Status of Animals used for Food and Fibre in India

(Beef cattle, Goats, Sheep, Pigs, other Poultry)

This report is part of a Humane Society International-sponsored project
by the Federation of Indian Animal Protection Organisations and hosted by the Blue Cross of India.

Foreword

As part of the HSI sponsored project to establish the status of animals used as food and fibre in India, a combined report was decided upon to report on the status of birds and animals whose use was of lower volume relative to chicken (broilers and layers), dairy cattle and dairy buffalo. Consequently, this report, encapsulating beef cattle, goats, sheep, pigs and other poultry (duck and turkey) was conceptualised. For the want of a better word, these have been grouped together in the “Miscellaneous“ category.

The information presented in this report does not go into the sort of depth that has been attempted in other reports as part of this project. As decided with HSI while conceptualising this project, for species in the Miscellaneous category we were interested in basic information only as it was felt this was adequate to derive interventions from the point of view of improving animal welfare.

The analysis of information on sheep and goats was challenging because in a lot of literature, this information was consolidated for both species. In this report, therefore, we have created a section called “Small Ruminants”, which carries in it information that could not be disaggregated between sheep and goats. Within this section, there are separate sub sections on sheep and goats where disaggregate information has been presented from sources where such division was possible.

CONTENTS

I. BEEF CATTLE[1]

The use of cows for the production of beef is restricted to a few states that do not have explicit laws prohibiting cow slaughter. These are West Bengal, Kerala, Assam, Nagaland, Mizoram, Manipur, Meghalaya, Tripura, Arunachal Pradesh. The table below sourced from statistics released by the DAHDF (2006) shows the number of cows slaughtered for meat. For the year 2005-06, this figure was 3.685 million. This is likely to be the minimum figure since states like Arunachal Pradesh, where cows are routinely used for meat, have not reported any figures. Further, these statistics pertain only to the "registered" sector i.e. slaughter carried out in government slaughter houses. As is well known, a number of animals are also slaughtered outside such slaughter houses.

Data for 2005-06 (in '000)

S. No.	States	No. of an slaughtered Cattle
1	Andhra Pradesh	32
2	Arunachal Pradesh	-
3	Assam	17
4	Bihar	540
5	Chattisgarh	-
6	Goa	-
7	Gujarat	2
8	Haryana	-
9	Himachal Pradesh	-
10	Jammu & Kashmir	-
11	Jharkhand	-
12	Karnataka	149
13	Kerala	606
14	Madhya Pradesh	-
15	Maharashtra	493
16	Manipur	66
17	Meghalaya	231
18	Mizoram	13
19	Nagaland	169
20	Orissa	0.053
21	Punjab	-
22	Rajasthan	-
23	Sikkim	-
24	Tamil Nadu**	103
25	Tripura	-
26	Uttar Pradesh	-
27	Uttaranchal	-
28	West Bengal	1236
29	A&N Islands	-
30	Chandigarh	-
31	D.& N. Haveli	-
32	Daman & Diu	-
33	Delhi	-
34	Lakshadweep	-
35	Pondicherry	27
	All India	**3685**

(Source: DAHDF 2006)

The DAHDF figures also vary from FAO data, which presumably factors in animals slaughtered in the unorganised sector as well. According to FAOSTAT 2004, for the year 2004, 14.2 million cattle (as distinct from buffalos) were slaughtered. This constituted 7.9 % of the total cattle population in 2004 (pegged at 189.1 million) and accounted for 31.1 % of the meat production in the country.

There are no cattle raised exclusively for meat, other than possibly in some parts of the north eastern states. Nearly the entire cattle production of the country is for milk and draught purposes only. Aging cattle become very expensive to

[1] Please read this section in conjunction with section VI.1 of the report on Dairy cattle for a comprehensive understanding of the scenario in the country vis-à-vis cattle.

maintain for subsistence farmers and landless labourers, who constitute over two-thirds of the families owning livestock. Subsistence farmers, almost always, sell only old animals - mostly over 14 years. Males of younger age may also be sold for slaughter (Rahman 2007).

II. SMALL RUMINANTS (SHEEP AND GOATS)

While discussing issues related to sheep and goats, it is necessary to underscore the importance of these animals to the livelihoods of some of the poorest communities in India. Development literature has underlined this significance.

CALPI 2005 states that in many states of India, small ruminant rearing provides significant proportion of self-employment opportunities and is a source of supplementary income for the landless, adivasis (tribals), and the dalits. Small ruminants easily fit into the smallholder production system, as they require low initial capital investment and low operational cost. They also give quick returns because of short generation interval and high level of prolificacy. In transhumance /nomadic system, the animals are often kept under scavenging conditions with little or no attention paid to supplementary feed inputs, or to disease control and housing. They are less costly to acquire and maintain, and can often thrive on harsher terrain. At the same time, they provide products for cash sale when a need arises, and provide the household with much needed protein (CALPI 2005).

Similarly Singh et al (2006) have described that goats have small land requirements, and their adaptability to harsh climates makes them suitable for landless and marginal farmers. Human population pressure and changes in social structure in the developing countries, including China and India, have increased the importance of goats to the poor families who maintain them for milk production and domestic consumption. These farmers lack space and money to invest in larger animals, such as cattle and buffaloes. This may explain the higher rate of increase in goat population compared to other livestock species in countries that have high densities of human population and relatively small land holdings (Singh et al 2006).

Misra et al (2006) have brought out various facets of goat and sheep rearing in India. Their essay says that rearing of sheep and goats plays an important role in the economy of India in general and sustainable livelihood of poor people of rainfed agro-ecosystem[2] in particular, because of inherent risk involved in the crop farming due to uncertainty of rainfall and occurrence of recurrent droughts. They are raised mainly for meat, milk, and skin and providing a flexible financial reserve in bad crop years for the rural population. Contribution of these species to the rural economy is estimated at Rs. 240 million per annum. Together, they produce about 0.7 million tonne of meat, which is about 15 % of the total meat production in the country. About 5 million families in India are engaged in various activities relating to rearing of small ruminants. The flocks of small ruminants provide gainful employment of 184 to 437 man-days per annum depending upon the size of the flock. Irrespective of the flock size women and children contribute to labour force to the extent of about 90%. Farmers of rainfed dry regions prefer rearing of small ruminants because: (1) they are less expensive to purchase and require minimal inputs and maintenance costs; (2) they are less susceptible to stress due to adverse changes in climatic conditions (e.g. drought); and (3) they have a relatively high reproduction rate and are easy to dispose off.

Livestock production provides a constant flow of income and reduces the vulnerability of agricultural production. Rearing of small ruminants is more profitable with assured and constant income. The poorest of poor often do not keep animals, but they would likely do so should this become possible. The expanding market for livestock products offers an opportunity for augmenting their income, even for those who do not have access to land and capital resources (Misra et al 2006).

A study by CALPI in 2005 identified the following factors that have inhibited the development of small ruminant breeds in the Indian context: (1) the animals are under constant migration; (2) they are under free grazing situation; (3) nutrition is usually weak as it is limited to whatever the animals can forage (4) herd size is small and (5) males are sold at relatively younger age making selection difficult. This study also underlines the fact that productivity enhancement among sheep and goat by crossbreeding them with exotic varieties is fraught with the danger of the sheep / goat populations losing their inherent sturdiness, vitality and the ability to withstand stress. Many experiments on crossing of small ruminants had met with indifferent results all over India. Cross breeding of sheep has improved wool quality only marginally and quantity, even less. Farmers are wise to these compulsions and therefore balance their output from sheep between wool and mutton (CALPI 2005).

II.1. Contribution of Ruminants to the Economy

Small ruminants make an important contribution to the sustenance of small and marginal landholders and landless rural people in India. They also make a substantial contribution (Rs 24,000 million per annum) to the rural economy. The contribution of agriculture sector to national GDP is 25% (during 1990s) and the share of livestock in agricultural GDP is 23%, of which small ruminants contribute about 10% to the total value of livestock sector. At the national level, small ruminants account for 14% of the meat output, 4% of the milk output and 15% of hides and skin production in the country. The small ruminant sector receives about 2.5% of the public spending on the livestock sector (CALPI 2005).

II.2. Husbandry Conditions of Small Ruminants

The small ruminant sector in India receives low allocation of funds and attention for veterinary services. The services available are, generally, not reaching most of the small ruminant rearers as a majority of them are in the remote resource poor areas and are migratory in nature. Even though the number of veterinary hospitals, polyclinics and dispensaries in the public sector has almost doubled during the last 15 years, small ruminant health care still receives low priority, possibly due to lack of infrastructure facilities required for small ruminants, shortage of trained personnel, non-availability

[2] Rainfed agriculture refers to agriculture that is dependent mostly on rain with very low coverage of irrigation and complemented by livestock rearing and collection of forest products. The central Indian states of Madhya Pradesh, Rajasthan, Chhatisgarh, Uttar Pradesh, Andhra Pradesh and Jharkhand are particularly characterized by rainfed agriculture, though farmers following such a mode of production can be found nearly throughout the country.

of medicines /vaccine and overall lack of information of small ruminants. Similarly, in the case of delivery of breeding inputs, though the breeding infrastructure to produce and distribute quality breeds has expanded considerably, the impact of breeding programmes has been limited. (CALPI 2005)

II.3. Limitations on the Contribution of Small Ruminants to Livelihoods

As mentioned earlier in this section, though sheep and goats are a key part of the livelihood strategy pursued in the rainfed regions of the country, there are significant limitations to maximizing the so called "potential" of small ruminants to livelihoods.

CALPI (2005) identified the following major marketing issues related to small ruminant production:

(i) Absence of a direct market access: Small Ruminant Rearers seldom have a direct access to the markets for live animals, meat, milk and wool. Generally, because of the high demand for meat existing in all parts of the country, sale of sheep and goats, pose no constraint even in the remote rural areas. However, the market is unorganised and operates under the clutches of a nexus of small traders, market agents and middlemen. Small rearers find it difficult to penetrate these markets because of the nexus.

(ii) Absence of strong rearer organisations and their network to address the marketing needs of the rearers and consumers is the other bottleneck.

(iii) Absence of market information: Rearers, their organisations or SHGs do not have any access to information on market prices, margins, cost of operations etc. either of the local or the distant markets. The rearers are therefore not in a position to recognise or appreciate the market opportunities and exploit them. In the absence of market information, the rearers lack the drive to explore newer and better options for marketing.

(iv) Lack of rearer organizations: Considering the growing demand for live animals and meat in the national and global market, the opportunities for small ruminant production are considered immense in India. However, absence of strong rearer organisations and appropriate infrastructure for production, procurement, processing, marketing and productivity enhancement are major bottlenecks in exploiting the fast growing national and global market potential. It also requires a critical mass of rearers and their output produced on the basis of market specifications, to be pooled to exploit such market demands. This would also require large investments in processing, transport and distribution infrastructure.

(v) Setting market standards and specifications: Presently there are no prescribed market standards for live animals or meat or acceptable practices for sale of animals and animal products. In the rural areas, animals are generally sold on the basis of head count. Sale by weight is seldom accepted by traders and market agents.

(vi) Disease prevention and eradication: Some of the diseases like Foot and Mouth hinder exploitation of the global market potential for live animals and meat.

The same publication has also identified other factors limiting ruminant productivity.

- A vast majority of small ruminant rearers such as the small and marginal farmers, pastoralists, dalits, adivasis and landless labourers largely depend on Common Property Resources (CPRs) to feed their animals to make a living. CPRs mainly consist of village pastures belonging to the Panchayats (local self government institutions), revenue land (Revenue Department) and forest land (Forest Department). Several studies in India's dry regions show that there is a decline in the area under common property from 1950 onwards due to expansion of agricultural land, encroachment, privatization, land reform measures and conversion of forest area into wildlife protected areas. Studies also show that the CPRs are under severe degradation due to unsustainable exploitation and lack of attempts for regeneration.
- Introduction of credit facilities under the various micro-financing and entrepreneurship development programmes caused entry of many new people with no experience in small ruminant production. They also had little awareness on rotational grazing, which was practiced by the traditional rearers. This has further increased the small ruminant production dependency on CPRs and hence added to the degradation effect on the grazing lands.

Seen from an animal welfare perspective, the above paragraph suggests that small ruminant rearing is non intensive in nature and it does not appear that intensification at any significant scale is likely in the near future. The existing rearing conditions appear to be predominantly free range and as welfare friendly as possible, within the constraints of the fact that the animals are ultimately being reared for human consumption.

II.a GOATS

According to Government of India's livestock census, there were 124.358 million goats in the country in 2003. West Bengal (18.774 mill.), Rajasthan (16.809 mill.) and Uttar Pradesh (12.941 mill.) have the largest goat populations in the country (DAHDF 2006).

The number of goats increased from 95 million in 1982 to 124 million in 2003, but at a decelerating rate throughout. During 1997-2003, the growth in goat population remained almost stagnant (Ali 2007). This lack of increase in the goat population is on account of the nature of goat ownership and the use that its products are put to. Goats are owned predominantly by the poorer families in rural India and used as a form of insurance to reduce livelihood risks. These are sold during times of crisis or when cash is needed for social occasions. Goat milk is predominantly consumed at source, usually within the family.

To put things in perspective on a global plane, China and India together have 39 percent of the world goat population. There are 16 countries with a goat population of more than 10 million. In Asia, these include China (195m), India (120m), Pakistan (57m), Bangladesh (37m), Iran (26m) and Indonesia (13m) (Singh et al 2006).

As Ranjhan (2004) reports, typically goat/sheep meat is marketed in villages by slaughtering one or two animals once in a week or as special occasions by a group of people joining together and sharing the cost of the meat so obtained. There is not much over head cost on meat in villages and there are little returns for skin, blood etc. In the small towns sheep/goat meat is directly marketed to the consumers from meat shops. Since the time gap between slaughter and the sale is very short, the deterioration of the quality of the meat is less. In the big towns and cities most of the meat is consumed on the same day or refrigerated by the consumer (Ranjhan 2004).

CLFMA (2005) reports that organised goat farms are conspicuous by their absence and that the consumption of goat meat per capita is declining. This is attributed to the rising price of goat meat, which makes its meat an item of consumption for the elite. Low levels of production ensure that prices of goat meat remain high. Price alone will be largely instrumental in depressing consumption as poultry meat is produced more efficiently and at lower costs.

As far as use for food and fibre is concerned, goats are predominantly a source of meat. Available data does not suggest that any spurt in demand or production of goat meat is likely. From an animal welfare point of view, the primary issues with goats appear to be with transport and slaughter.

Goat and sheep meat has a small market share in total meat demand because of low production and their high price among all the locally available meat categories. Though the Indian consumer has a taste preference for goat and sheep meat, supply has not kept pace with demand. The GOI had accordingly imposed a ban on the export of sheep and goat meat since 2007 (Dhankar 2008)

FAO data as presented in the table below shows the number of goats slaughtered for meat in India over the course of the last decade

Producing Animals/Slaughtered

No. of animals

Year	
1997	45799996
1998	47335000
1999	47411000
2000	43931000
2001	46712000
2002	50038000
2003	40847000
2004	53868000
2005	54110000
2006	54200000
2007	54300000

(Source : http://www.fao.org/ag/aga/glipha/index.jsp)

II.a.1. Profile of Goat Rearers

Various surveys conducted by institutions in India revealed that 40-60 percent of goat farmers belong to landless or marginal communities. Income for these families derives mainly from daily wages. Men often migrate for work while women and children take care of livestock. In India, large herds of sheep and goats are maintained together in the states of Rajasthan, Gujarat, Himachal Pradesh, and Jammu and Kashmir. The farmers maintaining the Gaddi goat breed, for example, migrate from Terai belts of Punjab to Himachal Pradesh close to the China border. Similarly, farmers from the arid zone of Rajasthan migrate along with goats and sheep from other states such as Uttar Pradesh, Punjab, Haryana, Madhya Pradesh, Gujarat and Maharashtra, during the dry summer months. The flock size of such farmers may ranges from 50 to 500 and migration period lasts from late winter until after the onset of monsoon rains (Singh et al 2006).

In India, the small and marginal farmers, including landless agricultural laborers, mostly in non green revolution areas where irrigation facilities are poorly developed, prominently rear goats. Many macro level studies have confirmed that goats are important for the people living in dry areas and mountainous regions. Also, it is now well documented that goat production can be an important tool to ameliorate the conditions of poor women in developing countries, thus, being seen as source of women's emancipation by the development agencies (Arya and Chander 2002).

II.a.2. Breeds (sourced from Kumar and Ayyappan 1998)

There are about 13 well known India breeds of goats apart from local non-descript ones scattered throughout the country. The breeds are described in 5 regions.
1. Himalayan region: Chamba, Gaddi, Kashmiri, Pashmina, Chegu
2. Northern region: Jamnapari, Beetal, Barbari
3. Central Region: Marwari, Mehsana, Zelwadi, Berri, Kathiwari, Sirohi, Jhakrana
4. Southern region: Surti, Deccani, Osmanabadi, Malabari
5. Eastern region: Bengal, Assam hilly breed, Ganjam

These breeds can be classified as fibre, milk or meat types based on their relative strengths:

Distribution of fibre, meat and milk type breed

Fibre type	Meat type	Milk type
Himalayan, Chegu	Bengal, Assam hill goat, Deccani, Osmanabadi, Jhakrana, Sirohi	Jamanapari, Beetal, Barbari, Marwari, Mehsana, Kutchi, Surti, Malbari

II.a.3. Trends in Goat Keeping

An interesting development in India in recent years has been the setting up of large farms of indigenous goat breeds by private entrepreneurs with either their own or borrowed finance. This has been brought about by the growing demand and prices for goat meat and that agricultural income (including income from goat rearing enterprises) is not taxed directly (Nimbkar 2006).

Similarly development agencies, both governmental as well as non government ones have been aggressively promoting goats as a means of livelihood enhancement. Of concern is the fact that progressive intensification of rearing regimes is being promoted. Literature from CALPI (2005) has several such examples. The Alwar goat project by a well known development NGO, PRADAN in Rajasthan is an example to show that goats kept under limited grazing conditions can be successfully reared with supplementary feeding. The goat production system in Kerala is another example of semi-intensive goat keeping. Studies undertaken in institutional flocks show that goats maintained under semi-intensive system performed significantly better than those under intensive and extensive production systems. The erstwhile Indo Swiss Goat Project in Rajasthan also produced evidence in favour of 'limited grazing with supplementary feeding'. The publication concludes that promoting semi-stall feeding would also help indirectly the poor goat /sheep rearers in preparing them to face the future challenges in respect of shrinking feed resource base. Further, the publication feels, it will reduce pressure on the environment (CALPI 2005).

II.a.4. Growth in production

There are many agricultural universities, private institutions and International organizations promoting commercial goat farming by disseminating technologies through "lab to land" programmes and training in commercial goat farming. There even exists a Central Institute for Research on Goats established by the central government to promote goat farming in the country.

Despite concerted efforts, say Singh et al (2006), commercial goat farming has been slow to develop in India. The authors of this paper feel that this is on account of:

- The majority of goats in India are raised on a 'zero input' basis, with farmers selling their goats at any price, making this highly attractive for middle-men.
- Goats are either maintained in large flocks under a free ranging system with migration or in small flocks on a stationary basis. The authors' experiences indicate that when goats from these rural farming systems are purchased and put in confinement under intensive and semi-intensive system of management they tend to suffer from contagious and communicable diseases.
- There is a lack of skilled labour to manage goats under intensive management systems.

Thus goat numbers are not expected to rise in the near future in a significant manner.

II.b. SHEEP

The number of sheep in the country according to the official livestock census was 61.469 million in 2003 (DAHDF 2006). Sheep population is generally found in the arid and semi-arid areas of Western India, Deccan Plateau and Western Himalayas. About 60% of sheep in the country are concentrated in five states, namely Andhra Pradesh, Rajasthan, Karnataka, Tamil Nadu, Jammu & Kashmir and Maharashtra. Sheep density is the highest in the arid ecosystem and least in the irrigated system (CALPI 2005). Over the 1997-2003 period, the sheep population grew by 1.12% (DAHDF 2006).

Sheep are animals used both for food and fibre; wool production in India has increased from 32.0 million kg in 1980-81 to 48.5 million kg in 2003-04. Annual growth in wool production was 1.7 percent per annum during 1980-2003, which was much lower as compared to annual growth in other livestock products. Domestically produced wool is poorly suited to garment production and fine wool is generally imported from Australia. The wool and hair produced in India mostly with a

diameter greater than 30 microns is used for furnishings, carpets and industrial fabrics. The production level of wool in the country is much lower than the existing demand in the wool processing industry. This gap is more critical in case of fine wool with a diameter of less than 25 microns (Ali 2007).

According to FAO the world production of Sheep meat was 8.63 million tones in 2006. India ranked seventh in sheep meat production. India's export of sheep/goat meat was 5481.55 mt with the valued of Rs. 63.04 crores (USD Million 13.98) in 2006-07. The major destinations for export of Indian sheep/goat meat are Saudi Arabia, U.A.E, Qatar, Oman and Kuwait (http://www.apeda.com/apedawebsite/six_head_product/animal.htm)

II.b.1 Rearing

Sheep farmers obtain forage from a combination of crop residues, private land and common grazing land. Thus, a sheep rearer obtains benefits from both common lands and framers' field. Grazing in common forests and pasture was estimated to account for 31% of livestock feed in India. Farmers' cultivated lands become common grazing lands for poor peoples' animals after harvesting the crop. Grazing norms do exist, but lack of institutional support and the disintegration of community management structures have contributed to the uncontrolled and illegal grazing on common lands.
The owners also migrate along with their sheep flocks in search of grazing lands during summer. Some farmers harvest the grasses from forests and common lands during winter season and store this grass for several months and use it to tide over the dry season, when forage scarcity tends to be most acute (Misra et al 2006)

II.b.2. Impact of WTO on Wool

Following the WTO agreement, the import of wool in India has been allowed under Open General License. Traditionally, India has been importing fine quality wool for the wool industry at an import duty of 20- 30%. Under new dispensation the duty was abolished. This has adversely effected the domestic wool production resulting in sharp fall in the domestic wool prises. At present almost all the requirement of wool for the industry is met through imports from Australia and New Zealand. Indian Sheep breeders finding no market for the fine and medium quality wool have crossed their animals with mutton breeds. Consequently, all programmes relating to improvement of wool quality in the country except in J & K and upper reaches of Himachal Pradesh and Uttranchal States have been closed (Planning Commission 2006).

II.c. Conclusions

In summary, therefore, it appears that there is little probability of intensification of small ruminant production systems in the near future. This would imply that as far as welfare is concerned, the issues remain transport and slaughter conditions. Further, the nature of small ruminant rearing is such that it will continue to be practiced by a large number of marginal farmers and pastoralists. In such regimes the animals are invariably free ranging. Also government driven development projects that promote the rearing of small ruminants have had limited success because of the limitations imposed by fodder availability.

III. PIGS

III.1. Population

The 2003 livestock census pegs the pig population of the country at 13.52 million animals. Between 1997 and 2003, this population has grown at a rate of 0.28%. North East India is the major centre of pig rearing in India as well as the largest consumer of pork. Off the 13.52 million animals in the country in 2003, the north eastern states (Assam, Meghalaya, Arunachal Pradesh, Nagaland, Mizoram, Manipur and Tripura) account for 3.82 million animals i.e. roughly 28% of the country's pig population.

The following table, adopted from Bujabaruah (2006), further underlines the preeminent role of north east India in any discussion related to the rearing and consumption of pigs.

Decadal Growth Rate	NE	India
1982-92	123%	26%
1992-2002	21%	5.79%

An even more telling statistic is the number of pigs/100 persons. In the North eastern states this figure is 18 animals while in the rest of the country it is 4. The reasons for this can be situated in the cultural and dietary preferences of the inhabitants of north east India, distinct as they are from other parts of the country. Bearing strong resemblance to south-east Asian cultures, the population (about 38 million) is nearly entirely non vegetarian with tribals accounting for about 80% of the population. (Bujarbaruah 2006)

III.2. Rate of growth in production and consumption

The 2006 livestock census has pegged the rate of growth of the pig population at a negligible 0.28% over the period 1997-2003 (DAHDF 2006)
A 1997-99 survey by the Food and Agriculture Organization showed pork to be a small slice - only 6 percent - of India's total meat consumption. Fish had the biggest share (51 percent), followed by beef –essentially buffalo meat (29 percent), mutton and goat (8 percent), with poultry and pork at 6 percent each (http://www.fao.org/ag/aga/glipha/index.jsp). This report observes, "the share of the population that does not eat meat due to religious practices, as opposed to economic necessity, is fairly small, perhaps as low as 10-20 percent."

While extant rates of growth of pork production are negligible, (Bhardwaj 2008) predicts future opportunities for pork producers through exports as well as domestic demand. The publication refers to the potential for export to China that has an insatiable pork market of 1.3 billion people. In the short-term, the forthcoming 2010 Commonwealth Games are seen as opportunities to local pig farmers, particularly those in New Delhi and adjoining states like Haryana. To be held in Delhi, two million foreign tourists and 3.5 million domestic tourists are likely to arrive in the Indian capital for the Oct. 3-14, 2010 games. During the 12-day games, Delhi will need tonnes of food, including pork meat, to feed its guests who will come from Canada, Australia, Africa and 50 other former British colonies and territories. Pig farms such as the Himalaya Piggery Breeders are preparing for the big event by expanding their production capacities and raising their production standards. (Bhardwaj 2008)

III.3. Rearing Conditions

A study of 7 piggeries done by CUPA in 2007 provides some insights into the conditions in which pigs are raised for the urban market:

Category of farm	large farm – mixed farming- pigs sheep goats and cows along with fodder crops	Small Farm – mixed farming- agriculture/ pig	Large Farm – mixed farming- agriculture/ pig	Large Farm – mixed farming- agriculture/ pig / jamunapari goats	Large Farm – mixed farming- agriculture/ pig /HF breed of cows-100 nos/ deer of 6nos	Large Farm – mixed farming- agriculture/ pig	Small Farm – mixed farming- agriculture/ pig
Total number of pigs	300 large white Yorkshire, 85 desi black pigs	50 Pigs (Including piglets) – 25 Yorkshire cross, 25 desi black pigs	600 Pigs (Including piglets) – yorkshire cross, one Duroc male	700 Pigs (Including piglets) – yorkshire cross, one Duroc male weighing 250-275 kgs	100 Pigs (Including piglets) – yorkshire cross, duroc	500 Pigs (Including piglets) – yorkshire cross, duroc	50 Pigs (Including piglets) – yorkshire cross
Free range/	free range	closed	closed	closed	closed	closed	closed

sheds		enclosure	enclosure	enclosure	enclosure	enclosure	enclosure
Number of people employed	2 men employed, family members – 4	family members	5	5	5	2 people along with family	family members
Number of pigs sold / batch	based on the demand the pigs are sold	10 pigs are sold at 1 yr every month	50 pigs are sold at 1 yr every month	based on the demand the pigs are sold	based on the demand the pigs are sold	based on the demand the pigs are sold	based on the demand the pigs are sold
Marketing channel	pig dealers from kerala collect the pigs from the farm	Sold to local people - 2 year old pigs, attain 100kg body weight each sold for Rs 5000/-	Sold to Mangalore pig dealers 2 year old pigs, attain 100kg body weight each sold for Rs 5000/-	Sold to Kerala , Mangalore pig dealers - 2 year old pigs, attain 100kg body weight each sold for Rs 5000/-	Sold to kerala , mangalore pig dealers - 2 year old pigs, attain 100kg body weight each sold for Rs 4500/-	Sold to kerala , mangalore pig dealers - 2 year old pigs, attain 100kg body weight each sold for Rs 5000/-	Sold locally 2 year old pigs, attain 100kg body weight each sold for Rs 5000/-
Workers safety	Nil	Nil	white apron, mask and two pairs of cloth per year	two pairs of cloth per year	two pairs of cloth per year	two pairs of cloth per year	
Type of housing	mud walls with asbestos roof	tiled roofing with stone walls and stone slab flooring	tiled roofing with stone walls and stone slab flooring	tiled roofing with stone walls and cement flooring	tiled roofing with stone walls and cement flooring	tiled roofing with stone walls and cement flooring	tiled roofing with stone walls and cement flooring
Area (length x width) in metres		15 x 10 sq.ft per animal for 15 animals	15 x 10 sq.ft per animal for 15 animals	15 x 10 sq.ft per animal for 15 animals	20 x 15 sq.ft per animal for 15 animals	15 x 10 sq.ft per animal for 15 animals	15 x 10 sq.ft per animal for 15 animals
Lighting	adequate	adequate	Adequate	Adequate	Adequate	Adequate	not adequate
Air quality	good	good	Good	Good	Good	Good	Poor
Quality of floor	wet cement floor	semi dry	Semi dry	Semi dry	Semi dry	dry	Semi dry
Method of disinfection	phenyl	nil	phenyl	phenyl	phenyl	phenyl	phenyl
Type of feeding / type of feed	stall feeding / waste food from hotels nearby	stall feeding / hotel wastes	stall feeding / hotel wastes mixed with Livomix vitamin and mineral supplements	stall feeding / hotel wastes including chicken wastes from the metro Bangalore	stall feeding / hotel wastes mixed with Livomix vitamin and mineral supplements	stall feeding / hotel wastes mixed with Livomix vitamin and mineral supplements	stall feeding / hotel wastes
Quantity of feed	unknown	10 kg / animal	10 kg / animal	10 kg / animal	10 kg / animal	10 kg / animal	10 kg / animal
Water source/ daily usage	pigs are cleaned daily and also the sheds	Bore Water	Bore Water stored in large tanks	Bore Water stored in large tanks	Bore Water	Bore Water	Bore Water
Frequency of cleaning	daily in the morning	once in a week	daily	daily	daily	daily	weekly

Veterinary aid	vet visits once a month	Treatment done by Government Vet. Doctor	Treatment done by Government Vet. Doctor	Treatment done by Government Vet. Doctor	Treatment done by Government Vet. Doctor	Treatment done by Government Vet. Doctor	Treatment done by Government Vet. Doctor
Disposal of waste	discharged to fields	discharged to fields	Discharged to fields	Discharged to fields	Discharged to fields	Discharged to fields	Discharged to fields
Medication	deworming, vaccination in FMD,HS	Not done	deworming , vaccinations for HS , FMD and iron injections for piglets	deworming , vaccinations for HS , FMD and iron injections for piglets	deworming , vaccinations for HS , FMD and iron injections for piglets	deworming , vaccinations for HS , FMD, swine fever and iron injections for piglets	deworming , vaccinations for HS , FMD
Transport for slaughter	Tempo	Small Tempo	Tempo	Tempo	Tempo	Tempo	Tempo
Space per animal	2-3 tons of pig weight	20 animals / tempo	40 animals / tempo	40 animals / tempo	Not known	2-3 tons/ 12x8 feet space	Not known
Feedback	Each member of the family involved in the care of animals	Pig sty and sheds are badly maintained due to lack of adequate water and labour and no medication done	Some of the piglets were infected with HS due to improper vaccination, typical haemorraghic spots were seen behind the ears and back of the pig. Otherwise the sheds and the pigs were neatly maintained and the workers were wearing apron, masks and their welfare was taken care of		pigs and the pig sheds are not neatly maintained as a result there was diarrohoeal infection in pigs may be also due to contaminated food	The pigs and the pig sheds are neatly maintained and they are taken care like a family. Swine fever vaccine is purchased from Punjab as they are not available locally and given to pigs and this is the only farm with swine fever vaccine given	The pigs and the pig sheds are badly neatly maintained with poor lighting and ventilation

Summary of the findings:

1. All the farms do mixed farming.
2. Almost all use enclosed rearing – only one is free range.
3. The majority farmers sell their animals to Mangalore and Kerala based pig dealers. This could be due to the larger demand because of large numbers of Christians, in these areas, but this has not been ascertained.
4. Worker safety is minimal where considered.
5. All piggeries use stall feeding and hotel wastes to feed pigs
6. Most have adequate lighting and good ventilation, but do not have totally dry floors. Floors are usually cleaned daily, and phenyl is used for disinfection.
7. Most depend on government vets for medical treatment. Deworming and vaccination against FMD and HS are standard procedures.
8. All piggeries discharge wastes into the fields.
9. Tempos are used to transport the animals.

Other issues highlighted by the report:

1. Farmers have to pay 500 to 1000 rupees each time during transport on grounds of overloading the pigs and lack of possession of animal welfare board certificate and the farmers are not aware of the transportation rules
2. Labor problems due to dirty smell in pig sheds mainly from waste foods and hence in most farms family members take care of the pigs
3. Since the hotel wastes are mixed with plastic cups, broken pieces of cutlery, the farmers have to manually separate these items from waste food in the hotel dump-yard every day. (CUPA 2007)

Similar details are available from a study (Bujarbaruah 2006) that summarises the pig husbandry practices, with special focus on feeding, from north east India. Three types of feeding practices have been documented:

- Scavenging
- Scavenging + evening ration
- Semi commercial

Types of feed given:

Type of farmer	Feeding practice
Semi scavenging (Landless)	Broken rice + leaves + other wastes
Small	Bran + broken rice + waste vegetables
Medium	Maize + rice polish + leafy vegetables + kitchen/hotel waste

III.4. Policy and legislation impacting Pigs

On the national level, the Indian government, through the National Bank for Agriculture and Rural Development, has a loan facility for agribusiness projects like a pig farm or a meat-processing enterprise. Pig farms in the country are classified into commercial and non-commercial. Those in the commercial category qualify for up to Rs. I0 million in loans, provided they can put the required collateral. The non-commercial category, on the other hand, involves pig-breeding projects for the low-income segment of the population. These projects are more of dole-outs than anything else.

Some states also have their own incentive programs for the livestock industry. Haryana for example, offers up to 50 percent in subsidy to pig farms with national government loans, on top of other concessions in the purchase of sheds, feeds, piglets, etc. For the non-commercial sector, the government subsidizes up to 30 percent of the cost of these materials. The government also picks up the tab for up to 50 percent of the cost of vaccine for the farm animals. (Bhardwaj 2008)

III.5. Conclusions

Given the nature of pig farming in India, the welfare issues essentially arise out of slaughter conditions and to a lesser extent, transport. Current trends and available evidence does not suggest that there is likely that industrial pig farming is likely to catch on in the country in the near future. This is essentially because of social and cultural factors that inhibit demand for pig meant even within sections of the population that do not have religious restrictions on the consumption of pork. As far as slaughter is concerned, available literature suggests the absence of designated slaughter houses for pigs in any city in the country. It is reasonable to conclude that pig slaughter is entirely decentralised and more importantly, wholly unregulated.

IV. OTHER POULTRY (Turkey, Duck, Guinea Fowl, Quail, Emu, Ostrich)

Other than chicken, ducks are the most commonly raised poultry in India. There are several other birds raised for meat and to a lesser extent for eggs. This section of the report focuses on all birds other than chicken. The scale at which other birds are raised for meat and eggs is variable. Other than chicken, no other poultry birds are currently under large scale farming in the country. However, the central and state governments are attempting to aggressively promote diversification of the Indian poultry industry. The 2007-08 annual report of the Government of India's Department of Animal Husbandry, Dairying and Fisheries refers to financial assistance available to state governments from the centre for the breeding of guinea fowl, quail, turkey in existing state government poultry and duck farms and their popularization among farmers. There are also poultry farms operated by the central government that are promoting diversification of poultry with regional thrusts. Thus, Ducks are being promoted in the Southern and Eastern region, Japanese quail in the Western and Northern region, Turkey in South and West and Guinea fowl in Eastern India. Emu farming was also experimented with in Southern India. Four Central Poultry Development Organisations have produced about 80,000 ducklings and a total of 261,000 hatchlings of turkey, quail and Guniea fowl till December 2007. It is not clear the period over which these hatchlings have been produced.

Parallel to government efforts, there have been small private efforts to cater to exclusive urban markets in parts of the country. A web site has reported the growing popularity of free range ducks in Delhi. A Farm run by a French expatriate in Gurgaon, a suburb of New Delhi, has been featured on the web site that raises thousands of free-range Peking and Muscovy ducks on feed that is free of pesticide and antibiotics.
(http://www.terradaily.com/reports/Organic_Farms_Provide_A_Clue_F)

The 2003 livestock census pegs the total duck population of the country at 29.959 million birds and turkeys at 246,000. Ducks form about 10% of the total poultry population of the country and contribute about 6-7% of total eggs produced in the country. Ducks are mostly concentrated in the Eastern and Southern States of the country. (CPDO undated)

Organized turkey farms under private sector are practically non-existent. Turkey farming is limited to few small units at Government/public sector farms. Turkey consumption is mostly concentrated in and around cosmopolitan cities of India in small numbers, particularly around specific festivals such as thanksgiving or private celebrations.

IV.1. Diversity of Breeds

Turkey

There are three varieties of turkey commonly available in India. They are Broad breasted bronze, Broad breasted white and Beltsville small white. Domestic turkey maintained at private small-scale units scattered throughout the country are mainly the descendants of semi-improved Broad Breasted Bronze turkey imported from Europe and North America during the early years and it is referred to as local breed. Few flocks of Norfolks and Cambridge turkeys, may be also there. (Singh and Sharma 2005). Indigenous and non-descriptive turkeys are found in in Kerala, Tamil Nadu, eastern districts of Uttar Pradesh. In India, Beltsville Small White type turkeys are being maintained at most of the Government/university experimental farms. At few centers, Broad Breasted Bronze and Broad Breasted Large White units are also being kept. (Singh and Sharma 2005).
The Central Poultry Development Organisation (Southern Region) based in Bangalore is making efforts to promote turkey farming. Kerala and Tamil Nadu are the leading states in turkey production (Ahmed et al, undated). According to the same publication Turkey farming is getting popular in the southern regions of the country.
There is however, no information available on the varieties of Turkey that are preferred by the thin consumer base. Since commercial production is virtually non existent, the issue of breeds in commercial use does not arise.

Duck

Among the egg laying breeds of ducks, Khaki Campbell is the highest yielder. Individual egg production of almost an egg a day in this breed for well over twelve months has been recorded and flock averages in excess of 300 eggs per duck per year are not uncommon. White Pekin is the most popular duck in the world known for meat purpose. It is fast growing and has low feed consumption. (CPDO, undated)
Like is the case with broilers and layers among chicken, there are preferred breeds for eggs and for meat among ducks. In India, mainly the following ducks of egg-laying type are reared:

- Sylhet mate
- Nageswari
- Indian Runner
- Khaki Campbell

These ducks start laying eggs when they are 3 months old. The annual average egg production is about 300 eggs or more.
The species of ducks raised predominantly for meat are: Pekin, Aylesbury, Muscovy, Rouen, Cayuga, Buff and Swedish breeds. (Kumar and Ayyapan 1998)

IV.2. Breeding and Rearing Conditions

The Central Poultry Development Organisation (a Government of India supported agency that popularises poultry among farmers) has brought out guidelines for rearing of non chicken poultry birds. Much of the information in this section is

based on CPDO publications (CPDO, undated (a) and (b)). However, it is not clear what the actual situation on the ground is.

Ducks

The CPDO makes prescriptions for duck rearing, parts of which are reproduced below. However, as mentioned earlier, there is no information on whether these standards are being followed or not. However, these prescriptions provide an insight into the likely welfare issues that may emerge in the future if duck farming is undertaken at scale following CPDO prescriptions.

"Though duck is a water fowl and very fond of water, water for swimming is not essential at any stage of duck rearing. However, water in drinkers should be sufficiently deep to allow the immersion of their heads and not themselves. If they cannot do this, their eyes seem to get scaly and crusty and in extreme cases, blindness may follow. In addition, they also like to clean their bills periodically and wash them to clear off the feed. "

"Under semi-intensive system the house should have easy access to outside run as the ducks prefer to be outdoors during the day time and even during winter or rains. Generally the proportion of night shelter to outside run is 1/4:3/4. The run should gently slope away from the houses to provide drainage. Normally a continuous water channel of size 50cm. (20") wide and 15-20cms. (6-8") deep is constructed at the far end, on both sides, parallel to the night shelter, in the rearing or layer house."

"Ducklings may be reared in intensive, semi-intensive or range system. Under intensive system, allow a floor space of 0.279m^2 (3 sq.ft.) up to 16 weeks of age. Under semi-intensive system, a floor space of 0.186 to 0.279m^2 (2$^{1/2}$ to 3 sq.ft) per bird is allowed in night shelter and 0.929 to 1.394 m^2 (10 to 15 sq.ft.) as outside run per bird upto the age of 16 weeks. Usually ducklings are allowed to move to runs at the end of 3 to 4 weeks of age depending upon weather. Water in the drinkers should be 12.5 to 15 cm (5" to 6") deep to allow minimum immersion of their heads. Partitions upto the height of 60-90cm (2 -3") inside the pens and the outside runs are adequate for control. Under range system a flock of 1000 can be reared per 0.405 hectare (one acre)."

Turkeys

Similar to Ducks, CPDO has rearing prescriptions for Turkeys as well (CPDO, undated (b)). "The turkey may be reared under intensive as well as extensive system of rearing. The intensive rearing system is largely restricted to the Government owned farms for the popularizing of poultry. The intensive management is almost similar to that of chicken and is basically of deep litter type. One sq ft of floor space per poult is required during the first 3-4 weeks and thereafter the floor space requirement per bird is 1.5 sq ft upto 8 th week, 2 sq ft upto 12 th weeks of age, 2.5 sq ft upto 16 th weeks of age and 305 sq ft after 16 th weeks of age. Free range system of rearing is most popular for rearing the local stocks of turkey. They are natural foragers and scavengers and always range farther. Indeed, they thrive best where they can rove about freely feeding on seeds, fresh grass, other herbage and insects which include locusts, cicadas, crickets; grasshoppers, worms, slugs and snails etc.

Debeaking: Poults should be debeaked to control feather picking and cannibalism. Debeaking can be done at day old or 3-5 weeks of age. Remove the beak at about one half the distance from nostril to the tip of the beak. Desnooding: Removal of the snood or dewbill is to prevent the head injuries from picking and fighting. At the day old the snood can be removed by shumbnail or finger pressure. At 3 weeks of age it can be cut off close to the head with sharp scissors. *Detoeing or toe clipping:* Clipping is done at day old by removing the tip of the toe just to the inside of the outer most toe pad including the entire toenail.

Turkeys are not the best starters in their life and will really need some tender loving care to get them safely through the first four weeks of life. The average mortality rate is 6-10% during this period. Young poults by nature are reluctant to eat and drink in the first few days of life, primarily because of bad eyesight and nervousness. Hence, they have to be force fed.

Force Feeding: Starve out problem is one of the major factors for early mortality in poults. So special care has to be taken for supplying feed and water. In force feeding, milk should be fed at the rate of 100ml per liter of water and one boiled egg have to be given at the rate of one per 10 poults up to fifteen days and that will compensate the protein and energy requirements of the poults.

Turkeys of all age group can be easily driven from one place to another with the help of a stick. For catching turkeys a darkened room is best, wherein they can be picked up with both legs without any injury. However, mature turkeys should not be kept hanging for more than 3-4 minutes.

Feather picking is a mild form of cannibalism to which turkeys are addicted, especially during the growth period. It can be prevented almost completely by debeaking.

Prevention:

- Avoiding overcrowding in confinement.
- Feeding an adequate diet. "

CPDO recommendations on rearing have been reproduced verbatim in order to provide an insight on possible welfare implications of rearing undertaken according to CPDO recommendations. The publication goes on to state that " There is considerable scope for turkey rearing in India, as turkey can be reared in free range or semi intensive systems especially in rural areas for economic enhancement of landless laborers, marginal and small farmers. Free-range turkey rearing

method requires low investment in facilities and equipments and it is a viable and sustainable bird both for backyard and commercial venture in economic point of view. “

IV.3. Structure of the (Duck) Industry

Ducks

Ducks are considered as an important source of human food, supplementary income and employment opportunities for rural farmers and enterprises who supply duck farmers with inputs and services such as hatching eggs, ducklings, feed mixes, transportation & marketing. Ducks also provide organic manure for crops and fish tanks, help to reduce diseases in cattle (Liver fluke and Nasal Schistosomiasis) by feeding on snails that serve as an intermediate host for the parasites causing these diseases (Bhardwaj 2008).

While duck rearing in India is predominantly a traditional activity among rural poor in the southern and eastern parts of the country, where ducks are kept mainly for egg production, Gajendran and Kathiravan (2008) have documented an organized industrial set up in Tamil Nadu that supplies duck products (eggs as well as live bird) to consumers in Kerala.

The study of marketing channels for duck egg production identified five channels through which the duck eggs were moved from the producer (farmer) to the ultimate consumer (including consumers in Kerala). They are as follows:

Channel I: Producer-Trader-Wholesaler (Consumption centre)-Retailer-Consumer

Channel II: Producer-Trader-Retailer (Consumption centre)-Consumer

Channel III: Producer-Wholesaler-Secondary WS (Consumption centre)-Retailer-Consumer

Channel IV: Producer-Wholesaler-Retailer (Consumption centre)-Consumer

Channel V: Producer-Consumer

Of the five channels, the quantum of eggs transacted through first channel was high while through fifth channel was very low or negligible. The 'trader' in the channels was like a preharvest contractor for crop produce, who lent money and other inputs to the farmers in turn receiving their produce.

Producers brought their eggs from farm to trader/ wholesaler shop in wire or bamboo baskets carried through bus or bicycles. The duck eggs were packed in bamboo or wooden boxes using layers of paddy straw as shock absorbent. In some places, eggs are packed in paper and plastic filler flats and then kept in cardboard boxes for further transport. They were transported to distant areas through rail, bus or lorries (Gajendran and Kathiravan 2008).

Analysing duck meat marketing in Tamil Nadu, the same study concludes that only live drakes and spent ducks are sold for meat purpose, unlike broiler chicken. Though duck products are available in large quantity in TN, their consumption was mainly in the adjacent state, Kerala. Three channels were identified in marketing of duck meat. They are as follows;

Channel I: Producer-Trader or Wholesaler-Retailer (Consumption centre)-Consumer

Channel II: Producer-Retailer-Consumer

Channel III: Producer-Consumer

Of the above three channels, Channel I handled large quantum of duck meat while Channel III transacted a negligible or meager quantity.

These traders and wholesalers procured live birds from producers and distributed to wholesalers or secondary wholesalers of consumption centres through lorries. At this stage of marketing there are large number of sellers and also buyers.

IV.4. Conclusions

Despite efforts of multiple government agencies to promote poultry other than chicken, there is no significant commercial production of such birds. Ducks are the only birds that are numerically large in number and these are restricted to parts of the country that have traditionally consumed duck products - the south and east. Even here ducks are not raised under factory farming conditions. However, as demand for meat increases, it is not unlikely that other types of poultry will also enter commercial production. This is particularly of concern as the setting up of such units is almost wholly unregulated. In particular, there is no regulation of condition under which birds are reared.

Other than this, transport and slaughter, particularly “culling” with repeated bird flu outbreaks, continue to be significant issues from the point of view of the birds.

V. REFERENCES

Ahmed, Majdood; Rajeshwara Rao, PS Mahesh, K. Ravikumar, Sayeed Ahmed, P. Nallappa. Undated. Turkey Management Guide. Central Poultry Development Organisation (Southern Region), Department of Animal Husbandry, Dairying and Fisheries. Ministry of Agriculture, Government of India.

Ali, J 2007. Livestock sector development and implications for rural poverty alleviation in India. Livestock Research for Rural Development Volume 19 Article 27. 2007.

Arya, HPS; Chander, Mahesh 2002. Goat Production By Landless And Small Scale Farmers In North Indian Plains. 17th International Farming Systems Association Symposium. Lake Buena Vista, Florida, USA. November 2002.

Bhardwaj, Rakesh 2008. A long way to go for Indian piggery. Meat & Livestock Business Asia Issue 5/2008.

Bhardwaj, Rakesh 2008. India's bird of hope. Meat & Livestock Business Asia Issue 5/2008.

Blench, Roger 2001. 'You can't go home again' - Pastoralism in the new millennium. Overseas Development Institute. London. May 2001.

Bootwalla, Salim 2005. Poultry and the population on the Asian subcontinent. World Poultry Vol. 21 No.4 2005.

Bujarbaruah, KM 2006. Status and Strategies for Pig Production in North East India. Pig systems in Asia and the Pacific: how can R&D enhance benefits to the poor? Bangkok, Thailand. Animal Production and Health Commission for Asia and the Pacific/International Livestock Research Institute. November 2006.

CALPI 2005. Sustainable Livelihood through Small Ruminant Production - Critical Issues and Approaches. Draft for Stakeholder Review. Capitalisation of Livestock Programme Experiences India/SDC/Intercooperation. September 2005.

CARTMAN, undated. Special Issue on Livestock and Development. CARTMAN - Centre of Excellence: Animals and Environment. A Project of Ministry of Environment and Forests, Government of India.

CLFMA 2005. Non-Poultry Meat Industry. Livestock Industry Report 2005. Compound Livestock Feed Manufacturers' Association of India. 2005

CPDO ,undated (a). Duck Management Guide. Central Poultry Development Organisation (Southern Region). Undated.

CPDO ,undated (b). Turkey Management Guide. Central Poultry Development Organisation (Southern Region). Undated.

CUPA 2007. Humane Standards for the Improvement of Pig Rearing- Farm. Compassion Unlimited Plus Action. Bangalore. March 2007.

DAHDF 2006. Basic Animal Husbandry Statistics. Department of Animal Husbandry, Dairying and Fisheries. Ministry of Agriculture, Government of India. Krishi Bhawan, New Delhi. 2006

Deka, Rameswar; Thorpe, William; Lapar, M Lucila; Kumar, Anjani 2007. Assam's pig sub-sector: Current status, constraints and opportunities. International Livestock Research Institute. September 2007.

Delgado, Christopher L; Narrod, Clare A; Tiongco, Marites M 2003. Policy, Technical, and Environmental Determinants and Implications of the Scaling-Up of Livestock Production in Four Fast-Growing Developing Countries: A Synthesis. Project on Livestock Industrialization, Trade and Social-Health-Environment Impacts in Developing Countries. Livestock, Environment and Development, Food and Agricultural Organization of the United Nations. July 2003.

Delgado, Christopher; Rosegrant, Mark; Steinfeld, Henning; Ehui, Simeon; Courbois, Claude 1999. Livestock to 2020 – The Next Food Revolution. Food, Agriculture and the Environment Discussion Paper 28. International Food Policy Research Institute, Food and Agriculture Organization of the United Nations, International Livestock Research Institute. May 1999.

Dey, A; Barari SK; Yadav, BPS 2007. Goat production scenario in Bihar, India. Livestock Research for Rural Development. Volume 19, Article 123. 2007.

Dhankar, Deepa 2007. India Livestock and Products Annual. Global Agriculture Information Network, USDA Foreign Agricultural Service IN7094. January 2007.

Dhankar, Deepa 2008. India Livestock and Products Annual. Global Agriculture Information Network, USDA Foreign Agricultural Service IN8098. February 2008.

Gajendran, K; Kathiravan, G 2008. Structure of Duck Egg and Meat Marketing System: The Case of Tamil Nadu (South India). World Applied Sciences Journal 3 (1): 63-66, 2008.

Geerlings, Ellen; Mathias, Evelyn; Köhler-Rollefson, Ilse 2002. Securing tomorrow's food - Promoting the sustainable use of farm animal genetic resources - Information for action. League for Pastoral Peoples. Germany 2002.

GoI 2000. Notification No. 29(Re-2000)/1997-2002. Department of Commerce. Ministry of Commerce & Industry. New Delhi. August 2005.

GoI 2003. Notification No. 03 (Re-2003)/2002-2007. Department of Commerce, Ministry of Commerce and Industry. New Delhi. March 2003.

GoI 2008. Operational guidelines for the scheme of Modernization of Abattoirs. Ministry of Food Processing Industries. New Delhi. September 2008.

Hugo, S 1997. Duck Production in India. Lecture at the Veterinary Research Institute (VRI), Peradeniya, Sri Lanka. December 1997.

IPAN 2007. Report on Animal Field Worker Training Program Block I/VI. India Project for Animals and Nature February 2007.

Kumar, K, Ayyappan, S 1998. Current Practices in Integrated Aquaculture from India. Integrated Aquaculture in Eastern India: DFID NRSP High Potential Systems - Working Paper Number 5. Integrated Aquaculture Research Planning Workshop, Purulia, India. March 1998.

Landes, Maurice 2008. The Environment for Agricultural and Agribusiness Investment in India. Economic Research Service, U. S. Department of Agriculture EIB-37. July 2008.

Misra, AK; Subrahmanyam, KV; Vijoy Sankar Babu, M; Reddy, TY; Shivarudrappa, B; Ramakrishna, YS 2006. Improving the livelihood of landless and marginal farmers through sheep rearing in rainfed agro-ecosystem of India. Livestock Research for Rural Development. Volume 18, Article 73. 2006.

MoFPI 2008. Annual Report 2007-08. Ministry of Food Processing Industries, Government of India. New Delhi. 2008.

Mui, NT; Hang, DL; Binh, DV 2006. Goat raising in Viet Nam. Goats - Undervalued Assets In Asia: Proceedings Of The APHCA-ILRI Regional Workshop On Goat Production Systems And Markets. Luang Prabang, Lao PDR. Animal Production and Health Commission for Asia and the Pacific/International Livestock Research Institute. October 2006.

NCRM. Abstract of Sub-project: A Value Chain for Clean Meat Production from Sheep. National Research Centre for Meat. Hyderabad.

Nimbkar, C 2006. Options for genetic improvement of goats by smallholders. Goats - Undervalued Assets In Asia: Proceedings Of The APHCA-ILRI Regional Workshop On Goat Production Systems And Markets. Luang Prabang, Lao PDR. Animal Production and Health Commission for Asia and the Pacific/International Livestock Research Institute. October 2006.

Nunan, Fiona 2000. Livestock and livelihoods in Hubli-Dharwad, India. Urban Agriculture Magazine No. 2, Urban Livestock. RUAF. October 2000.

Planning Commission 2006. Report of the Working Group on Animal Husbandry and Dairying for the Eleventh Five Year Plan (2007-2012) Planning Commission, Government of India.

Raju, Thammi D; Suryanarayana MVAN 2005. Meat consumption in Prakasam district of Andhra Pradesh: an analysis. Livestock Research for Rural Development. Volume 17, Article 130. 2005.

Ranjhan, SK 2004. Indian Meat Industry Perspective. Food and Agricultural Organization of the United Nations. 2004.

Shah, Deepak 2007. India's Trade Practices in Livestock Sector. Munich Personal RePEc Archive. July 2007.

Singh, KP 2002. Integrated Farming Systems For Smallholders In India - Models And Issues For Semi-Arid Tropical Conditions. 17th International Farming Systems Association Symposium. Lake Buena Vista, Florida, USA. November 2002.

Singh, Rajvir; Deepak Sharma 2005. Turkey and Guinea fowl: Role in Indian poultry production. IPSACON. 2005.

Singh, RB; Kumar, P; Woodhead, T 2002. Smallholder Farmers in India: Food Security and Agricultural Policy. FAO Regional Office for Asia and the Pacific. March 2002.

Singh, SK; Singh, MK; Singh, NP 2006. Role of goats in sustainable rural livelihoods in India. Goats - Undervalued Assets In Asia: Proceedings Of The APHCA-ILRI Regional Workshop On Goat Production Systems And Markets. Luang Prabang, Lao PDR. Animal Production and Health Commission for Asia and the Pacific/International Livestock Research Institute. October 2006.

USDA FAS 2007. Livestock and poultry: World markets and trade. USDA Foreign Agricultural Service Circular Series DL&P 2-07. November 2007.

USDA FAS 2008. Livestock and poultry: World markets and trade. USDA Foreign Agricultural Service. October 2008.

Vaidya, SV 2001. The Indian feed industry. Livestock and Animal Feed. Food and Agricultural Organization of the United Nations. August 2001.

Van Horne, PLM; Achterbosch, TJ 2008. Animal welfare in poultry production systems: impact of EU standards on world trade. World's Poultry Science Journal Vol. 64. March 2008.