year is the lowest number for the whole year, so the figures reflect this.

- **If the cattle waste is not treated effectively, it could lead to serious pollution from the manure, the odour, and the high density of organic materials and N and P (- - -). This will pollute the surface water and groundwater, cause the brooks to turn black, to smell and become rich in nutrition (- - -). The spreading of pathogens may cause infectious diseases in livestock and also affect human health (- -). Moreover as a ruminant livestock, cattle can breathe out greenhouse gases, such as CH_4 and CO_2 (-).**

In past years, the traditional mode of cattle raising has been based on 'one house, one head'. At that time, the cattle waste did not pollute the environment but rather was the main source of organic fertilizer for the soil. The small amount of waste produced during the meat-production process was also easily absorbed without affecting the environment. But in recent years, with the rapid development of the beef cattle industry, a large quantity livestock wastes have been produced. And in some places, they have been beyond the ability of the environment to absorb them. Furthermore, because many young and strong labourers have been coming into the towns from the countryside, only the older and weaker labourers stay in the field. They believe that to use manure is unhygienic and, because it has a slower effect than fertilizer, is not economically effective. Accordingly they prefer to use chemical fertilizer rather than manure. As a result the quantity of unutilised livestock waste increases and becomes a new important source of pollution.

The Present Effects of Beef Cattle Raising on the Environment

- **Data explanation**

The following is a report of a field study of 50 households and 30 feedlots.

- **The effect of small-scale households on the environment**

According to the study, most households raise cattle in pens in their courtyard. The scale is very small - no more than fifty head. In this situation all of the cattle waste becomes barnyard manure, with little wastewater flowing out. Furthermore, in households the number of cattle basically accords with the area of land utilised; the barnyard manure is used mainly to meet the needs of the land and it is within the ability of the land to absorb it. So the small-scale households have little effect on the environment (see Table 7). The utilisation ratio of manure reached a level of nearly 87 per cent, and causes little pollution. If one mu. of land can bear two head of cattle, the potential of households to raise cattle is still very large.

Table 7 Annual Average Output and Use of Manure in 50 Households

Contract land area (mu)	**Number of cattle** (head)	**Chemical fertilizer used** (kg)	**Manure production** (m^3)	**Manure used** (m^3)	**Utilization ratio of organic fertilizer**(%)
15.42	17.27	1770	39.6	33.25	86.82

Source: study data.

Odour, and flies in summer, are the main factors that will affect the lives and health of not only the households themselves but also their neighbors. Odour originates specifically from the cattle pens. It is composed of inorganic gases such as methane, vulcanised hydrogen and organic gas. Because in the small household the cattle pens and living area are in close proximity, the odour and flies affect living conditions and the health of the habitants directly. At present, most of the households simply take measures such as frequent cleaning of the backyard manure and spraying fly-killing chemicals to relieve the intensity of the odour.

2 The effect of the beef feedlots on the environment

a) production of large quantities of cattle waste

The treatment of cattle waste is the most significant environmental issue facing the feedlots. Odor and flies are the mainly the effect of solid manure which feedlots produce in large quantities. If the manure cannot be gathered up and sold, a large quantity of it will be accumulated. This will cause the spread of illness and affect the health of both workers and cattle. Some illnesses affect humans and cattle together.

Fortunately, from the study it was found that most of the feedlots are situated in the countryside surrounding cities. The newer feedlots with a capacity of more than 50 head are all situated at least 200 metres away from inhabited areas. The old feedlots which were in inhabited areas have now moved to out of these areas and outside of areas to which wind can carry the smell. The area of cultivated land within economic distance is large enough to absorb most of the solid feedlot manure. In recent years, with the development of vegetable sheds and the growing of mushrooms in the suburbs, the demand for cattle manure has kept increasing. Cattle manure (unlike that of pigs, which contains much more water) is drier. In addition most of the floors of cattle dormitories are hardened so it is easier to gather up solid manure. So in feedlots most of the solid manure is gathered up by workmen (and only liquid waste needs to be washed by water). The solid manure is then mostly sold to the local farmers and vegetable growers. There was little excess solid manure in all of the places studied (see Table 8). In many places agriculture has been effectively married to husbandry, and ecological farming has been built up as in the following mode.

Maize and maize straw→raise cattle→compost→maize

Maize and maize straw→raise cattle→compost→fish pond(lotus root pond)→maize

Raise cattle→sludge gas→efficiency plant (plant flowers, vegetable, fruit trees and mushrooms etc.)）

The use of solid cattle manure in this way not only solves the pollution problem but also promotes the development of efficient agriculture and tourism in the local area. In Wuli village of Cao County in Shandong province, the villagers use the abundant manure to produce sludge gas. A small amount of this gas is used in plant but the majority of it is used to open up tourist agriculture.

In Tanghe County of Henan province, the annual turn-off of cattle is about 550 000 head, and a lot of manure is produced. In order to treat the manure effectively and make good use of it, a county vice-magistrate takes charge of the 'cattle manure for mushrooms' project by himself. The implementation of the project has been both economically and ecologically beneficial.

So, in summary, the pollution effect of solid manure is not serious at present.

Table 8: Use of Feedlot Manure

Province	Feedlot name	Inventory (head)	turn off (head)	manure output (m^3)	Sold manure (m^3)	price (yuan/m^3)	Manure use
Hebei	Qipanshan feedlot	400	1100	5132	1200	40	
	Hua'an feedlot	2300	6000	6998	6990		vegetables
	Li Fucheng feedlot	13000	50000		49500		mushrooms, worms and vegetable shed
Shandong	Wangzifu feedlot	800	2200	2566	2566	40	
	Southwest Shandong Beef Center	3500	6500	20000		35	
	Wulitun village of Cao County	1000	2000		own use		tourist agriculture
Henan	Tongzhaipu feedlot	270	800			30	mushrooms

Source: Study data.

b) The effect on surface and underground water

Each kind of feedlot also produces a large amount of wastewater including urine and the water used to wash cattle, and to keep them cool in summer (see Table 9). The feedlot wastewater contains a lot of organic and inorganic materials such as N, P and K, in each case well in excess of the Chinese waste discharge standard: according to one estimate BOD by 50 times, SS by 48 times, COD by 16 times. The levels of N and P are even more serious (see Table 10). If the wastewater flows out without treatment, it may seriously pollute both the surface water and under-ground water.

Pollution of surface water: If the wastewater flows into irrigation canals and ditches, or holes and ponds, it will affect the water ecosystem and cause fish to die and water to turn black and smell. This will seriously affect fish culture. If the water flows into lakes and reservoirs, it will lead to rich organic matter and algae in water. All this will cause a serious decline in water quality.

Pollution of the soil and underground water: There two aspects of this issue: one is the pollution of nitrate and choleric anion on underground water; the other is biological pollution arising from the ability of many pathogenic microorganisms in cattle manure to live in the soil for ever and reproduce continuously. As a result, underground water used for both drinking and irrigation can be seriously polluted.

According to the study, over 90 per cent of feedlots have no installations for wastewater. In the suburbs of cities, wastewater from feedlots just flows into the city sewer either through precipitating tanks (although these are just mechanisms for gathering the wastewater and controlling its outflow) or without any oxidation and

fermentation process. Wastewater in cities is thus significantly increased and treatment is made even more difficult. In farming areas, the feedlot wastewater flows into nearby gullies or the underground water source directly. This seriously degrades the quality of irrigation water and fish water and also affects agriculture and livestock. Feedlot wastewater has thus become an important organic pollution source. In Shandong province about 70 million tons of wastewater (estimated by the cattle inventory at the end of the year) comes from cattle feedlots each year. In Shanghai the wastewater that comes from livestock farms affects the environment so seriously that it has become the second most significant source of pollution. The need to treat the large quantity of feedlot wastewater is thus very urgent.

Table 9: Wastewater Discharge in Different Feedlots

Head	Urine		Water for washing		Water to lower temperature in summer	
	kg / head • day	ton / feedlot • year	ton / head • year	ton / feedlot • year	ton / head • year	ton / feedlot • year
100	10	365	1	100	0.15	15
200	10	730	1	200	0.15	30
500	10	1825	1	500	0.15	75
1000	10	3650	1	1000	0.15	150

Source: Report of a project to make an environmental impact assessment of the development of a small-scale beef cattle project.

Table 10: The Composition of Feedlot Wastewater and the Water Standard in China

Parameter	BOD_5	SS	COD	N	P	colon bacillus
Tested density (mg/l)	16000	74000	8400	5800	1100	
3 grade standard of density	600	400	500	20	0.3	5000 /L
Times of each parameter surpassed the standard	26.7	185	16.8	290	3666.7	

Source: State Environmental Protection Administration

The Impact of the Abattoir and Tanning Industries on the Environment

- **Current development of the slaughter and leather industries**

The Zhongyuan Beef Belt has seen not only the rapid development of cattle production but also the vigorous growth of the beef slaughter and leather industries. Many new enterprises have been established. The following production process typifies the industry: households raise cattle; feedlots fatten cattle; abattoirs slaughter cattle and process the meat; and leather factories process cattle skins.

In Henan province there are about 67 abattoirs with an annual production capacity of more than 5000 head of cattle. Tanghe County of Henan Province includes 19 townships: each of them has a feedlot with the capacity of 300 head of cattle and a small- scale cattle abattoir. In the town of Mazhuang, Yexian County, the number of cattle slaughtered

annually is about to 140-150 thousand head and there are seven abattoirs. Many kinds of cattle abattoirs, deep processing factories and leather factories have also been built in Shandong and Hebei provinces. For example, Shandong Luyu Food Limited Company has both a slaughterhouse with a capacity in excess of 3 million head, and a leather factory; Hebei Tongda Meat Limited Company, Fuhua Meat Limited Company and Hua'an Meat Limited Company also have a large slaughtering capacity.

Table 11: Number of Slaughtered Cattle and Processed Hides in Typical Cities

City	Turn off (10000 head)	No of slaughtered cattle (I0000 head)	Processing hides (pieces)	Sold to outer of province (pieces)
Yucheng	12.03	10.93	40000	69300
Nanyang	102.77	83.37	300000	533700

Source: Henan and Shandong Livestock Bureaus

- **The impact of cattle abattoirs on the environment**

The large number of cattle slaughterhouses and leather factories bring economic and social benefits but at the same time generate a large quantity of wastewater flowing out during the production process and have an adverse effect on the environment. Slaughterhouse wastewater is typical organic wastewater. The task of purifying the water is one that is faced by slaughterhouses worldwide. The normal production process includes: live cattle; cattle sheds; slaughtering; skinning; dissection and extraction of internal organs; and the freezing of meat and its transportation out. In nearly every one of these procedures wastewater is discharged. Before slaughtering, wastewater containing a lot of manure flows from the washing sheds. In the slaughter shop, wastewater containing blood and cattle manure flows from the washing floor. In the dissecting shop, wastewater containing the residue from the tripping also occurs. The procedure is summarised in Fig. 1.

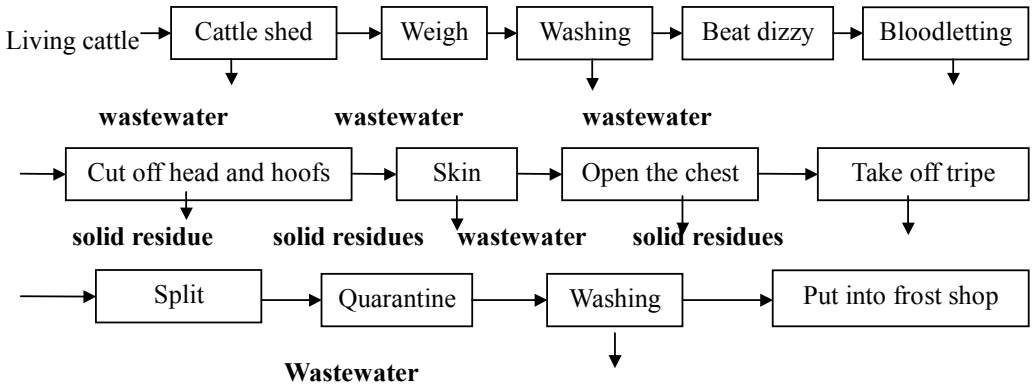

Figure 1: Wastewater Resulting from the Procedure of Slaughter

The wastewater contains mainly organic materials, such as blood, residues from the digestive system, manure and urine, bits of meat, fur and fat. So the suspended solid density (TS) is very high (see Table 12) and it is always red-brown with a high smell and a lot of parasitic moths and germs from the digestive system. If the wastewater discharges without treatment, it may have a critical effect on the environment. Melt oxygen in the

water will be used up when microorganisms catabolise organic materials and the quality of water (including drinking water) will decline.

2.1 Table 12: Composition of the Slaughterhouse Wastewater

Parameter	BOD_5	SS	COD	pH	Colon bacillus
Tested density (mg/L)	500-800	600-900	1000-1500	6.2-6.7	
III grade standard density (mg/L)	300	400	500	6.0-8.5	10000
Factor by which the standard is surpassed	1.7-2.7	1.5-2.25	2-3	1	

Source: Chinese Mandatory Standards, Yucheng Livestock Bureau

The study data indicates that large-scale abattoirs built in recent years, or those which have a high degree of mechanisation with advanced equipment and a large production capacity, have built sewage treatment equipment when the production building was finished. All these slaughterhouses, such as Hua'an and Fuhua Limited Companies in Hebei province; Nayang Shiye Limited Company and Nayang City Meat-Packing Plant in Henan province; and the Shandong Luyu Food Limited Company have advanced equipment and a high annual production capacity (more than 40 000 head). Each of them produces a large amount of wastewater from the slaughterhouse. All of the wastewater is directed into the sewage treatment shop for biochemical fermentation over a certain period, then discharged only when it is proved that the treated water has reached Chinese III grade standard by the local environment protection bureau.

But an overwhelming majority of small to mid-sized abattoirs have no wastewater treatment equipment. A large quantity of wastewater is discharged into the sewerage system directly then flows into nearby waterways, pools or ponds without any treatment, even without blood even being recycled. This wastewater contains suspended solids (TS) with high density and thick blood, such that it causes the nearby waterways to turn black, smell, and become rich in nutrition.

In some specialised slaughterhouse villages the lack of purification of wastewater is even worse. There the wastewater flows freely without any direction or treatment.

In summary, the wastewater occurring from the small to medium sized slaughterhouses and from private household slaughter has become a very significant source of organic pollution. Moreover, the pollution of abattoirs wastewater is getting more and more serious with the rapid development of the slaughterhouse industry. This form of pollution is one that calls urgently for measures by government.

- **The effect of tanneries on the environment**

The study showed that most tanneries in China are of small to medium size. They are located all over the countryside and have an annual capacity of more than 10 million cattle hides, 40 million goats or sheep skins, and 80 million pig skins. The impact of tanneries on the environment is mostly caused by the wastewater and solid wastes arising from the process of tanning. According to official statistics, there is about 70 million tons of wastewater resulting from the tanning industry, which is about 0.3% of that from the whole industry. The tannery wastewater is characterised by high basically, thickness of color, a large quantity of suspended solids, and harmful chromium (Cr). Annual drainage

of wastewater from the tannery contains COD (0.11-0.15 million tons), BOD (0.05-0.06 million to), SS (0.07-0.10 million tons), S (2000-3000 tons), and Cr (1500-2500 tons).

The other kind of pollution caused by tanneries occurs in the form of solid wastes-hair, meat membrane, leftover bits and pieces, and scraps of Cr. Under present conditions of production, to process a ton of raw skin will produce 279 kg solid waste (comprising 190kg waste hair, meat bits and leftover bits and pieces of raw skin; and 89kg Cr). All of the waste will affect the environment if left untreated. Unfortunately, (according to statistics) only about 10 per cent of the tanneries have waste treatment equipment.

Thus the pollution resulting from the tanning industry is very serious and is also is difficult to treat.

Current Environmental Protection Policy in China

Environmental laws and regulations have been developed over the last 30 years or so. Some efficient environmental regulations, relating to aspects such as charging for the discharge of wastes, environmental impact assessments, and the design, construction and operation of waste treatment equipment which matches production facilities, have been implemented. However, all of the laws and have been directed at *industrial* pollution. Until now there have been no special regulations relating to environmental pollution caused by livestock or feedlots. When pollution resulting from this cause occurred the local environmental administration responded only in terms of the Chinese 'mandatory standards', in particular the Atmosphere Quality Standard (GB 3095-1996), the Environmental Quality Standard for Surface Water (GB 3838-88), the Quality Standard for Underground Water (GB 3838-88), the Integrated Wastewater Discharge Standard (GB8979-1996), the Emission Standard for Odour Pollutants (GB 14554-93), the Discharge Standard of Water Pollutants for the Meat-Packing Industry (GB 13457-92) and the Control Standard for Pollutants in Sludges from Agricultural Use (GB 4284-84). No special regulations relating to the livestock industry applied, and this made control of pollution difficult.

The main reason for this problem is that, in China, the livestock industry has been regarded as a second-rank industry. The government has thus paid little attention to the pollution it causes. In recent years, as the industry developed rapidly, the pollution it caused became more serious and more attention has been paid to it by governments. The Ministry of Agriculture is preparing to establish laws and regulations aimed specifically at the livestock industry. In November 1998, State Council issued as the 253rd order the 'environmental protection rule for new construction projects' and brought it into operation. The order stipulated that all new projects – including those relating to livestock raising, the slaughter industry and the leather industry - can be put into operation only when they have received permission from the environmental evaluation authority. The design, construction and operation of waste treatment equipment must match production facilities. Existing industries must also, within a certain time, establish facilities to effectively treat waste, or face substantial fines.

Livestock raising: Feedlots with a capacity of more than 500 head of cattle, 5 000 head of pigs or 10 000 head of poultry must be equipped with wastewater treatment equipment. The water discharged from the feedlots must be up to the standard of agriculture irrigation water (i.e. with a thickness of BOD no more than 200mg/l and BOD_5 no more than 50-60mg/l).

Slaughterhouses: Water discharged from abattoirs must conform to a standard established for wastewater quality for meat processing industry. There are three levels of standards (see Table 13), level I applying to water which may be used for drinking water; level II to water used for industry, agriculture, or recreation purposes; and level III for water discharged into the city sewers.

Table 13 Discharge Standards of Wastewater for the Meat Processing Industry

Compositions	Suspended solids			BOD_5			COD			pH			Colon bacillus (number/l)	
Standards	I	II	III	I	II	III	I	II	III	I	II	III	I	II
Density (mg/l)	60	120	400	30	60	300	80	120	500	6.0-8.5			5000	10000

Source: Chinese Mandatory Standards

Tanneries: Studies indicate that all kinds of the cattle tanning factories have sewage treatment plant which is capable of treating the wastewater flowing from working shops. Because the wastewater contains a lot of harmful trace elements that may have a serious effect on the environment, the environmental protection authority has strictly supervised the treatment of wastewater. In accordance with the regulations relating to the charging for discharge of waste and the penalty for not meeting the required standard, the environmental protection administration regularly takes samples. Factories which do not meet the standard are fined heavily and those which are not able to purify wastewater are closed down.

Summary: in China, The pollution of livestock industry waste is getting more and more serious in China with the rapid development of the livestock industry. This problem is now receiving the close attention of the government. Existing regulations are being extended and applied more inclusively. However, the regulations, especially for livestock raising and slaughterhouses are in urgent need of stricter enforcement.

Policy recommendations

On the basis of the foregoing analysis a number of recommendations are made:

- **Regulations aimed at feedlot pollution must be established as soon as possible.**

Establish a wastewater discharge standard specifically for feedlots: Wastewater from feedlots has particular characteristics that differentiate it from industry waste. Pollution is caused primarily by organic materials. Wastewater discharge standards which take account of this need to be established.

Limit the size of feedlots: Larger feedlots are more economic. This does not mean, however, that the bigger a feedlot the better. The size of feedlots should not exceed the absorption ability of land within the vicinity. Pollution arising from some large-scale feedlots in developed countries is a warning. Some countries have in fact taken action to limit feedlot size: for example the raising of cattle in Hong Kong and Singapore has been banned for many years in order to protect the environment. In Taiwan, the size of cattle-raising enterprises is limited to demand for beef in the local area and there are strict controls on the development of new feedlots. Pollution caused by feedlots is not yet as

serious in China as that which has occurred in some developed countries, but the size of feedlots must be limited before a problem is created, even though this will mean continuing reliance on imports to feed the large population.

Rationalise the geographic distribution of feedlots and establish a standard for applying manure: The use of manure is very beneficial in growing irrigated crops. But if used beyond the ability of the soil to absorb it, pollution of nitrogen and phosphorous will occur. Thus feedlots must not be concentrated in any one geographical area otherwise the over-application of manure to crops will occur, or stocks of it will build up. Therefore consideration should be given to ways in which the geographic distribution of feedlots should be rationalised.

Encourage the development of technology that can render manure harmless: Technology which allows manure dehydration, composting and odour inhibition can assist in recycling manure and relieving pollution caused by livestock waste.

- **Improve and tighten the regulation of slaughterhouses and the packing and tanning industries**

Strictly enforce environmental regulations: All of the slaughterhouse and tanning enterprises (including new buildings, extensions, and renovations) should be forced to comply with the regulations. It should also be required that production and environmental management equipment be appropriately matched when they are designed, built and commissioned.

Control the number of new slaughterhouses and tanneries built (particularly in relation to their size and distribution): The capacity of new abattoirs and tanneries should be at least one hundred thousand head. Old abattoirs and slaughterhouses with a capacity between thirty and one hundred thousand should be amalgamated to the extent possible so that the purification of wastewater can be undertaken more efficiently and cheaply and the environmental effects reduced. Enterprises with a capacity of less than thirty thousand that are unable to treat waste should be closed.

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