Subregional Report on Animal Genetic Resources: **South Asia**

Acknowledgements
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Introduction

This document is one of a set of subregional and regional reports prepared as part of the Annex to *The State of the World's Animal Genetic Resources for Food and Agriculture*. It consists of two sections:

- a factsheet; and
- a synthesis of priorities.

The factsheet is a compilation of background material on the significance of livestock to the subregion's economy and food security; the characteristics, distribution, and relative significance of the various livestock production systems; and the characteristics of animal genetic resources.

The priorities presented in this report are based on the outcome of consultations held at the subregional level to review a draft report on strategic priorities for action, which had been prepared by FAO as a global-level synthesis of priorities identified in the Country Reports submitted as part of State of the World process. The consultations, which were held during the final quarter of 2005, took the form of e-mail conferences and/or physical meetings, and provided an opportunity for country representatives, from both technical and policy backgrounds, to identify priorities and to further strategies for cooperation.

Subregional factsheet: **South Asia**

1 Importance of livestock to subregion's economy and food security

The countries of the South Asia subregion, as defined for the purposes of this report, include Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan and Sri Lanka. Climates in the subregion range from tropical monsoon to temperate and even arctic in northern Pakistan, and there are huge diversities in population numbers and land use.

Maldives comprises 190 coral islands grouped into 26 atolls in the Indian Ocean, which reach elevations of only 2.5 metres. Sri Lanka is mostly low, with mountains in the interior. India, Nepal and Pakistan have the Himalaya and Karakoram mountain ranges, hills and upland plains. Deserts are present in India and Pakistan. Bhutan is largely mountainous, with some fertile valleys and savannah, while Bangladesh is mostly flat alluvial plain with hills in the southeast (FAO, 1995).

In 2003 the total human population of the South Asia subregion was estimated to be 1 408 million, an increase of more than 235 million people since 1993. The subregion has 22 percent of the world's total human population on about 3 percent of the world's total land area. It has 28 percent of the world's agricultural population, which exists on about 13 percent of the world's arable land. South Asia has the largest share of arable and permanent cropland in total agricultural land (91 percent) in the world.
India is by far the largest country in the subregion in terms of size and population. Its area is more than 70 percent and its population about 75 percent of the totals for the South Asia subregion. Except for Pakistan, the other countries occupy less then 4 percent of the total area, while Maldives occupies only about 0.01 percent of the total land area (ibid.). After India, Pakistan is the most populous country in the subregion with about 11 percent of the total, closely followed by Bangladesh. Bangladesh has a very high population density (1 049 persons per square kilometre for Bangladesh compared to 360 for India). Nepal and Sri Lanka each have nearly 2 percent of the population of the subregion, while Bhutan has less then 0.2 percent. Maldives has the highest population growth and, after Bangladesh, the highest population density in the subregion. A summary of general information for this subregion is shown in Tables 1, 2 and 3.

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TABLE 1
Land area and population

	Land area (× 1 000 km²)	Population 2003 (million)	Population density (km⁻²)	Population growth rate (% *per annum*)	
				1975–2003	2003–2015
Bangladesh	130	136.6	1 049	2.2	1.7
Bhutan	47	2.1	45	2.1	2.2
India	2 973	1 070.8	360	1.9	1.4
Maldives	0.3	0.3	1 000	2.9	2.4
Nepal	143	26.1	183	2.3	1.9
Pakistan	771	151.8	197	2.9	2.0
Sri Lanka	65	20.4	316	1.3	0.7

Data from UN and FAO statistics.

TABLE 2
GDP and the economic contribution of agriculture

	GDP[1] 2003 (US$ billions)	Value added in agriculture[2] 2003 (% of GDP)	Agricultural population1 2000 (%)	Livestock contribution to GDP[3] (%)
Bangladesh	51.9	21,8	56	4
Bhutan	0.7	33,2	92	3
India	600.6	22,2	51	5,5
Maldives	0.7	n.a.	26	n.a.
Nepal	5.9	40,6	84	18
Pakistan	82.3	23,3	48	9
Sri Lanka	18.2	19,0	42	7

[1] Data from UN and FAO statistics.

[2] Data from World Bank statistics.

[3] Data from Country Reports (Bangladesh, Bhutan, India, Nepal, Pakistan, Sri Lanka)

TABLE 3
Land use

	Arable (%)		Permanent pasture (%)		Forest/woodland (%)	
	1992	2002	1992	2002	1992	2002
Bangladesh	62	62	5	5	15	n.a.
Bhutan	2	3	7	9	66	n.a.
India	55	54	4	4	23	n.a.
Maldives	13	13	3	3	3	n.a.
Nepal	16	22	12	12	40	n.a.
Pakistan	27	28	6	6	5	n.a.
Sri Lanka	14	14	7	7	32	n.a.

Data from UN and FAO statistics.

Agriculture plays a major role in the subregion's economy. It produces most of the food requirements, and is a major source of employment and foreign exchange (ibid.). On average about 60 percent of the economically active population of the subregion pursue agricultural activities, and in Bhutan the figure

is as high as 92 percent. Agriculture accounts for about 40 percent of GDP in Nepal, and between 19 and 33 percent in other countries of the subregion. Livestock's contribution to GDP varies from 3 percent in Bhutan (CR Bhutan, 2002) to 18 percent in Nepal (CR Nepal, 2004).

As the result of rapid growth of the human population, expanding economies and increased urbanization, Asia in general but especially South, East and South-east Asia, has the fastest developing livestock sector among developing countries. Markets for livestock and livestock products are rapidly growing and this strong growth in demand is predicted to continue over the coming decades. Increased livestock production is accompanied by a shift to intensive production (FAO, 2005). The process is referred to as the "livestock revolution".

1.1 Production and consumption

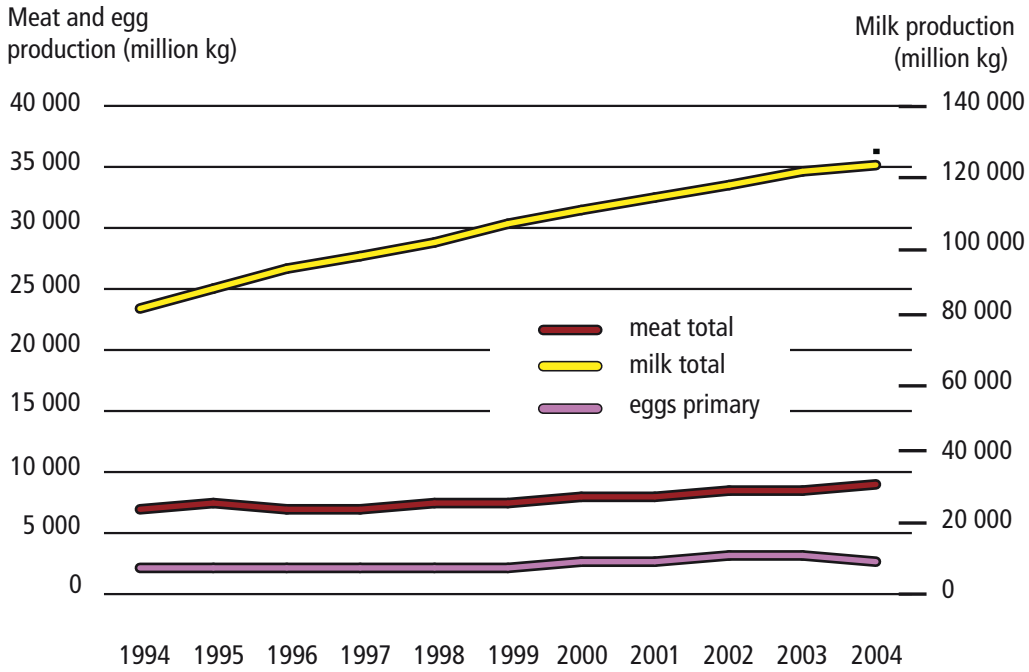
The nature of livestock production in the subregion varies with the environment and culture. Production and consumption figures reveal the significance of subregion-specific livestock species and products. South Asia is a high milk-consuming and producing subregion (Delgado *et al.,* 1999), and India and Pakistan in particular give high priority to dairy production (FAO/UNEP, 2000). In the decade 1990–2000 the highest annual growth in milk production in the world occurred in South Asia (4.9 percent per annum) (FAO, 2003a). The share of South Asia in world milk production was slightly more than 20 percent in 2004 (FAOSTAT). India is the world leader in milk production, contributing about 15 percent to total world output in 2004, compared to less than 7 percent in 1980 (FAOSTAT). However, milk yields per cow per year are extremely low compared to other milk producing countries such as the United States of America, Germany or New Zealand (FAO, 2003b; FAO, 2004a). Although milk and dairy products are preferred foods in South Asia and per capita milk consumption has increased in all countries of the subregion, especially in India, per capita milk consumption is very low compared to industrial countries. Average dairy consumption in industrial countries is 220 kg/person/year, compared to 64 kg in India and only 14 kg in Bangladesh (FAO, 2003a). India had high income growth rates during the 1980–1995 period, fuelling increases in per capita animal food-product consumption. Total milk consumption in India grew by 53 percent during that period (Delgado *et al.*, 1999). Pakistan has an average dairy consumption of 150 kg/person/year, which is well above the developing-country average of 45 kg (FAO, 2003a). Milk production in Pakistan is slightly higher than that of Germany, although it has over three times as many dairy animals as Germany. Over two-thirds of the milk is produced by buffaloes (FAO, 2003c). In India also, more than half of the milk is produced by buffaloes (FAO, 2003b). Unlike in Pakistan and India, milk production from bovines in Bangladesh is based heavily on cattle rather than on buffaloes, while goats contribute more than half of national milk production (ibid).

In South Asia, there has been a slow but steady growth in animal product consumption overall. This increase is mostly the result of the increase in milk consumption, together with an increase in the consumption of poultry meat (FAO, 2003a). Growth in poultry production between 1989 and 1999 was spectacular in South Asia (7.2 percent per annum) and reflects the rapid intensification of the poultry industry in the subregion (FAO, 2003a). The consumption of beef, mutton and goat meat has shown only modest increases by Asian standards (Steinfeld, 1998). In spite of the increase in the consumption of meat, the countries of South Asia remain among the countries with the lowest levels of meat consumption in the world (Speedy, 2003). The levels are lower than low income levels alone would suggest, because of cultural and religious reasons (Delgado *et al.,* 1999). Sri Lanka, India and Bangladesh are amongst the ten countries in the world with the lowest meat consumption. Consumption in these countries is between 3 and 5 kg/person/year. This is compensated to some extent in Bangladesh by higher fish consumption and in India and Sri Lanka by higher milk consumption (Speedy, 2003). In India, cow slaughter is banned in most states because of religious sensitivities. There are fewer restrictions on buffalo slaughter, and buffalo meat is the second most widely consumed meat in India, although consumers prefer mutton (goat or sheep meat) over buffalo meat. The most widely consumed meat (by volume) in India is poultry, and per capita consumption of poultry meat in India shows high growth rates (FAO, 2003a). Per capita consumption of buffalo meat and broiler meat is estimated at 1.8 and 1.9 kg/year, respectively, compared with 750 grams of sheep/lamb meat (Shunmugam, 2005). India's per capita meat consumption has grown by only 1 kg in the last 20 years (ibid.).

Egg production in South Asia has increased significantly, and the annual growth rate in egg production was 4.7 percent in the decade 1989–1999 (ibid.). However, consumption of eggs in South Asia is well below the developing-country average (ibid.).

The importance of livestock in most of the countries of South Asia goes beyond its food production function. Livestock provides valuable draught power, organic manure for agriculture, dung as fuel for domestic purposes and other by-products including leather, bones and horns (CR India, 2004). It is estimated that in Bangladesh, 40 percent of the value of the animal is in the manure it produces, and 20 percent is in the draught power it supplies (FAO, 1999). These outputs often do not appear in the figures showing the value of livestock to a country (ibid.) Figure 1 shows the total production of meat, milk and eggs in South Asia.

FIGURE 1
Total meat, milk and egg production in South Asia, 1994–2004

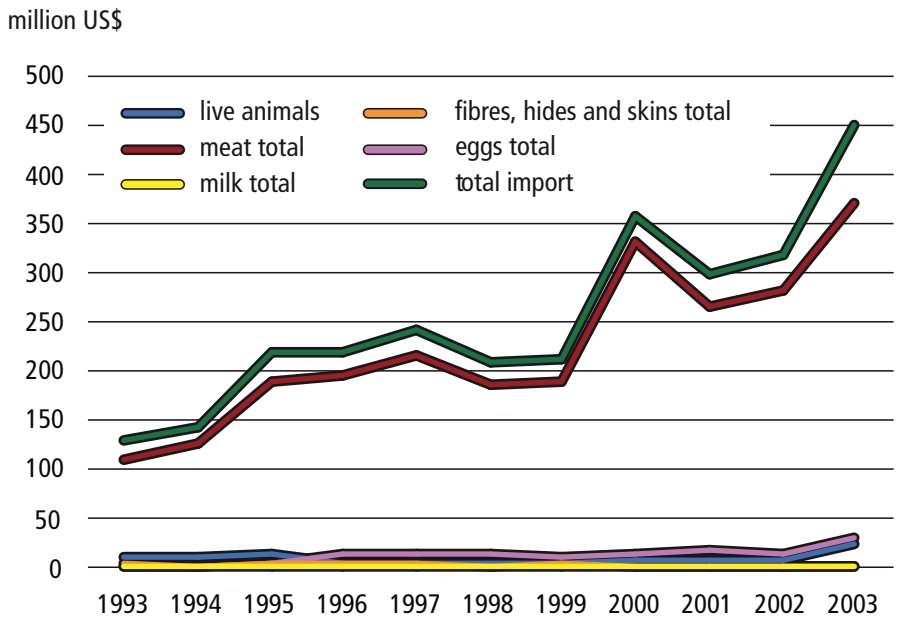


Source: FAOSTAT.

1.2 Imports and exports

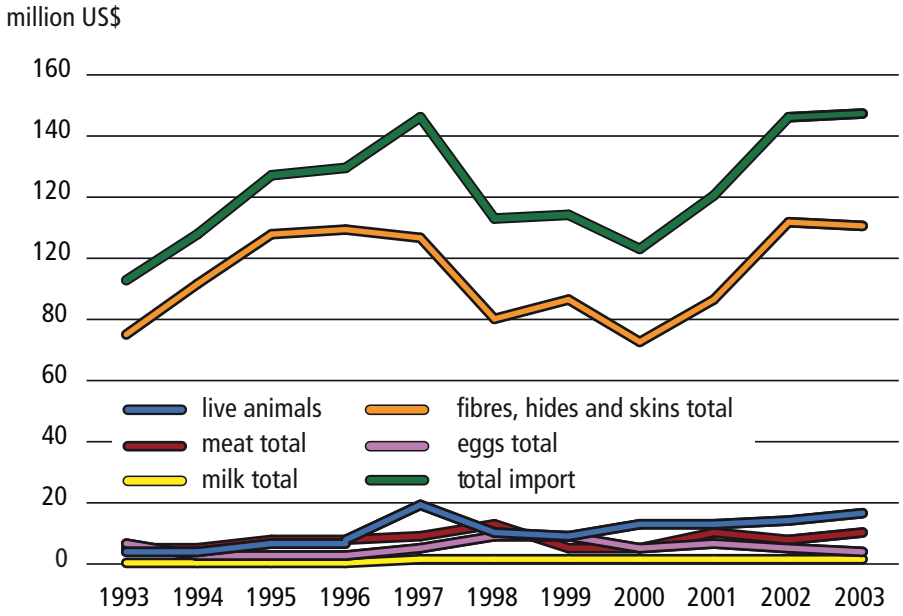
Figures 2 and 3, respectively, show levels of export and import of live animals and animal products in South Asia. The total export of live animals and animal products increased from US$128 million in 1993 to US$448 million in 2003, with two reductions in 1998 and 2001 as a result of reduction in meat exports. Meat is the most important component in the total export value, and beef and buffalo meat is the most important component of exported meat, with a contribution of around 90 percent. India is one of the largest meat exporters in the world. Where bovine meat is concerned, India has joined the more traditional developing-country exporters of South America as a significant exporter, mostly of buffalo meat (FAO, 2003a). Various BSE-related bans on beef from the United States and Canada have had a marginally positive impact on buffalo meat exports from India, and in 2005 India outperformed Canada in the export of meat (Shunmugam, 2005). India exports meat particularly to the Philippines, the Middle East and Malaysia. Indian meat exporters, however, face considerable challenges. Contagious livestock diseases are endemic in parts of the country. For this reason many countries will not import meat from India.

FIGURE 2
Export of live animals and animal products in South Asia



Source: FAOSTAT.

FIGURE 3
Imports of live animals and animal products in South Asia



Source: FAOSTAT.

The main contribution to the total value of imports of live animals and animal products in South Asia comes from the import of fibres, hides and skins. Figure 3 shows that the value of imports of hides and skins and hence of total imports fluctuates. This is because the demand for leather and leather products is elastic and generally fluctuates with global economic performance. The decrease in imports after 1997 was caused by Asia's financial crisis which badly affected leather manufacturing (USDA, 1998). The reduction in the import of hides and skins experienced after 2002 was the result of a combination of generally weak global economic growth and the outbreak of severe acute respiratory syndrome (SARS) which disrupted trade flows (FAO, 2003d).

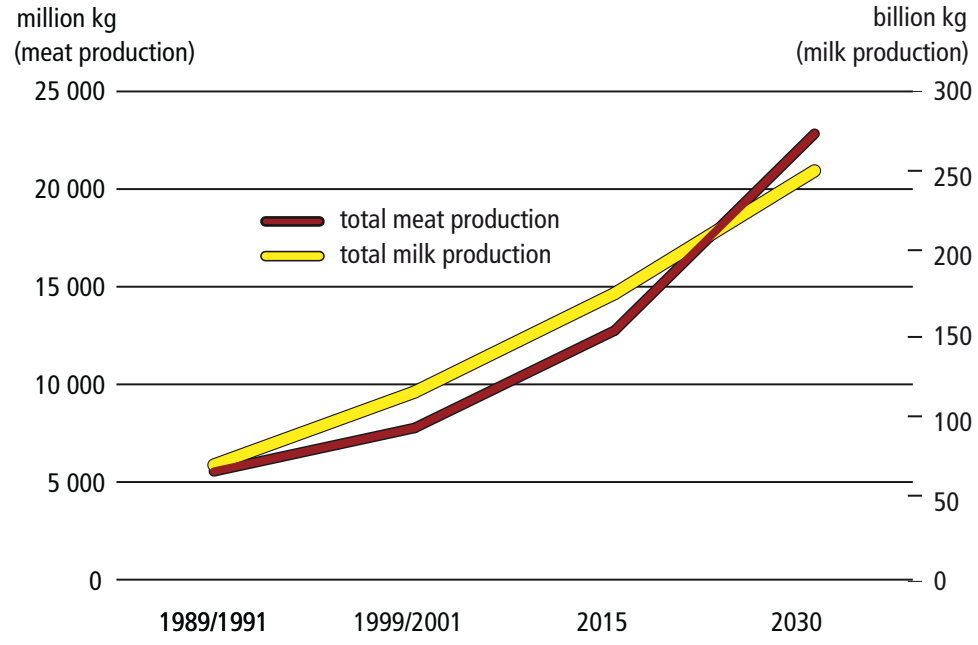
The import of milk into South Asia is negligible. In South Asia, milk import as a proportion of production has fallen despite increasing demand for milk and milk products, because of the strong growth in domestic milk production since the 1980s (FAO, 2002a). The import of meat to South Asia is very low, mostly as a result of the prohibition of the import of beef because of religious sensitivities in India (Shunmugam, 2005).

1.3 Projected demand for livestock products

Figure 4 shows total past and projected milk and meat production for South Asia. As Table 4 shows, annual growth rates for livestock numbers and meat and milk production were significant from 1990 to 2000. Annual growth rates for livestock numbers and milk production are projected to slow from 2000 to 2015, but for meat production the annual growth rate is projected to increase over this period. Given a projected per capita GDP growth for South Asia of 3.9 percent running to the year 2015, milk consumption in South Asia would rise to 88 kg/person/year of fresh milk equivalents. However, although the annual growth rate in meat production is high, meat consumption will only reach 7.6 kg/person/year. FAO cereal balance sheets suggest that by 2015 East and South Asia jointly will account for 42 percent of the total world demand of 2 379 million tonnes of grain (Slingenbergh *et al.,* 2002). Total livestock numbers in South Asia are predicted to almost double from 1989/1991 to 2015, from 1.1 billion to 2.2 billion.

FIGURE 4
Total meat and milk production South Asia past and projected

Source: FAO (2003e).



No data available for Bhutan.

TABLE 4
Growth rates for livestock numbers and production

	Annual growth rate (%)	
	1990–2000	2000–2015
Total livestock numbers	4.32	1.45
Total meat production (kg)	3.18	3.46
Total milk production (kg)	4.88	2.89

Source: FAO (2003e).

No data available for Bhutan.

Production of eggs has been very low compared to milk and meat production but projected annual growth rate is high (6 percent from 2000 to 2015) (FAO, 2003e).

India has the potential to dominate developments in the South Asia subregion and even to have a major influence on the global scale. The relative contribution of animal products to diets is predicted to increase up to 2030, largely as a result of increases in the consumption of milk and milk products (FAO, 2003a). A shift in Indian tastes that accelerated meat consumption could affect the global livestock economy. India is expected to rival China in population size by 2030 (1.41 billion versus 1.46 billion) and surpass it ten years later, reaching 1.5 billion by 2040 (ibid.). There are, however, differing views as to whether India can play the role China has had so far played in raising world meat demand.

Analysis of the differences in meat consumption among different income groups in India shows that high-income Indians, whether urban or rural, do not consume significantly more meat than low-income ones, although the differences in milk consumption are wide. Tomorrow's middle and high-income population groups are likely to behave in a similar fashion – a scenario which would not result in large increases in national meat consumption as overall income levels increase (Delgado *et al.,* 1999; FAO, 2003a). Other studies, however, point to changing tastes and the prospect that the emerging middle classes will tend to adopt diets with higher meat content (FAO, 2003a). The only generalization that can be made with some confidence is that the recent high-growth rates of per capita consumption of poultry meat in India (from 0.2 kg in the mid-1980s to 0.6 kg in 1997-99) will continue in the coming decades.

Consumption of other meats will probably grow by much less, with beef and pork subject to cultural constraints for significant parts of the population of India and indeed the whole of South Asia. In parallel, consumption of the preferred mutton/goat meat faces production constraints, implying rising real relative prices compared with poultry meat. Overall, the force of the growth of poultry meat consumption has the potential of raising India's average consumption of all meat by 2 kg in the period to 2015 (compared with 1 kg in the preceding two decades) and by another 4 kg in the subsequent 15 years – to 10 kg in 2030. This kind of growth would raise the very low intake of animal protein in the Indian diet. However, its effect on world averages and those of the developing countries will not be anywhere near the impact historically exerted by developments in China (ibid.). Delgado *et al.,* (1999) describe different animal product consumption scenarios. A scenario featuring high Indian meat and milk consumption would result in India becoming a major world importer of meat, milk, and cereal feed by 2020.

1.4 Poverty

Poverty rates can be quantified on the basis of a poverty line, which provides a threshold in income or consumption below which a household can be classified as poor. Some poverty lines aim to be internationally comparable and, thus, are useful for producing continental and global totals. Widely cited examples are US$1 day^{-1} and US$2 day^{-1} lines published by the World Bank. Data based on an international poverty line show the number of people who cannot purchase a roughly similar basket of commodities (World Bank, 2001). National poverty lines reflect intercountry differences in economic and social status and are used to assess progress on a national scale. The figures presented in Table 5, utilize three different poverty lines: US$1 day^{-1}, and US$2 day^{-1}and national poverty lines based on Technical Advisory Committee (TAC) of the Consultative Group on International Agricultural Research (CGIAR) data. Table 3 indicates that 45 percent or more of the population in South Asia live below the US$2 day^{-1} poverty line.

TABLE 5
Poverty rates by country

Country	TAC	Less than US$ 1	Less than US$ 2
Bangladesh	78.0	29.1	77.8
Bhutan	*	*	*
India	40.0	44.2	86.2
Nepal	60.0	37.7	82.5
Pakistan	28.0	31.0	84.7
Sri Lanka	39.0	6.6	45.4

Sources: FAO (1997) and World Bank (2001) as presented by Thornton *et al.* (2002).

*Data unavailable.

2 Livestock production systems

2.1 Overview

In this report, the different livestock systems will be described according to the classification produced by Seré and Steinfeld (FAO, 1996) (see the annex to this factsheet for further details of the classification system). However, more recent data, from 2004, are used for the presentation of quantitative figures (FAO, 2004b). Mixed farming systems dominate both the arid/semi-arid and the subhumid/humid zones of South Asia (see table 4). Grazing land is scarce, and arable land makes up the bulk of land use. Mixed irrigated systems support the largest numbers of people, 64 percent of the population of South Asia live in mixed irrigated systems. The mixed irrigated system of the arid/semi-arid zones is most important in terms of human population, resource base and outputs, and it is particularly significant in India and Pakistan. In this system, irrigation makes year round intensive crop production feasible (FAO, 1996).

Mixed rainfed farming systems are also widespread in South Asia and are often located in regions with especially difficult climatic conditions for livestock because of high temperatures and/or high humidity. Adaptation of highly productive temperate breeds to these challenges has been notably poor, and, particularly in smallholder production, local breeds are still widely used (ibid.). In these systems livestock often has multiple functions, and animals are used particularly for traction and manure. In both rainfed and irrigated mixed farming systems in South Asia small-scale dairy production is widespread, based on buffaloes and/or cattle. Large ruminants also continue to be vital sources of draught power despite some decline as a result of mechanization. Goat and sheep production systems are linked to annual crops particularly in semi-arid areas (Devendra *et al.,* 2005). Examples of integrated crop/animal systems include rice/wheat/cattle/sheep/goats in India and coconut/fruit/cattle/goats in Sri Lanka (ibid.).

Non-ruminants in crop–livestock systems mainly scavenge in villages on crop by-products and kitchen waste. In many parts of South Asia (e.g. Bangladesh) these village systems evolve into more intensive production systems depending on the availability of feeds, markets, and the development of cooperative movements (ibid.). Within mixed farming areas in India and Pakistan for example, landless agricultural labourers often keep livestock such as buffalo or goats based on zero-grazing practices, grazing of roadsides, or hired land with forage or leguminous trees from which leaves and pods are harvested (ibid.). Grassland-based systems in are of minor importance in South Asia. Temperate/tropical-highland grassland systems are represented in the subregion by the extensive grazing systems found in parts of northwest Pakistan involving sheep for mutton and wool (ibid.). Another example is the transhumant sheep keepers of the Himalaya, who spend the winter in lower-lying areas and ascend the great valleys when the snows melt in spring to take advantage of high-altitude alpine pastures (Devendra *et al.*, 2005; FAO, 1996).

Large-scale landless systems are growing in many parts of Asia, and a high concentration of landless systems is found in South Asia, particularly India and Pakistan. This system plays an important role in Asia, providing livestock to meet the increased demand generated by higher human population density and income (FAO, 2004b). In South Asia, growth of poultry production in particular has been

spectacular, and broiler production is characterized by vertically integrated, intensive establishments close to large urban centres (FAO, 2003a).

Table 4 presents data, on the main livestock products and productivity levels in the different production systems. Population densities are high. On average 0.2 ha of permanent pasture and arable land are available per inhabitant, both for the mixed rainfed and mixed irrigated systems. In the humid/subhumid zones population densities are even higher with just 0.1 ha per inhabitant. Cattle and buffalo stocks are large, with about 400 million large ruminants in the subregion. South Asia has the largest buffalo stock in the world, with more than 124 million head, and the size of the subregion's cattle population, at 280 million head, is second only to South America. The majority of both buffaloes and cattle are found in the mixed irrigated systems of the arid/semi-arid tropics. Milk production is on average about 900 kg per cow, ranging from 633 kg per cow in the mixed irrigated system in the humid/subhumid zones to 1 017 kg per cow in the arid/semi-arid zones. Considerable amounts of milk are produced by buffaloes and sheep, and in the mixed irrigated system of the arid and semi-arid zones – where most buffaloes are kept – the value of "other milk" production is almost three times as high as that of cow milk. South Asia has more than 300 million sheep and goats in total. Small ruminants are mainly kept in the two mixed irrigated production systems; less than 30 percent are kept in the mixed rainfed systems.

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TABLE 6
Resource base, production and productivity figures of the different production systems found in South Asia

	Grassland based			Mixed rainfed			Mixed irrigated			Land-less	TOTAL
	Temperate/ Highlands	Humid/ Sub-humid	Arid/ Semi-arid	Temperate/ Highlands	Humid/ Sub-humid	Arid/ Semi-arid	Temperate/ Highlands	Humid/ Sub-humid	Arid/ Semi-arid		
Parameters:											
Human population (millions)					148.0	338.6		322.0	557.1		1 365.7
a. Resource base											
a1. Permanent pastures (million ha)					1.9	6.3		4.1	7.0		19.3
a2. Arable land (million ha)					17.0	74.5		26.5	77.4		195.4
a3. Irrigated land (million ha)					3.9	19.1		11.6	46.8		81.3
a4. Livestock numbers											
cattle (million head)					40.7	67.4		64.2	106.0		278.2
dairy cows (million head)					7.2	10.6		11.3	21.0		50.0
buffalo (million head)					6.4			9.0	109.2		124.6
sheep and goats (million head)					25.6	60.0		75.1	141.8		302.4
b) Major outputs (million kg)											
beef and veal meat					300	400		500	1 000		2 200
buffalo meat					100	0		200	1 800		2 100
sheep and goat meat					100	200		300	800		1 400
pig meat					100	200		100	200	100	600
poultry meat					200	400		300	700	400	2 000
eggs					200	600		400	900	500	2 600
dairy milk					6 700	10 000		7 100	21 300		45 200
other milk					7 300	0		6 200	56 300		69 900
milk production total					14 100	10 000		13 300	77 700		115 100
c) Productivity and density indicators											
beef and buffalo meat kg/head					2	1		2	5		3
sheep and goat meat kg/head					1	1		1	1		1
milk yield kg/cow					940	940		633	1 017		903
d) Self-sufficiency of systems											
rum meat kg/inhabitant					3	2		3	6		4
monogastric meat kg/inhabitant					2	2		1	2		2
eggs kg/inhabitant					2	2		1	2		2
milk kg/inhabitant					95	29		41	139		84

Sources: FAO (1996); FAO (2004b).

2.2 Roles and functions of livestock in South Asia

The role of livestock in South Asia goes far beyond milk and meat production. In areas with low levels of farm mechanization and poorly developed markets, milk and meat may not be the primary reasons why farmers keep livestock. Especially in mixed farming systems, livestock have diverse functions, providing draught power, fertilizer, serving as a form of insurance, and making possible the utilization of land which is marginal for crops (Sajise, 1998). In Bangladesh, for example, some 80–85 percent of land preparation is carried out using large ruminants, despite an increasing interest in mechanization. In Bhutan, cattle, mithun and yak are used for draft purposes. In the various agro-ecological zones of India, cattle, buffalo, equines, camels and yaks are important for draft power. The production of draft bullocks remains an important aspect of cattle rearing in India, and it is estimated that there are some 70 million working animals in this country. In Nepal, almost all crop cultivation involves animal power. In addition to cattle, buffalo and yak, Baruwal sheep and Sinahal goats are used in Nepal for haulage in the mountain regions. In Pakistan, cattle are the main draft animals. In Sri Lanka, both cattle and buffalo are used, with 90 percent of the swamp buffalo providing draft power, predominantly for cultivation in rice production systems (Devendra *et al.,* 2000).

Another example of the integration of livestock with crop production is the case of smallholders in Sri Lanka, who are involved in the production of plantation crops and use their cattle, sheep and goats to control weeds and vegetation under coconut trees and oil palms (FAO, 2002b). There are many benefits from integrating crop and livestock production and roles and functions of livestock in this system are summarized in Table 7.

TABLE 7
Roles and functions of livestock in mixed crop-livestock systems

• Large ruminants provide power for operations such as land preparation and for soil conservation practices.
• Both ruminants and non-ruminants provide manure for the maintenance and improvement of soil fertility.
• The sale of animal products and the hiring out of draught animals provides cash for the purchase of fertilizers and pesticides used in crop production.
• Animals grazing vegetation under the tree crops control weeds and reduce the use of herbicides.
• Animals provide entry-points for the introduction of improved forages into cropping systems. Herbaceous forages can be undersown in annual and perennial crops and shrubs or trees established as hedgerows in agroforestry-based cropping systems.

Source: Devendra *et al.* (2005).

It is suggested that crop–livestock systems will see important growth in the future and will remain the dominant systems in Asia (Devendra *et al.,* 2005).

Roles and functions of livestock in grassland-based systems in South Asia include mutton and wool production from sheep in extensive grazing systems in parts of Pakistan. Many pastoralists in India are vegetarians and are opposed to the slaughtering of animals (Köhler-Rollefson, 1992). Camel rearing, in the dry zones of Rajasthan for example, is geared towards raising males for sale as draught animals, and the potential of the species as a source of food is largely ignored (ibid.). Manure is also highly valued in this area where pastoralism and crop cultivation have traditionally been integrated and herds are kept overnight on harvested fields (ibid.). Goats also have an important role in the livelihoods of many households in grassland production systems, being used mainly for the production of milk and meat (Robbins, 1992).

The role and function of livestock in the large-scale landless production systems of South Asia is purely oriented towards the output of products such as meat and eggs.

2.3 Projected changes in production systems

The rapidly increasing demand for livestock products in Asia, together with changes in international trade, is placing pressure on South Asia's livestock sector both to expand and adapt. This adaptation means that the subregion's production systems are changing in terms of livestock functions, the relative importance of different livestock species, and in terms of agro-ecological and geographical zones. The non-food functions of livestock are generally in decline and are being replaced by cheaper and more convenient substitutes. At the same time, the asset, petty cash, and insurance functions of livestock are being replaced by financial institutions, as even remote rural areas enter the monetary economy. Except for some parts of South Asia, the use of animals for draught power is declining as more farmers mechanize, partly attracted by government subsidies. Manure continues to be important in mixed farming, but its role in overall nutrient supply is diminishing because of the competitive price and ease of management of inorganic fertilizer. The same applies to animal fibres: although the demand for natural fibres is still high and in many places even increasing, there are a growing number of synthetic substitutes for wool and leather (FAO, 1999).

As noted above, there is rapidly increasing demand for milk in South Asia. In all South Asian countries, except Bangladesh and Bhutan, a major shift is taking place in milk production from cattle to buffalo (Devendra *et al.,* 2000). The reasons for this include customer preference for higher butterfat contents, the consistency/longevity of buffalo's milk yields under poor management conditions, and the greater disposal value of the animals (Devendra and Thomas, 2002).

Grazing systems have limited scope for expansion. Throughout the world, traditional grazing areas are coming under increasing pressure because of the growth in human population and subsequent alternative demands on land use. To some extent, in some countries, these systems can intensify by incorporating new technologies, especially in the higher potential areas. Where this is not facilitated by strong institutions, local empowerment and regulation of access to resources, and where population pressure persists, grazing systems are threatened with resource degradation through overgrazing (Steinfeld, 1998). Also, good pastureland is being converted into cropland, leaving increasingly poorer land for grazing and mixed farming (ibid.). However, the rangelands have proven to be more resilient than originally believed, and breeding and raising livestock in the drier areas and finishing them in more intensive systems closer to the final markets may offer the best option to increase productivity and the best opportunity to improve pastoralist income. There is also scope to exploit wildlife on rangelands by marketing bush meat and by deriving income from tourism (ibid.). Overall, current trends mean that the share of grassland in livestock production is falling and that of cropland in support of industrial livestock production is rising; and as such, grazing systems are diminishing in importance (Rae, 2002).

Mixed farming systems will see continued intensification and important growth, with livestock production based on crop by-products and surplus. Some productivity gains can be achieved by further enhancing nutrient and energy flows between the crop and livestock components. However, involution of the mixed farming system is a threat, for example, in parts of the Himalaya and Hindu Kush where the stability and sometimes very existence of mixed farming is threatened by population pressure, fragmentation of arable land, poverty and lack of market access (Steinfeld, 1998).

Landless systems in Asia are mainly established in the vicinity of large and medium-size cities and in the coastal developed areas. This has resulted in excessive animal densities, nutrient surpluses and other environmental and human health problems. Thus, although these systems are profitable in the short run, their sustainability is doubtful. A possible way forward is to allow specialized commercial production to operate in an "area-wide" integration with crop production, so that nutrient balances are maintained and the land's capacity to absorb animal waste is respected (ibid.). In South Asia, with respect to structural changes in livestock production systems, the strongest trend has been the advent, and subsequent fast expansion, of industrial, vertically integrated, large-scale broiler production (Steinfeld, 2003). As there is an increasing demand for poultry products, this trend will probably continue.

Two important structural changes apply across production systems: a general growth in scale and a trend from horizontal to vertical integration. Levels of livestock production and processing are increasing in response to technological development and market requirements. However, next to this modern, demand-driven and capital-intensive sector, producing poultry meat, eggs, pork and milk, the traditional, resource-driven and labour-intensive sector will continue to provide a multitude of services to subsistence-oriented farms (FAO, 1999).

2.4 Impact of production system trends on animal genetic resources

In Asia the major trend is from multipurpose to single-purpose animals, with the production of animal protein being the overriding objective. This is also reflected in the choice and manipulation of genotypes to favour specialization over product diversity. Another trend is the growing importance of monogastrics as economic converters of concentrate feed (ibid.).

- Grazing systems disappear because of land degradation and conversion into cropland. Breeds sustained in these systems will be threatened. However, in some areas extensive herding seems to be the only practical way of earning a living from the land and breeds held in these systems will be maintained.
- Mixed systems will see continued intensification and growth. As these systems adopt new technologies which allow for the intensification of production, existing genotypes are replaced with what are perceived to be improved varieties (Blackburn *et al.,* 1998). Also more emphasis will be placed on monogastrics. Native breeds sustained in mixed farming systems will be threatened.
- Landless systems in South Asia will further increase. Large-scale and vertically-integrated industrial poultry and pig production systems have increased significantly in recent years and continue to do so. The introduction of high-yielding breeds and specialized modes of production especially in landless monogastric systems will lead to losses in genetic diversity.

3 Animal genetic resources

3.1 Status

Table 8 gives total population sizes and number of breeds for the major domestic animal species recorded in the South Asia subregion and the subregion's share of the world's population and number of breeds.

TABLE 8

Total population size and number of breeds of the major livestock species in the South Asian subregion and their share of the world total

	Population size (1 000)	Number of national breed populations	Share of world total	
			Population (%)	Number of breed populations (%)
Buffalo	128 285	52	74	30
Cattle	242 288	153	18	5
Yak	n/a	10	n/a	37
Goat	216 625	98	28	9
Sheep	89 313	141	8	7
Pig	15 346	42	2	3
Ass	4 868	7	12	4
Horse	1 130	30	2	2
Camel[1]	1 435	11	8	10
Chicken	758 054	88	5	4
Duck[2]	49 930	21	5	5
Turkey	n/a	1	n/a	1
Goose (domestic)	n/a	2	n/a	1

Source for population figures: FAOSTAT estimates of 2004 live animal populations.

[1] Dromedary and Bactrian camel.

[2] Domestic duck and Muscovy duck.

Tables 9 and 10 show the transboundary mammalian and avian breeds in South Asia.

TABLE 9
Transboundary mammalian breeds in South Asia

Buffalo	Cattle	Goat	Sheep
Arni	Arunachalee	Alpine	Argali
Jafarabadi	Australian Friesian Sahiwal	Angora	Awassi
Mehsana	Australian Milking Zebu	Barbari	Baluchi
Murrah	Ayrshire	Beetal	Baruwal
Nili	Bengali	Bengal	Border Leicester
Nili-Ravi	Bhagnari	Bezoar	Comeback
Surti	Brown Swiss	Boer	Corriedale
Tarai	Burmese Gaur	Gaddi	Dorset Horn
Wild Water Buffalo	Dairy Shorthorn	German Improved Fawn	Hissardale
	Gir	Jamnapari	Karakul
	Hariana	Kamori	Madras Red
	Hissar	Kiko	Marco Polo's Sheep
	Holstein (black and white)	Lori	Merino
	Holstein (red and white)	Markhor	Poll Dorset
	Illawarra Shorthorn	Pateri	Polwarth
	Jersey	Saanen	Poonchi
	Kangayam	Tibetan	Rambouillet
	Khillari		Scottish Blackface
	Lulu		South Down
	Mithun		Suffolk
	Ongole		Tibetan
	Red Poll		Urial
	Red Sindhi		Wiltshire Horn
	Sahiwal		
	Santa Gertrudis		
	Siri		
	Sunandini		
	Thari		
Horse	**Pig**	**Rabbit**	**Ass**
Arab	Duroc	Angora	Tibetan
Bhotia Pony	Ghori	Angora German	
Chummarti	Hampshire	Chinchilla	
Haflinger	Jersey Red	New Zealand White	
Tanghan	Landrace	Soviet Chinchilla	
Tibetan Pony	Large Black	White Giant	
Waziri	Large White		
	Middle White		
	Saddleback		
	Tamworth		

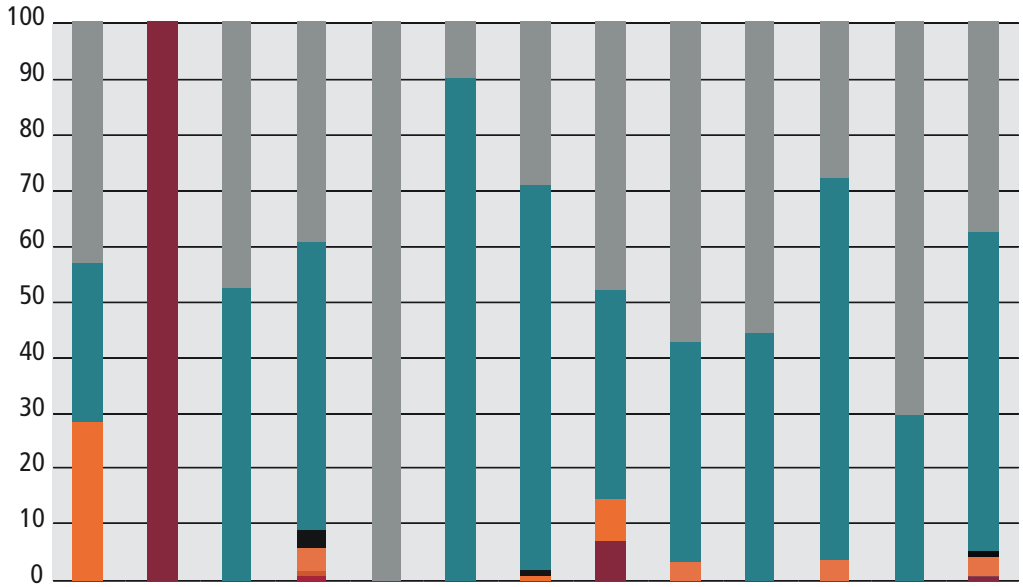
TABLE 10
Transboundary avian breeds in South Asia

Chicken (1)		Chicken (2)	
Aseel		Commercial strain, layer, Lohmann Brown	
Black Australorp		Commercial strain, layer, Shaver Starcross 579	
Commercial strain, broiler, Arbor Acres AA broiler breeders		Cornish	
Commercial strain, broiler, Ross		Dokki	
Commercial strain, broiler, Shaver Starbro		Fayoumi	
Commercial strain, Hubbard		Giriraja	
Commercial strain, layer, Cobb 500		Jungle Fowl	
Commercial strain, layer, Euribrid Hisex Brown		Light Sussex	
Commercial strain, layer, Hy-Line		New Hampshire	
Commercial strain, layer, Hy-Line Brown		Plymouth Rock Barred	
Commercial strain, layer, ISA Brown		Plymouth Rock White	
Commercial strain, layer, Leghorn		Rhode Island Red	
Duck	**Pigeon**	**Muscovy duck**	**Quail**
Indian Runner	White King	Muscovy	Rain Quail
Khaki Campbell			
White Pekin			

Figures 5 and 6 illustrate the structure of the data recorded in the Global Databank for Farm Animal Genetic Resources, showing the risk status of the mammalian and avian breeds recorded for each species in the South Asian subregion up to 2005. Only five percent (30 of 571) of extant mammalian and avian breeds in South Asia are categorized as at risk. However, this is probably an underestimate of the actual situation, primarily due to lack of information. Population data is available for only 50 percent of mammalian and avian breeds, and those that are most at risk of extinction are usually those for which it is most difficult to obtain accurate census information (FAO/UNEP, 2000).

FIGURE 5

Risk status of Mammalian breeds recorded in South Asia* up to December 2005: absolute (table) and percentage (chart) figures



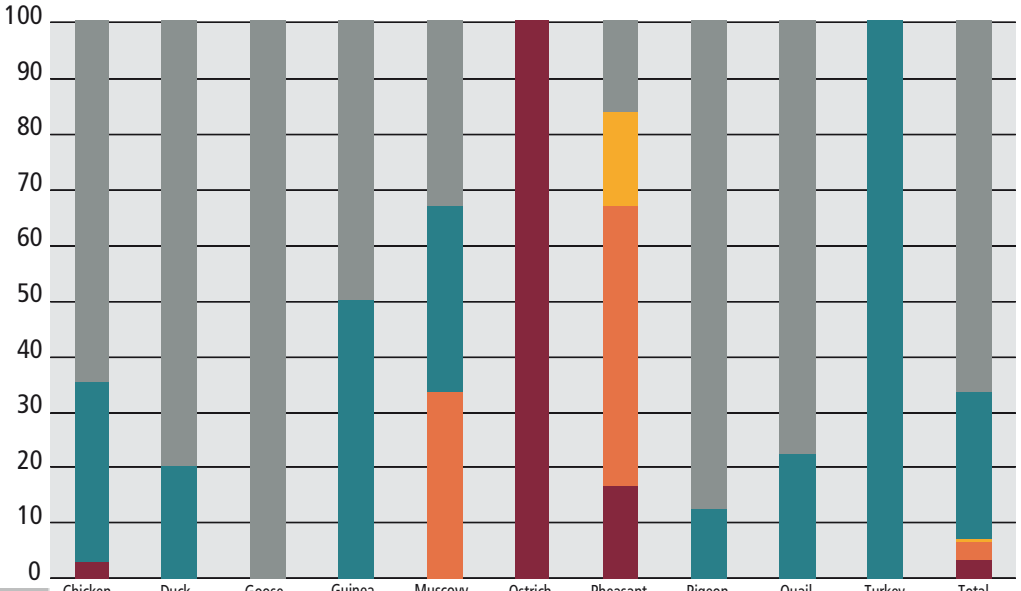
RISK STATUS	Ass	Bactrian Camel	Buffalo	Cattle	Deer	Dromedary	Goat	Horse	Pig	Rabbit	Sheep	Yak	Total
critical	0	1	0	1	0	0	0	2	0	0	0	0	**4**
critical -maintained	0	0	0	1	0	0	0	0	0	0	0	0	**1**
endangered	2	0	0	5	0	0	1	2	1	0	5	0	**16**
extinct	0	0	0	4	0	0	1	0	0	0	0	0	**5**
not at risk	2	0	21	60	0	9	56	10	11	4	88	3	**264**
unknown	3	0	19	46	1	1	24	13	16	5	36	7	**171**
Total	**7**	**1**	**40**	**117**	**1**	**10**	**82**	**27**	**28**	**9**	**129**	**10**	**461**

* Breeds that are also recorded in countries outside Asia are excluded from the analysis.

Also excluded: four dog breeds of unknown risk status.

FIGURE 6

Risk status of Avian breeds recorded in South Asia* up to December 2005: absolute (table) and percentage (chart) figures



RISK STATUS	Chicken	Duck	Goose	Guinea fowl	Muscovy duck	Ostrich	Pheasant	Pigeon	Quail	Turkey	Total
critical	2	0	0	0	0	1	1	0	0	0	**4**
endangered	0	0	0	0	1	0	3	0	0	0	**4**
endangered -maintained	0	0	0	0	0	0	1	0	0	0	**1**
not at risk	22	3	0	1	1	0	0	1	2	1	**31**
unknown	44	12	2	1	1	0	1	7	7	0	**75**
Total	**68**	**15**	**2**	**2**	**3**	**1**	**6**	**8**	**9**	**1**	**115**

* Breeds that are also recorded in countries outside Asia are excluded from the analysis.

Also excluded, 7 partridge breeds: 1 not at risk, 6 of unknown risk status.

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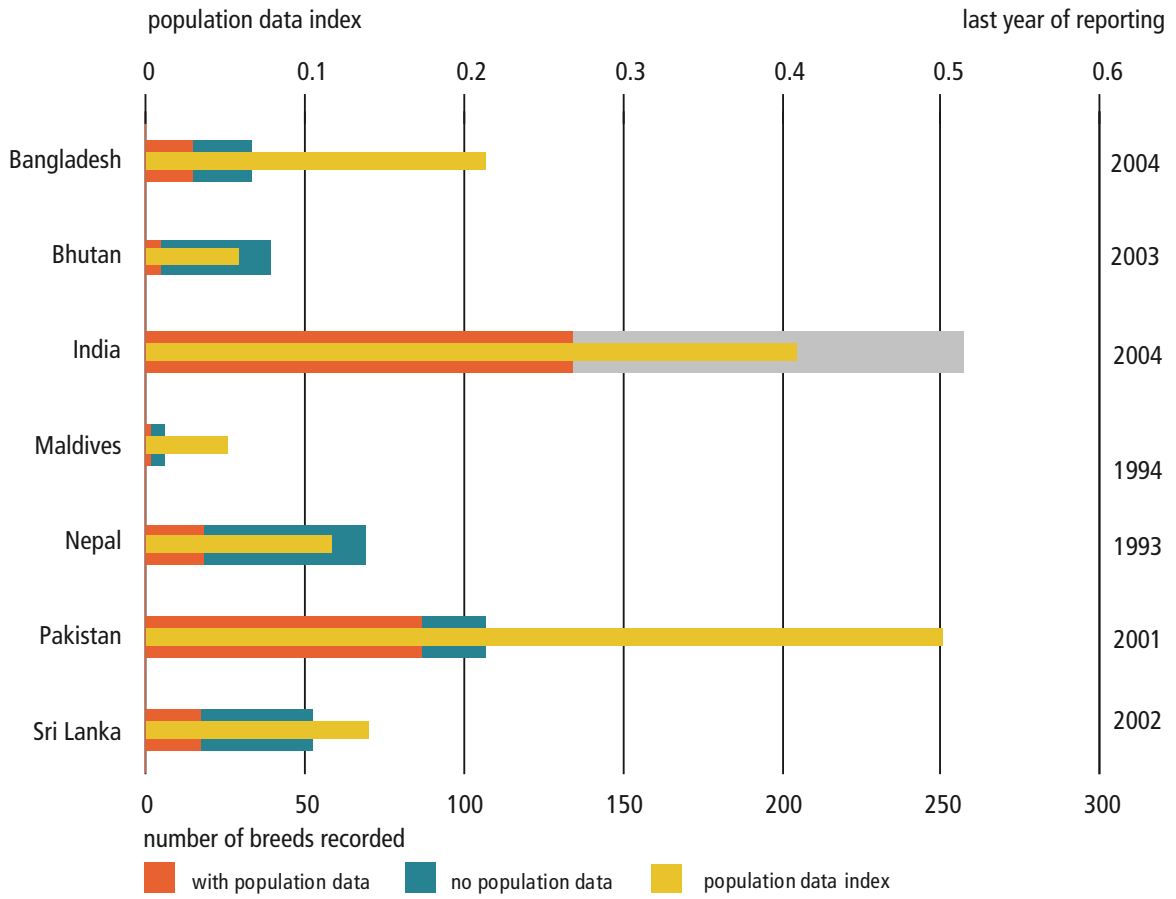
Figures 7 and 8 provide general overviews of the quantity and quality of the population data provided by each country for their animal genetic resources. The total number of breeds recorded by each country is shown. For all countries, breeds are split into those with population data and those with no population data (risk status unknown). When one or more fields in the Global Databank for Farm Animal Genetic Resources are completed then the breed is identified as having population data. For those breeds recorded as having population data, a population data index (PDI) is calculated, which gives an indication of the completeness of the data provided by the country. Selected basic population data fields, considered to be the most important and used in the calculation of risk status, are taken into account – population size (absolute or range), number of breeding females, number of breeding males and the percentage of females bred to males of the same breed (FAO/UNEP, 2000).

FIGURE 7
Population data status and index for mammalian breeds recorded by countries of the South Asia subregion up to December 2005

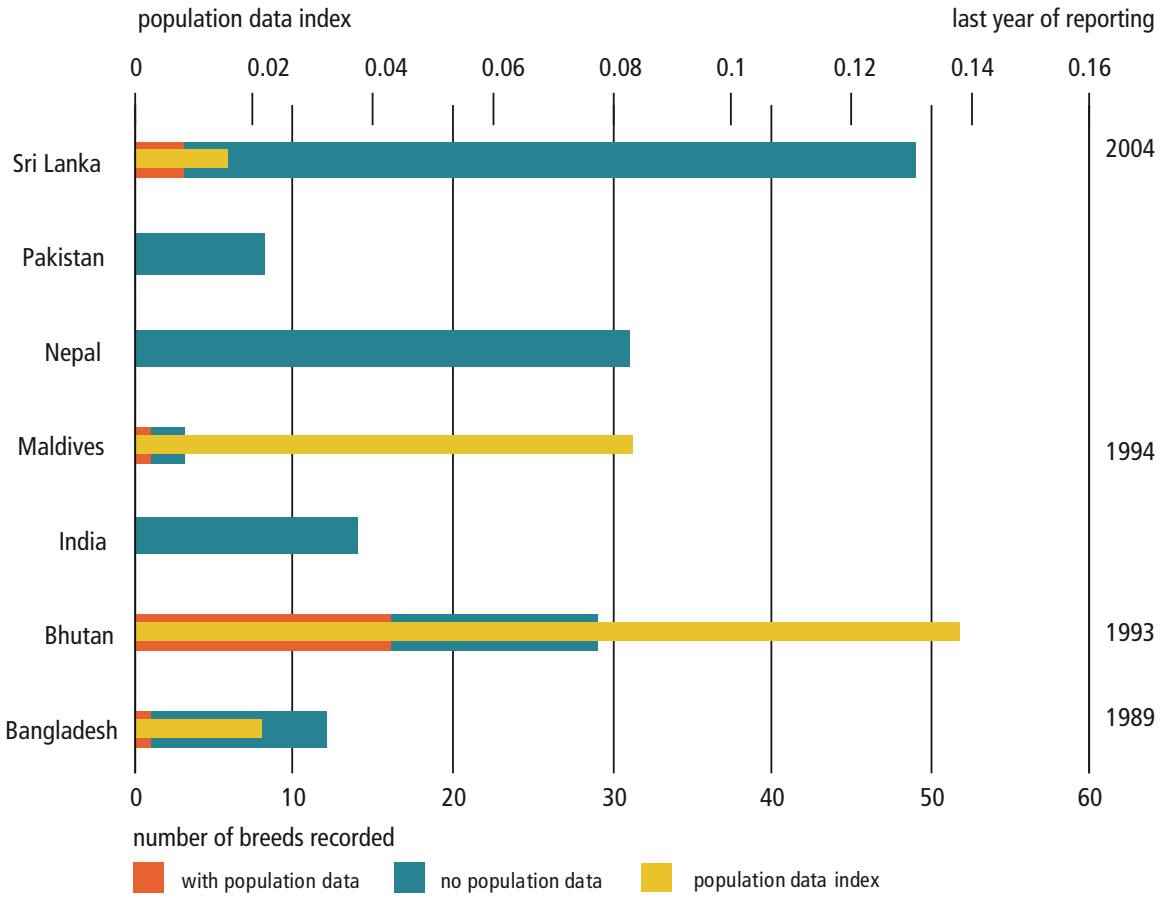


With population data: Those breeds with information recorded in one or more of the 16 population data fields.

No population data: Those breeds with no information recorded in any of the 16 population data fields.

Population Data Index (PDI): For each country the PDI was calculated only for those breeds recorded with population data. The PDI is the fraction of selected population data fields (population size, number of breeding females, number of breeding males and the percentage of females bred to males of the same breed) that contain information, averaged across breeds.

FIGURE 8
Population data status and index for avian breeds recorded by countries of the South Asia subregion up to December 2005



With population data: Those breeds with information recorded in one or more of the 16 population data fields.

No population data: Those breeds with no information recorded in any of the 16 population data fields.

Population Data Index (PDI): For each country the PDI was calculated only for those breeds recorded with population data. The PDI is the fraction of selected population data fields (population size, number of breeding females, number of breeding males and the percentage of females bred to males of the same breed) that contain information, averaged across breeds.

3.2 Threats to animal genetic resources in South Asia

In South Asian production systems there is a need to improve the overall efficiency of resource use, to improve breeding systems and local breeds, to provide adequate feed for these breeds and to tackle the various endemic diseases that have a debilitating effect on animals. Future needs of the subregion will probably only be met by intensification, and this could result in a considerable reduction of the subregion's animal genetic resources. Worldwide the greatest threat to domestic animal diversity is the highly specialized nature of industrial livestock production. In most countries, economic support to implement active conservation programmes is often inadequate. Also, current development pressures often fail to consider efficiency in the context of available resources, and tend to be guided by developed country definitions and views (FAO/UNEP, 2000).

The most important threats to animal genetic resources in South Asia are epidemic and endemic diseases and their control measures, intensification of production systems, natural disasters and lack

of appropriate livestock policies. Several of the threats operate through diverse and overlapping mechanisms. For example, economic development generally causes an intensification of livestock production which creates a demand for widespread cross-breeding and/or breed substitution which can severely threaten the survival of local animal genetic resources.

Most of South Asia has enjoyed rapid economic growth and development in recent years, which led to a rise in consumer demand for animal products. In order to meet this demand, animal production systems intensified and exotic, high-output breeds were introduced. Cross-breeding of indigenous stock with exotic animals, and thereby exploiting hybrid vigour, is widely acknowledged to be a valuable strategy for rapidly increasing production. Perhaps the best example of cross-breeding in South Asia is the use of temperate cattle to improve milk production. Spectacular increases in production have been registered in countries such as India through the National Dairy Development Board (Devendra *et al.,* 2000). However, there is a down-side to cross-breeding and perhaps the most damaging effect of the widespread development of cross-breeding programmes is the genetic erosion of valuable indigenous breeds and the threat of their ultimate extinction (ibid.).

Threats to animal genetic resources due to endemic and epidemic diseases and their control measures are present throughout South Asia. Diseases such as Newcastle disease, foot-and-mouth disease (FMD), haemorrhagic septicaemia, fowl pox, Japanese encephalitis, classical swine fever, brucellosis and rinderpest are threats to livestock in South Asian countries (CR Bangladesh, 2004; CR India, 2004; CR Nepal, 2004; CR Pakistan, 2003; CR Sri Lanka, 2002). Outbreaks of Newcastle Disease, which may wipe out entire village poultry populations, are a major threat to rural poultry production (CR Pakistan, 2003). FMD is one of the most contagious diseases of mammals and has a great potential for causing severe economic loss. This disease is endemic and at a high prevalence in many countries in South Asia; not one South Asian country is included in the official World Organisation for Animal Health list of disease-free countries and zones (OIE, 2007). Recently, avian influenza (AI) outbreaks have occurred in India and Pakistan. Besides deaths due to the disease itself, massive numbers of birds are culled in an attempt to eradicate the disease. According to FAO guidelines on AI, immediate stamping out is the most appropriate response. Stamping out usually involves the destruction of all poultry in a defined radius around infected areas and of poultry on "at risk" farms (FAO, 2004c).

Natural disasters are also a threat. In 2000, for example, a severe drought hit Pakistan and India. In Pakistan cattle-breeding – a key source of income for the local inhabitants – was seriously hit by a lack of grazing (BBC, 2000a). In India also, farmers were reporting severe livestock losses (BBC, 2000b). In October 2005 an earthquake hit the South Asia subregion, which destroyed a lot of the farming infrastructure, agricultural fields were lost and livestock perished in the disaster (BBC, 2005). Bangladesh, Nepal, Bhutan and India suffer frequent floods, which also cause major livestock losses.

In many countries a lack of appropriate livestock policies is a threat to farm animal genetic resources and there are often problems with the implementation of existing legislation and policies. A lack of awareness among the general public, the livestock farming community and policymakers is a constraint to the successful implementation of strategies for the utilization and conservation of animal genetic resources (CR Bhutan, 2002; CR Pakistan, 2003). An example is the lack of research and development for conservation and utilization of Kari sheep whose existence is now at risk. Cross-breeding with Kail (sheep from Azad Kashmir) for improved body weight is a major threat to this breed (CR Pakistan, 2003). The presence of other sheep breeds in migrating Afghan flocks is another potent threat to the breed (ibid.).

Lack of knowledge and training on conservation and sustainable use of animal genetic resources is also a constraint. For example, at present there is no network established for sharing resources, data, information and knowledge regarding animal genetic resources in Sri Lanka (CR Sri Lanka, 2002). In Bangladesh, a lack of knowledge about the management of farm animal genetic resources has resulted in indiscriminate cross-breeding with exotic breeds (CR Bangladesh, draft, 2004).

A lack of financial support, technical capacity and technological facilities is also stumbling blocks for the conservation of animal genetic resources in some countries (CR Bhutan, 2002; CR India, 2004).

3.3 Unique resources highlighted

Aside from the major livestock species, the Asia region is host to a range of microlivestock species. For example, the pygmy hog (Sus salvanius) which is found in northern India is on the verge of extinction. Its small size makes it ideal for keeping in small village communities where it can be used as a source of meat. It is also likely that this species carries resistance to a number of indigenous porcine diseases (FAO/UNEP, 2000).

Buffaloes are widespread in South Asia. The majority of the world's buffaloes are found in South Asia and they are concentrated especially in India and Pakistan. Buffaloes in Pakistan are part of the traditional small mixed farming system integrated with crop production, and are the backbone of the dairy industry. Sixty-five percent of the milk produced in Pakistan comes from buffaloes (CR Pakistan, 2003). Buffaloes are also an important species in Bangladesh (CR Bangladesh, 2004). In Nepal, both native and cross-bred buffaloes are considered good dairy animals and are also used for meat production (CR Nepal, 2004). In Sri Lanka also, buffaloes are one of the most significant livestock species (CR Sri Lanka, 2002). Important buffalo breeds include the Jaffarabadi, Surti, Murrah and Nili–Ravi (Devendra *et al.,* 2000).

Yaks (*Bos gruniens*) are found in India, Pakistan, Nepal and Bhutan. Because of its adaptation to high altitudes, the yak is vital to the livelihoods of mountain people. The yak is a multipurpose animal, kept mainly for subsistence and providing milk, meat, draught, hair and manure (CR Pakistan, 2003).

Bos frontalis is a type of cattle found in some countries in South Asia. In India and Bhutan is it called Mithun, in Bangladesh it is called Gayal. In India it is used primarily as a sacrificial animal and regarded as social status symbol (CR India, 2004). The animals are reported to be very hardy and capable of thriving well on the natural habitat of the hilly forests (CR Bangladesh, 2004). In Bhutan the Mithun is considered to be precious gem by farmers. It is commonly used for cross-breeding by cattle owners. However, there has been a gradual decline of the Mithun due to inbreeding, degradation of its habitat and changing tribal lifestyle (CR Bhutan, 2002).

Valuable indigenous camel breeds are also found in Pakistan and India, for example, the Malvi of Madhya Pradesh (Devendra *et al.,* 2000). In Pakistan camels contribute to the national meat and milk supply, but more importantly they are part of socio-economic culture in coastal areas, arid desert and mountainous regions where living conditions are difficult and survival of other species is almost impossible (CR Pakistan, 2003). In Bangladesh some deer are reared, mainly at household level, for meat purpose (Bangladesh, 2004).

Important cattle breeds in South Asia include the Sahiwal, Gir, Tharparkar, Kankrej, Dhanni, Ongole (Nellore), Hariana and Red Sindhi; sheep include the Chokla, Ganjam, Magra, Muzzafarnagri and Nellore; and goats the Barbari, Beetal, Black Bengal, Jamnapari and Sirohi (Devendra *et al.,* 2000). Valuable indigenous germplasm also exists for poultry (e.g. the Aseel fowl of northern India) (ibid.).

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Annex 1 Import and export figures for the subregion

TABLE A1
Export of livestock and livestock products in South Asia

Product	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Live animals	10 610	9 578	13 517	4 325	4 753	2 734	3 273	6 000	7 185	7 395	25 118
Meat, total	111 026	126 506	190 340	194 910	215 772	186 059	188 516	331 325	264 950	281 075	370 720
Beef and buffalo	90 170	104 140	172 591	174 002	197 655	166 368	165 056	307 545	255 768	270 150	333,365
Mutton and goat	20 296	21 307	17 562	19 989	16 988	19 173	22 718	23 435	8 752	9 532	30,252
Pig	151	807	20	155	210	72	316	6	151	156	24
Poultry	182	138	92	654	720	358	373	214	209	801	6,260
Other	227	114	75	110	199	88	53	125	70	436	819
Milk, total	0	0	411	0	7	42	19	164	156	600	1 831
Eggs, total	3 083	2 248	4 465	13 630	14 125	12 516	10 137	13 826	16 824	15 636	31 445
Fibres, hides and skins	1 861	1 975	4 614	2 566	3 067	2 375	5 639	1 444	1 075	1 100	1 415
Other	1 791	2 032	5 900	3 375	5 660	4 487	4 182	6 135	6 604	12 667	17 892
TOTAL	128 371	142 339	219 247	218 806	243 384	208 213	211 766	358 894	296 794	318 473	448 421

Source: FAOSTAT.

Note: value in 1 000 US$; no data for Maldives.

TABLE A2
Import of livestock and livestock products in South Asia

Product	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Live animals	4 531	5 338	7 267	7 943	18 951	9 403	9 044	12 784	11 877	13 186	16 004
Meat, total	3 979	4 143	6 282	6 606	9 193	11 905	5 082	5 325	9 867	6 940	9 688
Beef and buffalo	18	43	51	241	123	2 394	382	397	257	345	473
Mutton and goat	2 728	1 231	2 627	4 165	4 068	6 933	1 491	1 867	4 979	1 955	2 474
Pig	547	535	614	597	77	206	16	21	24	60	42
Poultry	686	2 328	2 974	1 560	4 839	2 355	3 086	2 930	4 507	4 468	6 570
Other	0	6	16	43	86	17	107	110	100	112	129
Milk total	252	220	206	157	430	499	688	832	617	665	917
Eggs total	6 407	2 040	2 315	2 533	4 604	8 104	9 203	5 341	6 374	4 572	3 747
Fibres hides and skins	75 397	91 361	107 694	108 945	106 345	79 814	86 792	72 213	85 787	111 503	110 414
Other	2 709	4 573	3 970	3 288	6 564	3 264	3 404	5 964	6 738	9 583	6 633
TOTAL	93 275	107 675	127 734	129 472	146 087	112 989	114 213	102 459	121 260	146 449	147 403

Source: FAOSTAT.

Note: value in 1 000 US$; no data for Maldives.

Annex 2 Classification of livestock production systems

FAO (1996)[1] used the agro-ecological zones (AEZ) described by the Technical Advisory Committee (TAC, 1994)[2] and provided a comprehensive description of global livestock production systems using quantitative statistical methods. In this system the distinction is based upon grassland-based systems (LG), mixed-rainfed systems (MR), mixed irrigated systems (MI) and landless systems (LL). The landless livestock production systems are not linked to agro-ecological zones.

- Grassland-based systems (LG) are livestock systems in which more than 90 percent of dry matter fed to animals comes from rangelands, pastures, annual forages and purchased feeds and less than 10 percent of the total value of production comes from non-livestock farming activities. Annual stocking rates are less than 10 livestock units per hectare of agricultural land. A further distinction is made between Temperate Zones and Tropical Highlands (LGT), Humid and Subhumid Tropics and Subtropics (LGH) and Arid and Semi-arid Tropics and Subtropics (LGA).

- Mixed-rainfed systems (MR) are defined as rainfed systems in which more than 10 percent of the dry matter fed to livestock comes from crop by-products and/or stubble or more than 10 percent of the value of production comes from non-livestock farming activities. A further distinction is made between Temperate Zones and Tropical Highlands (MRT), Humid and Subhumid Tropics and Subtropics (MRH) and Arid and Semi-arid Tropics and Subtropics (MRA).

- Mixed-irrigated systems (MI) are defined as irrigated systems in which more than 10 percent of the dry matter fed to livestock comes from crop by-products and/or stubble or more than 10 percent of the value of production comes from non-livestock farming activities. A further distinction is made between Temperate Zones and Tropical Highlands (MIT), Humid and Subhumid Tropics and Subtropics (MIH) and Arid and Semi-arid Tropics and Sub-tropics (MIA).

- Landless systems are defined as those where less than 10 percent of the dry matter consumed is produced on the farm where the livestock are located, and where annual average stocking rates are above 10 livestock units (1 LU = 1 cattle or buffalo or 8 sheep or goats) per hectare of agricultural land. Furthermore, landless monogastric (LLM) and landless ruminant systems (LLR) are distinguished. The former are mainly industrial, intensive and vertically-integrated pig and poultry enterprises whose economic outputs are higher than those of ruminant enterprises. In landless ruminant systems, the value of production of the ruminant enterprises is lower than that of the pig and poultry enterprises.

[1] **FAO.** 1996. *World livestock production systems. Current status, issues and trends*, by C. Seré, H. Steinfeld & J. Groenewold. FAO Animal Production and Health Paper No. 127. Rome.

[2] **TAC.** 1994. *Animal agriculture in developing countries: technology dimensions*. Development Studies Paper Series. Morrilton, Arkansas. Winrock International.

Subregional priorities: **South Asia**

The subregional consultation on which these priorities are based included participants from Nepal, Pakistan and Sri Lanka.

1 Inventory and characterization

In the countries that participated in the subregional consultation there is a lack of breed characterization due to a lack of financial resources, relevant expertise and technical know-how. There is a need for standardized protocols and formats for characterization and measurement of comparative performance. Experts and professional involved should be familiar with the tools available from DAD-IS[3].

The Himalayan College of Agricultural Sciences and Technology (HICAST) in Nepal could participate in preparing inventories, characterization and monitoring of indigenous breeds in collaboration with the Nepal Agricultural Research Council (NARC).

Activities would include:

- field training;
- regional networking;
- establishment of a database and information system; and
- a research project.
- The biotechnology laboratory of NARC could be used as training facilities for animal genetic resources (AnGR).

Some methods and participatory approaches used in the field of plant genetic resources could also be applied to raise awareness among stakeholders in AnGR.

2 Sustainable use and development

Breed improvement remains an important activity that needs to be emphasized if breeds are to be made safe from the threat of extinction. The following requirements were identified:

- Artificial insemination should be combined with traditional practices and knowledge regarding the selection of sires by the community in programmes for the improvement of local breeds.
- It is necessary to identify niche markets and marketing opportunities.
- Marketing of value-added products should be channelled through producer cooperatives so that they can get reasonable prices and be encouraged to keep their breeds. Governments should facilitate this process.

3 Conservation

There are no conservation programmes in the subregion. There are proposals to link biodiversity programmes with conservation of AnGR. Governments could proclaim conservation areas and develop conservation programmes in partnership with local communities. Breeds at risk should be treated as global resources. This status would facilitate the mobilization of resources.

[3] www.fao.org/dad-is/

4 Policies, institutions and capacity building

Positive initiatives were taken because of the awareness created during the process of elaborating the Country Reports on AnGR. However, many professionals who were involved in the preparation of Country Reports have moved to other positions. In addition to the lack of specific professional expertise in the field of AnGR management, it is difficult to maintain the existing levels without funding.

Important constraints include:

- lack of capacity at political level; and
- weak linkages among institutions.

There is no subregional cooperation except informal contacts among scientists. There seems to be a need for an external support to establish this kind of cooperation. The establishment of a "centre of excellence" could contribute to coordinated research and conservation activities, and facilitate exchange between countries that have similar AnGR. There is a need to learn from the CGIAR experiences.

A regional focal point has been seen as an important institution, but none of the countries is able to allocate resources for its establishment and maintenance.

The national coordinator of Sri Lanka considers that the main reason for there being no functioning focal point is the lack of a clear programme which would enable it to attract support of international donors. Thus, it is proposed that a sustainable conservation programme be established, with an institute to manage this programme which could serve as a regional focal point.

To facilitate the mobilization of resources to implement the priorities identified, FAO could help countries to:

- obtain a list of donors and their criteria for approving projects; and
- help to improve capability of writing good projects.