10

URBAN LIVESTOCK KEEPING

Delia Grace,1 Johanna Lindahl,1,2 Maria Correa3 and Manish Kakkar4

1 INTERNATIONAL LIVESTOCK RESEARCH INSTITUTE, NAIROBI, KENYA
2 SWEDISH UNIVERSITY OF AGRICULTURAL SCIENCES, UPPSALA, SWEDEN
3 NORTH CAROLINA STATE UNIVERSITY COLLEGE OF VETERINARY MEDICINE, USA
4 PUBLIC HEALTH FOUNDATION OF INDIA, DELHI, INDIA

Introduction

For the first time in history, more people are living in towns and cities than in the countryside and at least one billion intra- and peri-urban dwellers are estimated to practise agriculture. Their farming varies from growing herbs on a windowsill, to cultivating a vegetable allotment, to raising poultry under their bed, to running a dairy.

Urban livestock keeping is an interesting aspect of urban agriculture. Compared to crops, livestock produce foods that bring more profits and have a higher nutrient content, but that are more expensive to produce and buy. Livestock products are highly perishable, a strong driver for producing them around cities; also, livestock products are more prone to spoilage and contamination with disease-causing organisms. Livestock require little room and can better share spaces with human beings, but they also create more nuisance, waste and injuries than plants. Hence maintaining livestock in ways that minimize risks and maximize benefits is a powerful indicator that urban agriculture is thriving.

This chapter considers the past, present and future of urban livestock keeping and discusses the benefits and risks and their management. We first review keeping of livestock in cities: nearly ubiquitous in historical times, gradually evicted from ‘modern cities’ over the last century, and their comeback in recent decades. The second section discusses the different types of livestock keeping in cities and provides up-to-date information on the extent of livestock keeping and its motivation. We then discuss benefits and risks of livestock keeping in cities and suggest ways to maximize the former while reducing the latter. Finally, conclusions are drawn and a way forward offered. The chapter as a whole revisits the earlier synthesis by Schiere et al. (2007).
History of livestock and cities

In the beginning was livestock, and then came cities

Livestock are older than cities. Bezoars, ancestral to goats, were probably the first animals to be domesticated around 11,000 years ago (Pereira and Amorim 2010), followed by cattle, whose ancestors were so large and savage they were almost not domesticated at all; the world’s 1.3 billion head of cattle are descendants from an original population of just 80 aurochs (Bollongino et al. 2012). More peaceable jungle fowl have been domesticated on multiple occasions, starting at least 5,400 years ago (Miao et al. 2013).

Cities probably arose after the invention of agriculture (although some argue the other way round). Ancient cities often had only modest populations and archaeology suggests livestock mingled with citizens. With time, cities and civilizations grew; and by the year AD 100 the world’s three most populous cities (Rome, Luoyang and Seleucia) had more than a million human inhabitants among them, and likely many more productive animals and peri-domestic pests. Animals were kept in biblical towns, in ancient and medieval European cities, in Mayan and Aztec city-states, as well as in Chinese civilizations (Schiere et al. 2007). In pre-colonial Nigeria, the edges of cities consisted of intensively farmed land where the majority of the urban population worked each day (Winters 1983), while in eastern and central African cities, the quarters of these cities were separated and the spaces between them used for farming. As one observer said of Kampala, “it was less of a city than an immense garden” (Gutkind 1963).

Up to the last century, equids, camelids, ruminants and canids transported people and goods into, out of and around cities. As late as the 1960s, citizens in Europe and America got dairy products delivered to their door by horse and wagon. In England, rag and bone carts did rounds to buy sellable discards, while dustcarts removed refuse for a fee. In America, urban dairying grew rapidly after the 1850s when breast-feeding fell out of favour for cultural reasons (Du Puis 2002). In the mid-nineteenth century New York, many dairies were attached to breweries and distilleries where as many as 2,000 cows could be maintained in one giant stable feeding on brewers’ wastes, hot from the still.

Some cities owe their origins to livestock. The American stockyard cities such as Chicago, Kansas City, Fort Worth and “Porkopolis” (Cincinnati) depended on the livestock and meat-packing trade during their establishment and growth. By 1900, the Chicago stockyards employed more than 25,000 people and produced 82% of the meat consumed in the United States. They also provided the backdrop for Upton Sinclair’s novel The Jungle. This book was intended to draw attention to appalling workers’ conditions, but ended up becoming a cause celebre for food safety, eventually leading to the establishment of the US Food and Drug Administration.

All day long the blazing midsummer sun beat down upon that square mile of abominations; upon tens of thousands of cattle crowded into pens whose
wooden floors stank and steamed contagion; upon bare, blistering, cinder-strewn railroad tracks and huge blocks of dingy meat factories, whose labyrinthine passages defied a breath of fresh air to penetrate them; and there are not merely rivers of hot blood and carloads of moist flesh, and rendering-vats and soup cauldrons, glue-factories and fertilizer tanks, that smelt like the crater of hell – there are also tons of garbage festering in the sun, and the greasy laundry of the workers hung out to dry and dining rooms littered with food black with flies, and toilet rooms that are open sewers.

(Sinclair 1906: 8)

**Livestock leave (some) cities**

The first half of the last century saw a striking decline in the number of productive animals in cities in North America, Europe and Australia. Some authors trace this de-urbanization of animals to attitudes emerging in the nineteenth century whereby animals were increasingly seen as “impure, polluting, disruptive, and discomforting occupants of city spaces” (Philo 1995). A belief which the quotation from Upton Sinclair suggests was not wholly unwarranted.

These developed country cities could throw off their agriculture because of the invention of fertilizers, refrigeration, and steam and motorized transport, which together created the modern food system. Agriculture became increasingly industrialized, large-scale, dependent on specialized and expensive inputs, and located far from urban consumers. In parallel, urban areas stopped being seen as spaces for food production (Bellows 2010), at least in the countries where agriculture intensified first.

Several well-documented case studies show how livestock left cities. Perhaps surprisingly, the temperance (no alcohol) movement had a major role in the de-urbanization of livestock in the United States. Feed has always been the most expensive input for intensive livestock keeping, and at the time, urban dairies were heavily dependent on by-products of city breweries and distilleries. Temperance leagues joined with physicians to campaign against filthy conditions of urban dairies and the resultant “white poison”; instead, they called for “pure country milk” to replace beer and gin (Shaftel 1978). These campaigns, along with the decline of the distillery industry, rising land values and ‘standards of propriety’, led to the expulsion of dairies from Brooklyn by the twentieth century (Tremante 2000).

Gaynor (2007) describes how livestock went from ever-present to almost-absent in Australia’s cities. In 1895 metropolitan Sydney recorded no less than 8,246 sheep and goats, 7,318 dairy cows and 5,560 swine. By the late twentieth century, almost no productive animals remained. The decline resulted from an increasing intolerance to animals in residential areas, leading to zoning restrictions, prohibitive license fees and regulations that made keeping of livestock increasingly difficult. This was not an uncontested eviction and many people, especially women and the working class, resisted the re-imagining of cities as livestock free.
Many of the regulatory mechanisms to exclude livestock from cities were adopted by cities in Africa and Asia but their application was generally much less successful. A review of laws of southern Africa published in 1999 found that regulations on land use in urban areas were present in most countries but little enforced and corruption was regularly reported (Briscoe 1999). Although livestock were kept out of some residential and commercial areas, their presence was widely visible and indeed has been considered a characteristic of developing-country cities.

**Livestock comeback**

The eviction of livestock from cities, never total, was soon to prove transitory. The last 50 years have witnessed a remarkable resurgence of interest in urban agriculture, and with this keeping of livestock in cities. In Africa and Asia, where urban agriculture remained an important subsistence and economic activity, it was the focus for sporadic civic action and research from the 1960s on, but this failed to persuade international organizations or governments to take urban agriculture seriously (Lee-Smith 2010). But, around the same time, there was a blossoming of community farms in the UK, Europe, USA and Australia, probably linked to increasing environmental concerns and more leisure, and these movements had more influence in the policy arena.

As urban agriculture became popular, it started to attract the attention of development agencies and donors. In 1991 the United Nations Development Programme commissioned an assessment of the relatively unknown field of urban agriculture. Canada’s International Development Research Centre (IDRC) later played a leading role in forging this new discipline. IDRC and other partners supported the creation of a key global network, the RUAF Foundation (International network of Resource centres on Urban Agriculture and Food security) (Mougeot 2011). The CGIAR launched a decade-long program on health and resource recovery dimensions of urban agriculture in selected cities.

In developed countries, attitudes and policies have gradually become more positive to urban agriculture. A survey of urban agriculture regulation in 16 US cities, including Washington, DC, Detroit and Boston found that most cities supported community gardens. Keeping chickens was permitted in many cities but fewer allowed keeping of other livestock or bees. Moreover, regulations regarding the keeping of animals were stricter than those for gardens and restrictions on where animals were kept and the number that could be kept were nearly always in place (Goldstein et al. 2011). In the UK, up to 50 household chickens can be kept without the need to register.

The same trends are seen in developing countries. The Food and Agriculture Organization of the United Nations (FAO) reports that in the past decade, governments in 20 countries have sought their assistance in removing barriers and providing incentives, inputs and training to low-income city farmers (FAO 2010).

But paradoxically, although developing-country cities were slower to eject livestock from cities, they have also been slower to accept them. A case study on urban policy-makers in Dharwad, India, observed that there was no official
recognition of urban agriculture or policies to support it. Especially, urban livestock keeping was viewed by city officials as a major obstacle to fulfilling their responsibility of providing water and sanitation and the apex court had adopted regressive laws which ban ‘stray’ cattle and aims to phase out all cattle within cities of a population larger than 500,000 (Nunan 2000b).

Livestock in cities today

*Why are livestock kept in and around cities?*

In 2008, for the first time the majority of the world’s population lived in cities, around one-third of them in informal settlements or slums. Over 90% of urbanization is occurring in poor countries and the urban population is expected to double from 3.3 billion in 2007 to 6.4 billion in 2050. Increasing urban populations create increasing demands for food products (Yeung 1988), as urbanization

![Figure 10.1](image.png)

*Figure 10.1* Transporting live pigs by motorbike in Vietnam

*Source: ILRI.*
is associated with higher consumption of meat and other animal-source food products (Rae 1998; Delgado 2003) and greater reliance on ready-to-eat foods.

The massive increase in demand for livestock products over the past few decades has created equally significant opportunities for smallholders who raise animals to meet that demand (Herrero et al. 2010). In urbanized economies, there may be fewer opportunities for smallholder provision of livestock commodities; but this also varies, with smallholders being far more competitive, for example, in the dairy sector, but far less likely to prosper for monogastric production (Tarawali et al. 2011).

In many developing countries, transport infrastructure is inadequate and expensive and it is difficult or impossible to maintain a cold chain. Hence, growing demands for perishable products can best be met by nearby production: it is most efficient to produce milk and eggs and slaughter livestock for food as near to the point of consumption as possible (Schiere and Hoek 2001; Veenhuizen and Danso 2007). Figure 10.1 shows some of the challenges of transporting pigs without a cold chain in Vietnam and, partly as a result, 97% of the pork consumed in Vietnam is sold in wet markets. By bringing live pigs to cities, and reducing times between slaughter, sale and consumption, large amounts of pork can be cheaply delivered to millions of urban consumers (Fahrion et al. 2014).

In some countries, policy-makers have actively encouraged farming within city limits. In China, making cities self-sufficient in food is a policy objective. Within Beijing, intra-urban agriculture supplies 70% of non-staple food to city inhabitants (consisting mainly of milk and vegetables) (FAO 2011). In developed countries, livestock are often kept for reasons other than production or work: mainly leisure and community development.

Where are livestock kept in cities?

Animals can be kept almost anywhere in and around cities and towns. There is a tendency for livestock density to decrease as human density increases, and for livestock to be less present in slum and central business areas (Lindahl et al. 2012). However, this is not absolute. For example, a study in a Vietnamese city found that pig-farming can persist at even high human density and in many cities livestock may pass through highly populated areas, either providing transport or looking for food. In densely populated slums, livestock are less common and small stock, such as poultry, dogs, cats and rabbits, which have minimal space requirement, predominate (Figure 10.2).

The suburbs and outer areas of cities typically have more space and available biomass for feeding animals. In these areas, dairies are common (Figure 10.3) and so are multi-species enterprises, which may include poultry, dogs, cats and rabbits. The specialized sheep- and goat-fattening systems, which are a feature of semiarid systems, are also typical of suburban farming.

Outside the city bounds there are often fewer regulations that restrict livestock keeping while access to the large city markets is still good. Unsurprisingly, peri-urban production is characterized by larger farms, more animals and a greater
FIGURE 10.2 Pigeons in Burkina Faso require little space or housing costs
Source: ILRI.

FIGURE 10.3 Peri-urban dairy in Bamako, Mali
Source: ILRI.

business orientation. Peri-urban production is predominantly based on pigs and poultry because these are most suited to intensive production. Commercial peri-urban production of livestock is an extremely fast-growing sector, representing 34% of total meat production and nearly 70% of egg production worldwide (FAO 1999).
The importance and character of urban livestock also vary by region:

- **Asia:** More than half of the world’s urban population live in Asia, and more than 60% of them are estimated as poor (Mougeot 2005; Satterthwaite 2010). Urban livestock keeping includes rearing of dairy cattle and buffaloes, small ruminants (sheep, goat), pigs, poultry (chicken, ducks, turkey) and small animals like guinea pigs, rabbits and pigeons. They are reared in intensive systems or backyard, scavenging systems. As in other parts of the world, the species present in the urban livestock keeping are reflections of the species commonly kept and consumed in the area. Whereas India has a large number of urban dairy cows, Vietnam and China have higher proportions of urban pigs and Indonesia of poultry.

- **Africa:** Today, about 40% of the African population live in urban areas. Over the next four decades, Africa’s urban population is likely to triple in size. In many cities of sub-Saharan Africa, slums account for three-quarters of urban residents. Studies show that livestock keeping is common in African cities and that smaller livestock (poultry, rabbits) are most common, but keeping of sheep and goats (called shotts in East Africa) and dairy cattle is also prevalent (Kang’ethe et al. 2007). Cities in South Africa have tended to have fewer livestock and those of West Africa the most (Heilig 2012).

- **South America:** Three-quarters of the population and half of the poor in Latin America live in cities (Fay 2005). Swine and poultry are the two more common species raised in urban areas in Latin America, although rabbits are becoming more popular. Guinea pigs have been historically domesticated and raised for food in the Andean region of South America. In the periphery of the cities, small ruminants in small to medium-size herds are common. These animals are walked to public lands for foraging during the day and brought back at night to be housed in patios adjacent to houses (Correa and Grace 2014).

- **Europe and North America:** In developed countries, livestock are often kept as part of community development or as a leisure enterprise. Livestock are kept in petting zoos, children’s farms, rare breed farms, science museums and residential care homes for the disabled (LeJeune and Davis 2004). Currently, there are around 136 million international migrants living in developed countries, with numbers continuing to rise (OECD 2013). Many immigrants come from a rural background or developing-country cities where livestock keeping is ubiquitous and they often choose to keep city livestock in their new home.

**Who keeps livestock in cities?**

The rapid growth of cities has led to previously rural areas being incorporated in cities. Many of the original inhabitants were farmers, and have continued their occupation as cities engulfed them. At the same time, many poor people have left
the countryside to seek new opportunities in cities, and brought their livestock or their habits of livestock keeping with them. Livestock keeping is widespread among poor people. Recent estimates suggest nearly 1 billion people living on less than two dollars a day are dependent to some extent on livestock (Staal et al. 2009), so it is not surprising that the influx of poor people to cities has led to increases in urban livestock keeping.

Livestock keeping in cities can be very profitable and has attracted entrepreneurs, sometimes with no background in livestock keeping. Many of these are young people with tertiary education but who cannot find jobs in the formal sector.

**How common is livestock keeping in cities?**

Obtaining accurate information about the extent of urban livestock keeping is not easy. The largest urban populations live in the informal settlements of rapidly growing cities in developing countries. But in these areas there is little reliable information on human demography, let alone animal populations; additionally, the ambiguous legal position of livestock keeping also hinders reporting.

Schiere et al. (2007) summarized some earlier studies and reports on livestock in cities: over one-third of households surveyed in Harare, Zimbabwe, kept chickens, rabbits, pigeons, ducks and turkeys. In Cairo, Egypt, 5% of households kept small animals like chickens and pigeons. Some 41% of the households in Hue City, Vietnam, had livestock and 80% of Dhaka's (Bangladesh) inhabitants kept animals. However, many of these earlier reports lacked sufficient rigour to accurately estimate livestock populations. Moreover, as livestock keeping in cities has long been controversial, estimates by interest groups are prone to an upwards or downwards bias. Box 10.1 describes a study, which overcame the challenges of gaining information of livestock in cities to develop an accurate estimate of actual numbers along with an estimate of uncertainty.

---

**BOX 10.1 ESTIMATING THE NUMBER OF LIVESTOCK KEEPERS IN CITIES**

As part of an IDRC supported study, the International Livestock Research Institute (ILRI) undertook the first statistically rigorous survey of livestock keeping in two cities in Nigeria. As there was no reliable census for households or livestock keepers, households were selected by random sampling from a spatial grid. Nearly 2,000 households were involved with 985 detailed questionnaires. In Ibadan and Kaduna, with a combined human population of approximately 1.7 million, around 2 million livestock are kept. Chicken predominated (1.7 million), and sheep and goats (shoats) were also common (200,000). Cattle were comparably infrequent (13,000), but around 200,000 from a wide range of niche species were kept (turkey, guinea fowl, quail, snail,
Two-thirds of households reported keeping livestock on the compound in the last year. Poultry keeping was most common (46% of households), followed by small ruminants (31% of households), while cattle and pig keeping was rare (2% and 1%, respectively). Herd size was generally small, but a small number of households kept substantial numbers of animals (3% of households had more than 100 animals on the compound). Livestock contributed most to food (purchase or direct consumption) and to a lesser extent to general expenses, school fees and medical fees.

Source: ILRI project report.

In 2007, in India, the Ministry of Agriculture estimated there were 67 million livestock in Indian cities (6% of the total livestock in India) or one livestock for every five persons in cities (Singh et al. 2013). Numbers were dominated by poultry but cattle made up 85% of the livestock biomass. Numbers of poultry and cross-bred cattle were increasing rapidly and goats slowly; sheep, pigs, equids and indigenous cattle were declining. This implies the dairy and poultry, which can best supply rapidly increasing demand, are increasing while less-productive animals are declining and transport animals are being replaced by motor vehicles.

**FIGURE 10.4** Livestock keeping by rural and urban households in 12 developing countries

*Source: Data from Pica Ciamarra et al. 2011 (Image: ILRI).*
A recent study provides solid information on livestock keeping in 12 other developing countries between the years 1995 and 2004 (Pica-ciamarra et al. 2011). Across the 12 countries, 65% of rural households and 17% of urban households kept livestock. If this proportion is extrapolated across the 2.5 billion people who currently live in developing-country cities, it implies there are 450 million people in urban livestock keeping households in poor countries. The study also found that, in cities, poor people were much more likely to keep livestock, whereas in rural areas, it was often the rich who had more and higher-value livestock. Although little information is available, it is probable that in developed countries a much lower proportion of households keep livestock. In developed countries, a far lower proportion of households keep livestock, although the trend has been upwards, probably less than 5%.

**How are livestock kept in cities?**

Livestock keeping in cities is highly diverse (Table 10.1). Systems may be categorized according to location (slum, urban, suburban, peri-urban); species (from guinea pigs to camels); farming system (intensive or semi-intensive predominate); production objective (food, money, draft power, financial services, assets and psycho-social well-being); and stage in the value chain (supplying young stock, males for breeding, livestock products).

Livestock as well as other animals are often kept for production or work. Most common are dogs and geese for guarding houses and compounds, and cats for pest control. In South East Asia, songbirds and fighting cocks are also common. In West and Central Africa, wild-caught deer and monkeys may be kept as curiosities. Table 10.1 summarizes some of the characteristics of urban livestock diversity.

In developing countries, the most common urban livestock keeping systems are backyard poultry, urban dairying, pig-keeping and fattening of sheep and goats.

**Backyard poultry:** Poultry are probably the most common type of livestock kept in urban areas. It is likely that poultry are present in all developing-country cities and towns in Africa, South Asia and South East Asia. A study from Kampala reveals a typical system. The household contained on average 8 persons and 17 local chickens. Women were most commonly in charge of chickens. The main reason for keeping poultry was income, and additional reasons were for food for the household and manure. Neighbours were positive about urban chicken production, 70% saying they benefited directly. One respondent stated, “Friendship is formed because chickens scavenge on my land” (Dimoulas et al. 2008). In India, large-scale poultry farms exist near every big city. In North America, poultry are the most commonly kept backyard livestock and seem to be increasing. A 2010 US Department of Agriculture study in four urban areas (Los Angeles, Denver, Miami and New York) found that 4% of the households planned to get chickens within the next five years, compared to less than 1% who had backyard poultry at the time of the survey (USDA 2013).
TABLE 10.1 Typologies of urban livestock keeping diversity

<table>
<thead>
<tr>
<th>Diversity in scale</th>
<th>Diversity in species</th>
<th>Diversity in management</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small-scale predominates but medium- and even large-scale are found. In Nairobi, a crowded city with a population of 2 million, there are 1,350 commercial pig and poultry farms linked to national chains. Farmers with 3,000 birds or 30 breeding sows can earn USD $1,000 per month.</td>
<td>Small stock (poultry, sheep and goats) predominate but dairying and feedlots are found in most cities. Niche and unusual species are common. These include rabbits, snails, grass-cutters (greater cane rat), cattle, dogs and even camels. Often, a mix of species is kept.</td>
<td>Backyard systems where animals are confined to premises but allowed to roam freely for part of the day are most common. Permanent housing (zero-grazing) is a high input, high output system. The poorest often let animals scavenge freely or illegally use common spaces (roadside, open areas, rubbish heaps).</td>
</tr>
</tbody>
</table>

Diversity in production objective

Unlike other urban agricultural activities, production for sale is usually the most important objective. Self-consumption usually ranks second. Other functions are:
- Financial
- Converting by-products
- Social (status, presents)
- Pleasure (the enjoyment of living things, hobby)

Diversity in input level and capitalization

Businesses generating high profits such as dairying and fattening male sheep for Ramadan and Eid are usually high input. Most livestock kept by the poor are in low external input systems.

Diversity in farmers

Women have a high involvement in livestock keeping. The poor have a high involvement. The poor generally keep a wider mix of lower-value animals (indigenous species and small stock) than do richer farmers.

Sources: based on UNDP 1996; Waters-Bayer 1996; Schiere and van der Hoek 2001; Schiere et al. 2007.

**Dairying:** Dairying is probably the second most important urban livestock system. It is common in cities and towns inhabited by milk-drinking cultures. These are mainly found in East Africa (especially Kenya and Ethiopia), Sahelian cities of West Africa and South Asia. Studies in Nairobi and Addis found one in 100 urban households kept cattle and in Indian cities there was one bovine for every 20 persons. These cultures have rich traditions around cattle.

There are also emerging dairies in cities without a tradition of milk-drinking, such as South East Asia. These are much less numerous and, in some cases, interesting new systems have evolved. A study in Greater Beijing found that approximately one-quarter (26%) of farmers checked into cow hotels after the Milk Scandal, increasing from 2% before the crisis (Mo et al. 2012).

**Pig-keeping:** Urban pig-keeping is most common in South East Asia and North East India. Pork-China is often compared to Dairy-India, because pork has the same central role in China as dairy products do in India. Pigs are reared near and inside every city of China. Estimates suggest around 500 million pigs are kept, with 60% in intensive systems which are generally urban or peri-urban. In
the Philippines, 30% of pigs are kept in commercial herds and 65% of these are near the major urban market of Metro Manila (one pig per three persons).

Small ruminant-fattening: Sheep- and goat-fattening is common in towns and cities of arid and semiarid regions of West and East Africa and the Middle East. In these systems, sheep and goats are born in rural areas and reared in extensive, low-input systems and then taken to cities for intensive fattening before slaughter. However, free range sheep and goats are found at lower densities in Asia and southern Africa. In the Sahel and Middle East, fattening is linked to the Islamic festival of Eid-al-Kabir (Tabas ki) (Ayantunde et al. 2008). In Ethiopia, it is common to see sheep and goats in urban areas, including the capital, Addis Ababa. Feed resources are usually household wastes, market area wastes, mill leftovers, by-products and roadside grazing (particularly in the peri-urban system (Abegaz et al. 2002)).

What other activities do urban livestock keeping necessitate?

The entire livestock value chain is compressed into urban areas. Figure 10.5 shows some of the different stakeholders involved in the urban livestock chain. These include:

- Input suppliers: Feed, fodder, housing material, equipment, drugs, animals, utilities.
- Service suppliers: Extension, health and breeding advice.
- Producers: Ranging from small to large scale.
- Transporters: Inputs, animals, livestock products.
- Processors: Abattoirs, dairy cooperatives, food processing.
- Retail: Door-to-door hawkers, street sellers, kiosks, milk bars, restaurants, shops, supermarkets.
- Consumers: household, institutions (schools, hospitals), restaurant consumers.

All of these stakeholders are present in many or most developing-country cities. In the developed world, large-scale processing operations (abattoirs, dairy cooperatives) and larger farms have been mainly moved outside cities. In some developing countries there has been a dramatic increase in farmers' markets. According to USDA-AMS-Marketing Services Division, in the USA, the number of markets nearly doubled from 5,000 in 2008 to 8,144 in 2013. These typically sell livestock products, but not live animals.

Live animal markets: Live animal markets for cattle, sheep and goat are often found in, or close to, cities. These are often referred to as terminal or tertiary markets, as large numbers of animals are brought from smaller markets or other countries for distribution or sale. In many cases animals are sold to butchers for slaughter, but other animals may be bought for fattening, breeding or work. For example, the Niama market in Bamako, Mali, is the largest in the country. Around 25,000 animals are sold each month. Live markets are dominated by cattle,
sheep and goats. Pigs are typically sold from the farm to the butcher or slaughterhouse, and poultry and eggs are sold alongside other perishable products in wet markets.

**Slaughterhouses**: Many of the cattle, goats and sheep bought in terminal markets will be slaughtered in urban abattoirs. Urban slaughterhouses have typically poor conditions but the lack of a cold chain makes it imperative that animals are killed close to the point of consumption. For example, a typical abattoir in a West African city may kill 300-400 animals a day. Slaughter is done without stunning on a concrete slab. The lack of infrastructure leads to filthy and unpleasant conditions. Many animals are not inspected and even when problems are found veterinarians find it difficult to ensure condemned meat is discarded. If an animal is condemned by veterinarians as unfit for human consumption, middlemen lose their entire days’ earnings, so they strongly resist attempts to condemn meat.

**Wet markets**: Most of the livestock products produced in and outside developing-country cities is sold in wet markets. These exist in many different forms across Africa and Asia but have common characteristics: food escapes effective health and safety regulation; many retailers do not pay tax and some are not licensed;
traditional processing, products and retail practices predominate; infrastructure, including water, electricity, sanitation and refrigeration, is lacking; and little support is provided from the public or the non-governmental sector. Unsurprisingly, women and the poor have much greater involvement in informal markets. In addition to their meat and eggs, poultry and rabbits, animals are most commonly sold live to be slaughtered in the household or by the producer of ready-to-eat food.

Hawkers and retailers: Eggs and dairy products are often sold directly to neighbours: a very short value chain. In addition, traders may buy eggs and milk to sell directly to consumers or to other users. Especially in India, hawkers often have an established round whereby they deliver milk direct to the doorstep. Figure 10.5 illustrates some of the different ways peri-urban milk makes its way to consumers in India.

Street food: Many livestock products end up as street food (FAO/WHO 2005). Street food is a source of inexpensive, convenient and nutritious food and is especially important for the poor, who lack resources to prepare meals at home (Riet et al. 2001). In Ghana, for example, a study found that among the poorest quintile almost 40% of the total food budget goes to purchasing street food, compared to just 2% in high-income households (Maxwell et al. 2000). Lower-cost livestock products are popular types of street food. In Kenya, vendors sell sausages as a franchise business. In South Africa, ‘walky talkies’ are chicken feet and heads sold ready cooked. In most African countries, the majority of street-food processors and vendors are women (Canet and N'Diaye 1996), while the majority of customers are men (Nago 2005). Animal source food is often sold alongside alcohol in roadside eateries (the pork joints of Uganda, pubs in Tanzania and dietaries in Senegal).

Benefits and risks associated with urban livestock keeping

Food and nutrition security

Urban livestock keeping contributes directly to food security by providing food for consumption and contributes indirectly to food security by providing income to buy food. Animal-source foods (ASF) are nutritionally dense sources of energy, protein and essential micronutrients. Micronutrients tend to be more bio-available in animal-source foods, and some, such as vitamin B12, are found naturally only in animal-source foods (Smith et al. 2013).

Cross-country evidence consistently shows children in urban areas are better nourished than those in rural areas. For example, in 82 out of 95 developing countries for which evidence is available, the proportion of underweight children is less in urban areas (UNICEF 2013). Moreover, livestock products benefit not just the poor but also middle-income households, who prefer fresh products and pay a premium for fresh milk (Nunan 2000b).

Yet, despite the obvious connection between producing food and consuming food, recent reviews agree that there is little evidence that farming benefits
nutrition (Leroy et al. 2008; Webb et al. 2008). This is partly because many evaluations of agricultural interventions have not looked at nutritional outcomes, but it is also possible that direct access to livestock products is offset by the need to obtain income. For example, experience from India shows that poorer households keeping buffaloes sell more of the milk produced and keep back less for home consumption (Nunan 2000b).

**Income, assets and financial instruments**

Production and processing of livestock may be the main or a subsidiary source of livelihood. Animals contribute to income sources in a household and, therefore, agriculture improves the ability to spread livelihood risks in a largely informal economy where the majority of the urban poor are daily-wage earners (Lupindu et al. 2012). Employment in intensive urban-rearing systems also forms a ready poverty alleviation pathway for those who are recently migrated from rural agricultural systems.

In countries with poor performing financial markets and weak credit systems, livestock act as savings, insurance and collateral. They are critical assets available even to disadvantaged groups that are not entertained by the formal credit suppliers. They reduce vulnerability of households to unplanned expenditures and act as collateral for quick loans (Randolph et al. 2007).

There are few formal studies on the economics of urban livestock keeping, with most studies on nutrition and livelihood benefits or health impacts.

**Health impacts**

By providing nutritious foods and by generating income that can be used for health care, urban livestock keeping makes important although indirect contributions to health. Negative impacts of overconsumption of ASF are increasingly contributing to chronic diseases, such as cardiac disease, even in developing nations plagued by malnutrition (Randolph et al. 2007).

A direct health advantage of urban livestock keeping is zooprophylaxis, or the reduction of transmission of diseases by using animals to attract disease-transmitting insects away from people. Recommended by the WHO as a management strategy for malaria since 1982, it has been found to be effective if (but only if) epidemiological factors are favourable. For example, pigs have been associated with a greater risk of Japanese encephalitis viral transmission in urban areas, but the presence of livestock like cattle may be a protection as they divert mosquitoes away from human beings or pigs by providing alternative food sources (Lindahl et al. 2012).

However, urban livestock keeping is also an important source of health risks in the urban environment. These may be categorized as occupational risks encountered by people working in livestock value chains and public health risks that affect the wider urban population.
Occupational hazards include:

- Mechanical injuries and ergonomic morbidity resulting from close proximity to animals as well as repetitive tasks associated with urban livestock keeping often carried out in confined spaces.
- Bio aerosols include biological agents, endotoxins, gaseous irritants as well as allergenic factors like dust, fungi and mites. This increases the risk for immunotoxic occupational diseases of the respiratory organ (bronchitis, occupational asthma and inflammation of the mucous membrane), especially in vulnerable groups such as children and the elderly, as well as manure handlers and poultry farm workers (Myers 2011).
- Biological agents include viruses, bacteria, fungi, microbial toxins and various particles of plant and animal origin. Many of these include zoonotic diseases. Value chain actors other than farmers are also susceptible, especially abattoir workers. Exposure to Brucella was found to be 22% among abattoir workers in Abbottabad, Pakistan, and as high as 35% in endemic regions in Saudi Arabia (Mukhtar and Kokab 2008).
- Bacterial resistance factors may be more common in the micro-flora of urban animals as antimicrobial agents are more accessible, and may be more used. These can transfer to humans. It is also interesting to note study findings that have identified resistant bacteria in the nasal, throat and faecal microflora of pig farmers (Aubry-Damon et al. 2004).
- Chemicals are often used in urban livestock keeping including pesticides, fungicides, antibiotics, and cleaning and disinfection agents. In addition, water used in urban livestock keeping may include agricultural or industrial chemicals.
- Allergens produced by microscopic fungi pose an occupational hazard (Dutkiewicz et al. 2011).

Close proximity to livestock and waste management practices create not only zoonotic risk to livestock keepers but also public health risk to urban populations. These diseases can be categorized by their transmission routes:

- **Direct transmission**: Crowding and high density of population constitute a contributing factor in direct transmission of pathogens where pigs, poultry and livestock act as intermediary hosts (De Haan 2013).
- **Vector-borne**: Cities without a proper sewage and waste disposal system favour vectors such as mosquitoes and rodents that transmit malaria, and viral diseases like dengue, Rift Valley fever, Hanta virus and West Nile Virus (Bauergartner and Belevi 2001). A study in Can Tho City, Vietnam, showed that urban pig-rearing increased the number of mosquitoes competent as vectors for JEV (Lindahl et al. 2012).
- **Water-borne**: In addition to vector-borne diseases, open sewage and untreated urban waste also aid in transmission of zoonotic parasitism. Important water-borne zoonoses include salmonellosis and cryptosporidiosis.
• **Urine-borne**: Diseases like leptospirosis are re-emerging as a public health problem in urban centres. This is attributed to increased exposure of humans, especially children to playgrounds, and recreational spaces contaminated with the urine of reservoir hosts (Dutkiewicz et al. 2011).

• **Food-borne**: There is evidence from major cities in Nigeria, India, Brazil and Saudi Arabia on human brucellosis infection and echinococcosis transmitted by domestic livestock through food (Satterthwaite et al. 2010). Brucellosis can spread to humans by drinking unpasteurized milk. Food-borne pathogens not only cause active infections or toxin-related symptoms, but also endanger intra-uterine foetuses (Listeria and Toxoplasma) causing death or serious malformations (Birley and Lock 1998).

In addition to zoonotic diseases, urban livestock keeping can threaten human health by antibiotic resistance and exposing people to agro-chemicals and livestock waste.

• **Emergence of antibiotic resistance** has been linked to the higher disease burden and higher production costs in urban farms. These drive farmers to over-use antibiotics. Leaching, improper waste disposal and contaminated animal faeces can introduce these antibiotic-resistant pathogens into the food chain. Antibiotic resistance in human pathogens may also result when people eat products that contain high residues (Birley and Lock 1998).

• **Chronic illness** has also been associated with agro-chemicals in the food chain in urban ecosystems (Birley and Lock 1998).

• **Livestock waste** generates as many as 60 volatile and non-volatile compounds. This can cause nausea, headaches, breathing problems, sleep interruption, appetite loss and irritation of the eyes, ears and throat. The urban poor, residing closer to open dumps, appear to be more exposed to this environment.

Increased animal transportation increases the spread and distribution of disease pathogens. This transitioning epidemiology is further influenced by persisting rural and pastoral practices in urban areas (Flynn 1999). As mentioned earlier, pastoral practices like open grazing, and scavenging practised for ruminants, poultry and pigs magnify the zoonotic risk in crowded urban and peri-urban spaces. One example is the increased prevalence of echinococcosis. What was essentially a rural disease is fast establishing itself as an urban menace. Despite a lower prevalence in urban canine population when compared to rural population, risk of transmission to humans is higher in urban areas due to greater human–animal contact. This situation is further aggravated in policy environments where food security takes precedence over food safety (Randolph et al. 2007). The non-adaptation of husbandry practices in response to urbanization and related changes increases the risk of urban population to zoonoses.
Direct environmental impacts

Urban livestock keeping can contribute to the reuse of urban solid and liquid waste. Easy and cheap access to by-products of the food processing industry (bran, oilseed cakes), hotel refuse and kitchen waste in urban spaces is one of the main reasons why urban livestock keeping flourishes and remains profitable in urban ecosystems. Along with better management of urban waste, organic manure from the livestock industry helps in maintaining soil fertility for gardens and recreational spaces (Randolph et al. 2007).

However, urban waste is considered one of the most serious and pressing urban environmental problems, and urban livestock keeping contributes to this. Abattoir effluent containing blood, fat, solid waste (intestines, hair, horns, etc.) and rumen content are often discharged into nearby rivers and reused for crop irrigation and as drinking water for cattle. Dumping solid wastes from livestock production or abattoirs is common. Nitrates from feedlots percolate to groundwater, and runoff into water sources is said to contribute to water contamination. Urban livestock keeping increases the competition for resources such as water and land. This can exacerbate prevailing shortages for household and industrial use.

Environmental impacts can be mitigated if farms in peri-urban spaces can develop better waste management practices. Some farmers generate a substantial
part of their income from the sale of organic waste. Other farmers install biogas plants or dry manure for direct usage as cooking fuel (Ishag et al. 2002). The latter use is less beneficial as biomass fuels form the largest source of indoor air pollution, causing acute respiratory disease in children and chronic obstructive lung disease in adults (Birley and Lock 1998).

**Greenhouse gases and contribution to global warming**

Ruminant livestock are a major contributor (18%) of global anthropogenic greenhouse gas emissions (Gill et al. 2010), and may cause up to 2% of global warming in the next 50 to 100 years (Johnson and Johnson 1995). The negative impact of global warming is also felt by peri-urban farmers through major floods and landslides as well as degradation of grazing land (Deka et al. 2009).

However, intensification of livestock can reduce the emission of methane and other greenhouse gases per unit weight of livestock product produced, as intensive agriculture produces more outputs per animal. In developing countries, most intensive livestock systems are urban or peri-urban. For example, 80% of the Chinese operations related to large intensive livestock are located around Beijing and Shanghai. Similarly, almost all intensive pig farms in Kenya are located around Nairobi (Burney et al. 2010; De Haan 2013; Havelik et al. 2014). Urban agriculture also reduces carbon footprint of cities by reducing the traffic flow of food and manure from distant rural areas and by substituting non-renewable fuels with biogas or biomass (Nunan 2000b).

**Equity**

Overall, men have more ownership of livestock and their products. Typically, men have ownership and responsibility for larger and more valuable animals, and as farms become more intensive and highly capitalized, male participation tends to increase. In backyard farms, women and children are often responsible for care-giving tasks (feeding and cleaning), thus making them more prone to health risks from occupational exposure. However, smaller ruminants and poultry are women’s most important assets and income (Niamir-Fuller 1994; Deka et al. 2009; Smith et al. 2013). In addition, women are often involved in dairying, traditional processing of foods, and foods in wet markets and streets.

In rural areas, livestock keeping tends to increase with wealth but in cities the reverse is the case and the poor keep more livestock. In general, urbanization is often associated with worsening equity. For example, poor children in urban areas are at up to ten times higher risk for childhood stunting than the wealthiest group, differences which are not so marked in rural areas (Menon et al. 2000; Smith and Aduayom 2003). Urban livestock keeping could help improve nutritional and income equity in urban areas.
Social impacts

Urban livestock keeping also aids in increasing social cohesion and improving the social position of farmers in urban communities. Urban farmers in India sell milk directly to hotels and households in exchange for kitchen waste. Some farmers milk their cows in front of consumers to assure clean and unadulterated produce (Nunan 2000a). Trust in the community improves social security of farmers and aids social cohesion. In low-income urban districts of Bissau, urban farmers contribute to community welfare and funeral groups and gift their home produce as a reciprocation of social support, especially in times of distress and natural calamity (Mougeot 2000).

However, urban livestock value chain actors can be in conflict amongst themselves as well as with other groups such as non-rearing neighbours and civic authorities. In cities with shortage of water resources, livestock farmers compete with other industries for these resources and thus may face a hostile neighbourhood. Livestock farmers have been in conflict with non-rearing neighbours on the detrimental effect of the surrounding aesthetics caused by organic waste and pests. While farmers following the intensive system of rearing have conflicts regarding waste disposal, those involved in backyard farming and scavenging system can have conflicts associated with damage to neighbourhood gardens, theft, accidents on road traffic as well as injury from aggressive livestock (Ishagi et al. 2002). A study in Nigeria found that urban farmers suffered higher losses from pilfering of livestock than from rural farmers. Moreover, they were more likely to report emotional distress and discouragement as a result of pilfering (Anongoku et al. 2008).

Municipal authorities and public health researchers often see urban livestock keeping as a public health risk, pollution hazard and an impingement on urban aesthetics. Since urban agriculture is taken up usually by the urban poor and vulnerable groups, they lack a supporter or champion for urban agriculture in the policy space. Legislation and law enforcement therefore work against urban and peri-urban livestock keeping (Flynn 1999; Ishagi et al. 2002; De Haan 2013).

Maximizing the benefits and minimizing the risks of urban livestock keeping

The fact that most studies of hazards in urban livestock keeping find the presence of high levels of hazards demonstrates that current risk management is not very effective. Indeed command- and control-based regulation may actually make things worse. A study in Kampala found that dairy farmers who had more harassment from public authorities had fewer good practices (Grace et al. 2012).

When tackling hazards in urban livestock keeping, the best way can be the enemy of the good. For example, in Lusaka, Zambia, street sellers were moved to
a new ultra-modern market funded by a USD $3 million grant from the European Union. The process involved careful consultation with vendors and other stakeholders. Yet many vendors returned to selling on the streets as they found they made more money by being closer to consumers (Ndhlovu 2011). During the bird flu epidemic, there were many attempts to close or upgrade wet markets. However, most were unsuccessful in improving hygiene or they covered only a tiny proportion of birds sold.

Approaches based on working with the existing situation and gradually improving it have been more successful. A well-documented initiative working with butchers in wet markets of Ibadan used positive deviants and peer-to-peer training. This led to 20% more meat samples meeting standards and cost USD $9 per butcher but resulted in saving USD $780 per butcher per year from reduced cost of human illness (Grace et al. 2012). This resulted in a very attractive benefit cost ratio of $87 benefit for every $1 invested.

In Kenya, authorities moved from harassing the informal milk vendors who distributed more than 80% of the milk consumed in Kenya, to supporting them. This included training on hygienic milk production and business management; provision of better technologies such as milk cans; and providing a license and certificate. The change in policy is shown to have improved the safety of milk and saved the Kenyan economy USD $26 million a year by lowering the cost of providing milk to consumers.

Effective strategies for risk mitigation include: education of farmers on hazards and prevention; quality labelling of products (Fall et al. 2001); education of consumers on hygiene (Sheth and Obrah 2004); animal health programmes to reduce the double burden of zoonoses (Lopetegui 2004); pollution assessment and zoning of areas (Kucharski et al. 1994); monitoring of fresh urban solid-waste treated soil and crops (Rao and Shantaram 1995); composting methods and variable sorting to control chemical and microbiological agents (t Hart and Plummers 1996); and programmes to eliminate schistosomiasis and occupational risks in freshwater fish farming (McColough 1990). A project on the risks of livestock keeping in Nairobi, Kenya (Box 10.2), provides an example of a rational and effective approach to health risks associated with urban livestock.

**BOX 10.2 SYSTEMATIC AND RISK-BASED APPROACHES TO MANAGING HEALTH HAZARDS IN URBAN DAIRYING IN NAIROBI.**

With the objective of assessing and minimizing the risks of diseases spread from urban dairies, the project team applied an 'ecohealth' approach to its study. A multidisciplinary team was formed, which started by surveying and understanding dairying in Dagoretti, a district of Nairobi. Next, a systematic
risk assessment was undertaken which covered a range of hazards: aflatoxins, brucellosis, cryptoспорidiosis, colilosis, tuberculosis and antimicrobial residues. The study also looked at social and gender determinants of health. This identified cryptoспорidiosis as the issue of greatest concern to be tackled first (on the grounds of its unexpectedly high prevalence, its emerging nature, and its riskiness to children and people living with HIV). The team of professionals, policy-makers and Dagnoretti residents developed targeted messages for each high-risk group. They identified practices that were both good and uncommon and so had high potential for being more widely adopted. They incorporated social incentives (such as the desire to be seen as good parents) to help motivate behaviour change. The communication strategy included workshops, community champions, brochures and a television episode, and it involved policy-makers. Surveys showed a significant improvement in knowledge and practice and a reduction in the risk of cryptoспорidiosis and other pathogens transmitted through the faecal route. The research findings were published in 17 multidisciplinary papers in two special editions (East African Medical Journal and Tropical Animal Health and Production).


Conclusions

Much attention has been paid to the role of urban livestock keeping in maintaining and transmitting diseases and contaminating the environment but little to the role of urban livestock keeping in supporting livelihoods and nutrition. Urban livestock keeping supplies livestock products for household consumption and sale. The informal markets where most urban farmers sell their products offer benefits to poor farmers, traders and consumers. They often sell food at lower prices than the formal sector and the food sold often has other desired attributes including freshness, preferred taste and convenience, and the food originates from local breeds.

Because of the perishable nature of livestock products, there are strong incentives to produce livestock for city markets in cities and their surroundings. However, city farming is often banned or restricted by city by-laws. Considered to be dirty, smelly, noisy, disruptive, disease-ridden and a symptom of backwardness, city livestock are ignored or underestimated in official records. In Mexico City, authorities denoted that pigs were kept on urban rooftops until they were dislodged by an earthquake and found walking the streets. By-laws are often based on precedent or on arbitrary decisions and rarely on evidence or logic. For example, in Tanzania it is legal to keep four cows in urban areas but illegal to keep five. Much of the opposition to keeping livestock in cities and selling livestock products in informal markets is based on the strongly held but poorly evidenced belief that city livestock and their products are a risk to human health.
Undoubtedly hazards can be found in urban livestock and their products, but this is also true for the rural counterparts. As a rule of thumb, most studies that look for hazards find them. Food-borne illnesses and animal diseases are of growing concern to consumers and policy-makers alike. Consumers respond to scares by stopping or reducing purchases with knock-on effects on smallholder production and wet market retail. Policy-makers often respond to perceived health risks by favouring industrialization and reducing smallholder access to markets. These changes are often based on fear and not on facts. Without evidence of the risk to human health posed by informally marketed foods or the best way to manage risks while retaining benefits, the food eaten in poor countries is neither safe nor fair (Grace 2011).

Urban and peri-urban livestock also plays an important, and in some cases increasing, role in supporting livelihoods and nutrition. Recent studies suggest there are 450 million people in urban livestock keeping homes and most of the 2.5 billion people who live in developing-country cities depend on urban live animal markets, wet markets, slaughterhouses and vendors to obtain their animal sources of food.

Although the potential harm of urban livestock keeping is well documented, there is surprisingly little evidence on quantified impacts (e.g., the number of people who fall sick from eating street food) or the relative importance of the risks versus the benefits of urban livestock keeping (which have been much less well documented). Better evidence is needed on the costs and benefits of urban livestock keeping to help decision makers and others to identify its most appropriate role. Encouragingly, the last decade has given many examples of how risks can be mitigated and livestock can contribute to a green and resilient urban environment. This offers a roadmap for future development of urban livestock keeping.

Keeping of animals has always been part of the city, and a link between the countryside and cities. After decades of neglect, urban livestock keeping is back on the development and political agendas. Urban livestock keeping has always been vulnerable to fears around disease and environmental contamination; fortunately, we now have the evidence and tools to ensure that it is not only productive and profitable but can be safe, fair and environmentally friendly.

Note

This work was carried out with the aid of a grant from the International Development Research Centre, Ottawa, Canada.

References


Urban livestock keeping 281


