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

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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 America**

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

The countries of the South America subregion, as defined for the purposes of this report, include Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, Paraguay, Peru, Uruguay and the Bolivarian Republic of Venezuela. These countries together have a land area of 17 million square kilometres – 13 percent of the total world land area. The subregion covers a wide range of latitudes – from north of the Equator to sub-Antarctic latitudes. Four-fifths of its landmass is located within the tropics. It has a great diversity of climatic and ecological zones. Topographically the continent is divided into three sections – the South American cordillera, the interior lowlands, and the continental shield. The continental shield, in the east, forms highland regions and is divided by large basins including the vast Amazon basin. The western portion is occupied almost entirely by the Andes Mountains. The Andes region is seismically active and prone to earthquakes. Volcanoes are present but mostly inactive. South America's major natural resources include copper, iron, gold, tin and oil.

In 2003, the population of the ten countries covered by this report was estimated at more than 363.5 million, more than twice the population in 1960, and almost 6 percent of the total world population. The population is very culturally diverse. The largest country, in both area and population, is Brazil, followed by Argentina. Since the Second World War, the urban population has rapidly expanded. Squatter settlements have multiplied around urban areas. Unemployment is widespread. Outside the cities the population density is very low, with vast portions of the interior virtually uninhabited. The subregion has seen considerable political instability related to social inequality. A summary of general information for this subregion is shown in Tables 1 to 3.

SOUTH AMERICA

TABLE 1
Land area and population

	Land area (× 1 000 km²)	Population 2003 (million)	Population density (km²)	Population growth rate (%)	
				1975–2003	2003–2015
Argentina	2 737	38.0	14	1.3	1
Bolivia	1 084	8.8	8	2.2	1.7
Brazil	8 459	181.4	21	1.8	1.2
Chile	749	16.0	21	1.5	1
Colombia	1 039	44.2	43	2	1.4
Ecuador	277	12.9	47	2.2	1.4
Paraguay	397	5.9	15	2.8	2.2
Peru	1 280	27.2	21	2.1	1.4
Uruguay	175	3.4	19	0.7	0.6
Venezuela (Bolivarian Republic of)	882	25.8	29	2.5	1.6
South America	17 079	363.6	21		

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 population[1] 2003 (% of total)
Argentina	129.6	11	10
Bolivia	8.1	15	42
Brazil	505.7	10	15
Chile	73.4	4	15
Colombia	80.1	12	19
Ecuador	27.2	8	26
Paraguay	6.0	27	39
Peru	60.8	10	29
Uruguay	11.2	12	11
Venezuela (Bolivarian Republic of)	83.4	5	8

[1] Data from UN and FAO statistics.

[2] Data from World Bank statistics and Country Reports.

TABLE 3
Land use

	Arable (%)		Permanent pasture (%)		Forest / woodland (%)	
	1993	2003	1993	2003	1993	2003
Argentina	10	10	37	36	19	-
Bolivia	2	3	31	31	53	-
Brazil	6	7	22	23	66	-
Chile	3	3	17	17	22	-
Colombia	3	2	39	40	51	-
Ecuador	6	6	18	18	56	-
Paraguay	6	8	55	55	32	-
Peru	3	3	14	13	66	-
Uruguay	7	8	77	77	5	-
Venezuela (Bolivarian Republic of)	3	3	21	21	51	-
South America	6	6	26	27	52	

Data from UN and FAO statistics.

Only a small part of South America's land area consists of arable land. Dense forests, steep slopes, and unfavourable climatic conditions limit the amount of cultivable land. Despite these constraints, agriculture contributes greatly to the subregion's economy, contributing about 12 percent of GDP and serving as a major source of employment in many countries (Orozco, 2003). During recent decades, however, the contribution of the agricultural sector to the gross domestic product of the subregion, and the proportion of the population working in agriculture have declined.

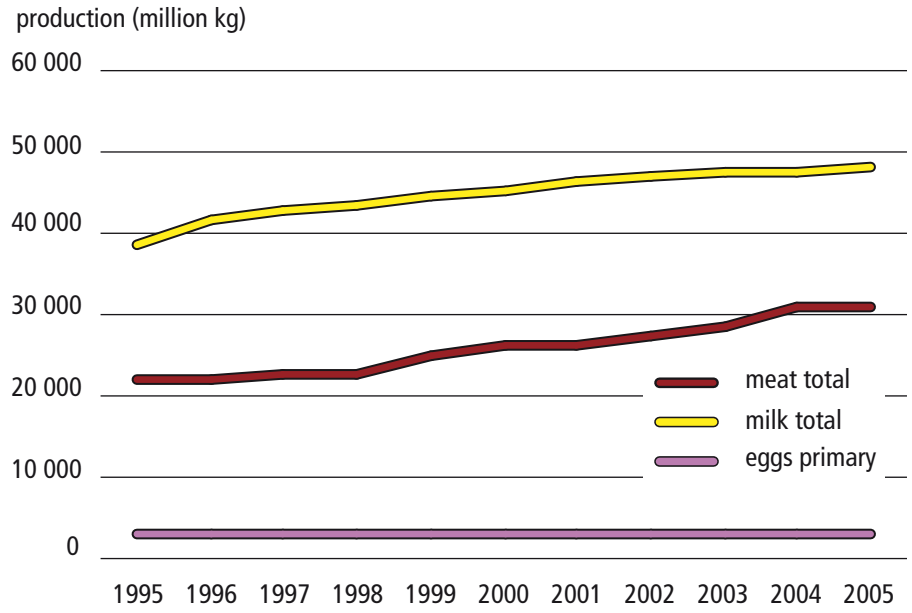
In some countries– Argentina, Brazil, Chile, and Uruguay – commercial agriculture predominates, while elsewhere subsistence farming is more widespread. Subsistence farmers grow a wide variety of crops. In the Andes, potatoes and maize, along with wheat as well as a number of native grains, are important crops. In the tropical forest regions, maize, rice, sweet potatoes, maniocs and bananas are grown. South American plantations and commercial farms are large, use modern inputs and methods, and produce a wide range of crops, including cereals, coffee, sugar, bananas, cotton and cacao, mainly for export. Meat is also an important export product.

1.1 Production and consumption

The importance of livestock keeping varies across the subregion depending on the environment and culture. Production and consumption figures reflect region-specific livestock species and products (FAO/UNEP, 2000). Among the major regions of the world, South America is uniquely positioned for livestock production. Low population densities combined with vast productive pasture areas, the absence of many major diseases and a fairly well developed infrastructure in most countries provide opportunities for low-cost production. At the same time, comparatively high incomes, a high urbanization rate and the absence of major dietary taboos create a favourable demand situation. Despite these conditions, the development of the livestock sector has been slow. Only in the last fifteen or twenty years, has there been marked growth, mainly in poultry production (FAO, 1998).

Figure 1 shows the total production of meat, milk and eggs in South America.

FIGURE 1
Total meat, milk and egg production in South America, 1995–2005



Source: FAOSTAT.

Of livestock products produced in South America, milk has the highest levels of output, accounting for 8 percent of total world production. In recent years, South American milk production has grown steadily – 23 percent in the ten-year period 1995 to 2005, and has outstripped local consumption. Brazil produces more than 23 billion litres of milk a year, making it the fifth largest dairy milk producer in the world. Around 40 percent of Brazil's milk is produced on small, non-specialized farms, and per cow productivity is low. However, the emergence of increased numbers of large-scale commercial operations with low production costs has pushed up milk supply. As a result, Brazilian dairy growth has averaged 3 percent since the late 1990s (Phillips, 2006). Milk production in Argentina fell between 1999 and 2004 as an economic crisis precipitated a shake out of the dairy industry. Uruguayan production was also affected by the economic downturn and stayed relatively static over this period (ibid.). From 2004 onwards, milk production in the countries affected by the crisis increased or at least stayed stable.

Dairy consumption in South America varies considerably across the subregion and can be strongly affected by economic conditions, particularly in rural areas. Poverty and unemployment are still major problems in rural South America and this depresses demand for dairy products. Brazilian per capita consumption is low in comparison to its South American neighbours at 131 litres per person per annum. Argentina and Uruguay's consumption is closer to that of developed countries such as Australia, averaging over 200 litres per annum on a milk equivalent basis. Per capita consumption growth for dairy products averaged about 1 percent per annum over the past decade. In 2002 and 2003, per capita consumption actually fell in Argentina and Brazil reflecting the poor state of the economy and high unemployment rates (ibid.).

Meat production in South America is 12 percent of total world meat production. It increased by 42 percent in the ten year period 1995 to 2005 – an annual growth rate of 4 percent. Beef and veal meat is the main contributor to total meat production. This production increase is pushed by robust export demand for bovine meat (FAO, 2005a). Although this production showed a steady increase of 2.4 percent annually in the last decade, the share of beef and veal meat in total meat production in South America is decreasing. This is a result of the strong growth of the poultry sector, with poultry meat production growing by 6.3 percent annually. Brazil, in particular, experienced significant increase in poultry meat production and had an annual growth rate of almost 8 percent from 1993 to 2003. Since the 1990s, South America has experienced the growth of intensive, vertically integrated pig and poultry meat production systems, close to large urban centres. This intensive production has developed partly

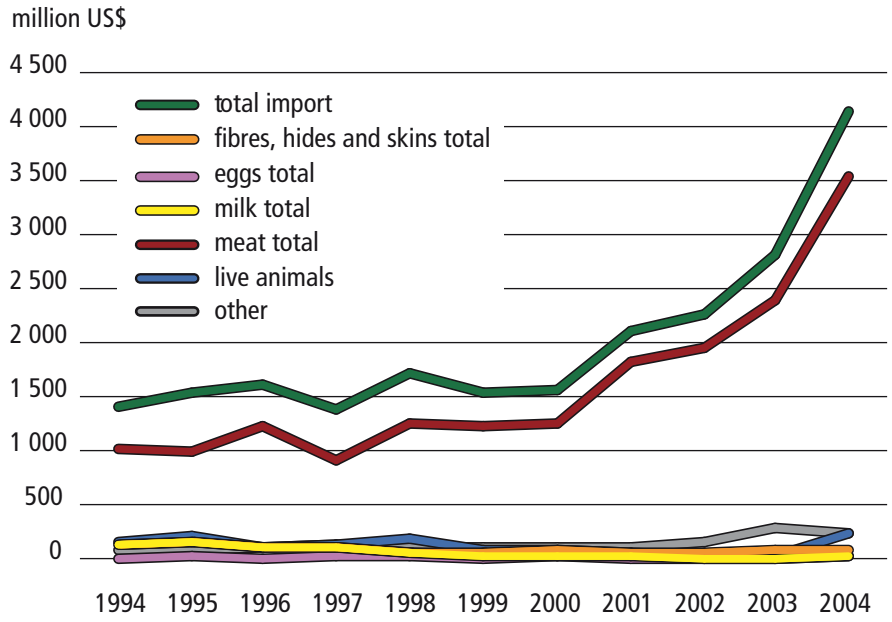
in response to the high level of urbanization and a resumption of economic growth in the 1990s (FAO, 2003a). In 1995 poultry meat made up 32 percent and beef and veal almost half of total meat production in the subregion. By 2005 poultry meat production made up 41 percent of total meat production, and beef and veal 43 percent (FAOSTAT). The production of pig meat showed a decrease in 1996, but grew significantly by 3.1 percent annually from 1997 onwards.

In the period 1993 to 2003 the subregion's meat supply per capita per year increased at an annual growth rate of 1.5 percent, which is just slightly above world average. Per capita supply of meat in South America is on average 25 kg per capita higher than world level. The traditional meat producers and exporters (Argentina and Uruguay) had levels comparable to those of the industrial countries, but experienced declining levels of supply in the early years of the new millennium. Conversely, Brazil increased meat supply per capita to levels equivalent to those of industrialized countries, and now has a higher per capita supply than Uruguay. In 2003, bovine meat was still the meat with the highest consumption in the region – supply was almost 29 kg per capita. However, the annual growth rate is low and poultry meat is substituting for bovine meat. Average poultry meat supply per capita in 2003 in South America was 25.5 kg, compared to 15.9 kg in 1993, an annual growth rate of almost 5 percent. Ecuador and Brazil, in particular, had a significant increase in poultry meat supply, increasing annually at a rate of 8.3 and 6.7 percent respectively (FAOSTAT).

1.2 Imports and exports

During the last decade the total value exports of live animals and primary animal products in South America showed an upward trend, especially after 2000 (Figure 2). This was mainly the result of an increase in the export of meat. Export of all meat increased, but particularly poultry and pig meat which showed increases of 15.5 and 14.9 percent, respectively, per annum over the period from 1994 to 2004.

FIGURE 2
Export of live animals and primary livestock products in South America



Source: FAOSTAT.

Brazil was the world's largest meat exporter in 2005 – both of beef and poultry (FAO, 2005b). Besides Brazil, raising beef for export is an important export commodity for Argentina, Uruguay, Paraguay and Colombia. The different beef and veal meat exporting countries of South America each had different trends in export. In the 1960s Argentina was by far the biggest exporter of beef and veal in the world,

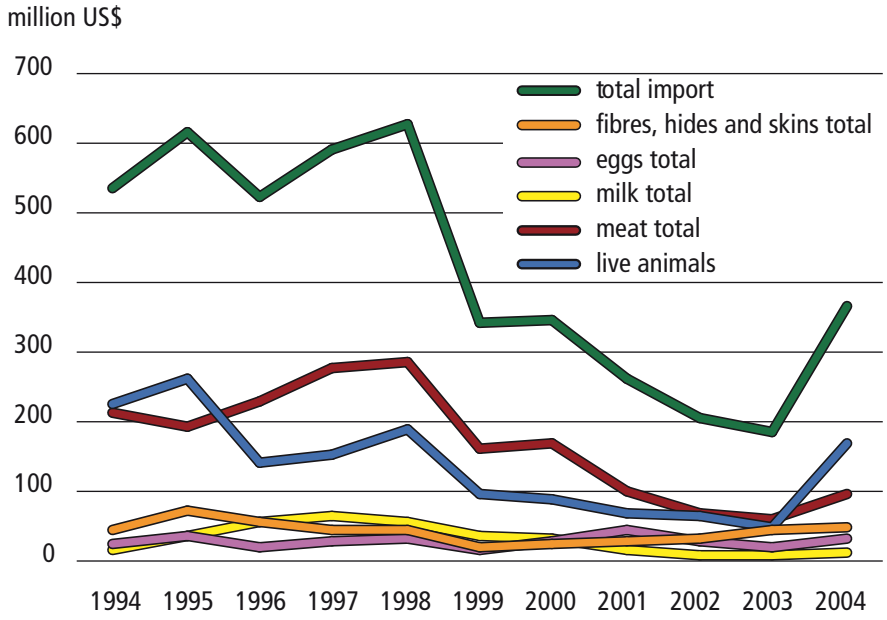
but since end 1960s European countries took over. Argentina was the biggest exporter of beef and veal in South America until the mid 1980s. After 1985 Paraguay and particularly Uruguay have been big exporters of beef and veal, with Uruguay showing a significant peak in 1998. Argentina peaked in 1995 but decreased afterwards until 2001, after which it showed an increase again (FAOSTAT). Since 2003 export of beef and veal meat in South America has increased significantly, with annual growth averaging between 20 and 40 percent. Demand for beef worldwide increased during the last few years, fuelled by higher imports by Mexico, Japan, the Republic of Korea and the Russian Federation (FAO, 2005a), while production stagnated in some traditional beef keeping countries and regions such as Europe, Australia, New Zealand and United States of America. Moreover, persisting animal health problems, such as bovine spongiform encephalopathy (BSE) in Europe and now in the United States of America, strengthened demand for South American products (Safras and Mercado, 2005). Indeed, in 2004/2005 most of the beef imported in Europe was sourced from South America, and the region expanded its export share in global beef markets from 17 percent in 2000 to an estimated 43 percent in 2005 (FAO, 2005a). The significant increase in exports of poultry meat is mainly the result of the growth in Brazil. In 2004 Brazil alone supplied 20 percent of global chicken meat exports (FAOSTAT).

Shifts in production and consumption trends have meant that dairy trade from South America has been sporadic. However, in recent years South American milk production has grown steadily and outstripped local consumption; dairy products from the region have greatly increased their presence in world markets. Between 1995 and 1999, Argentina's dairy exports grew by 50 percent annually before falling back sharply as the national economic crisis reduced the profitability of dairy farming and its relative attractiveness compared to other agricultural products such as soybean. However, with the recent increase in production, availability for export has risen sharply, and Argentina dairy exports doubled between 2001 and 2005, now accounting for over 4 percent of world trade (Phillips, 2006). Brazil also, which in the late 1990s was a major import market for dairy products, has moved close to self sufficiency and is steadily increasing export sales (ibid.).

Export of fibres, hides and skins made up an important share of total export value in South America until the end of the end 1990s. Uruguay in particular, has been exporting wool and hides for many years and it constitutes the majority of Uruguay's exports. Wool and hides are also important export products in Argentina.

While exports of live animals and primary animal products in South America increased, the value of total imports of live animals and primary animal products in South declined showed a fluctuating but downwards trend during the last decade (Figure 3).

FIGURE 3
Imports of live animals and primary livestock products in South America



Source: FAOSTAT.

Meat and live animals were the two commodities most imported during the last decade. The decrease in total imports after 2000 was mainly the result of the decrease in imports of meat. Particularly Brazil decreased its imports of primary livestock products drastically – almost 70 percent compared to the previous year. After 2003 both imports of live animals and imports of meat show an increase. Among live animal imports, cattle are the most important, followed by chickens. Brazil is the subregion's main importer of live animals as well as of primary livestock products, although the figures are not greatly higher than other countries such as Argentina, and more recently the Bolivarian Republic of Venezuela. Up to 2000, Brazil was mainly importing cattle, while after 2000 chickens were the main import. The Bolivarian Republic of Venezuela showed a huge increase in cattle imports in 2004, representing almost 75 percent of all live animal imports in South America.

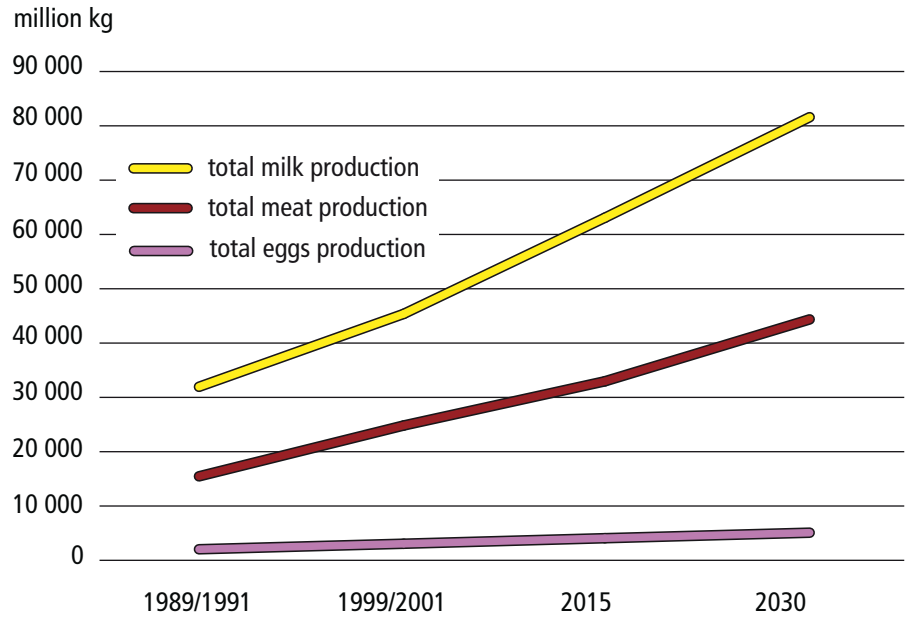
The import of milk (cow, whole, fresh) has fallen since 1997, decreasing by over 20 percent per annum, mainly as a result of decreasing imports in Brazil. Total milk production in Brazil increased by almost 3 percent per annum during the same period.

The import of fibres, hides and skins also makes up an important part of the total imports in the subregion. Uruguay particularly imports a significant amount of greasy wool.

1.3 Projected demand for livestock products

Figure 4 shows that total past and projected milk, meat and egg production for South America are predicted to increase to 2030.

FIGURE 4
Total meat, milk and egg production in South America: past and projected



Source: FAO (2003b).

Annual growth rates for total livestock numbers and total meat, milk and egg production are given in Table 4. Except for total egg production, all are projected to be slower over the period 2000 to 2015 than during 1990 to 2000. The sharpest decline in growth rate is expected in the case of meat production, which showed a high rate of growth from 1990 to 2000. Annual growth rates in egg production are expected to increase, and will show higher annual increases than the other products. Total livestock numbers in South America are predicted to almost double from 1989-1991 to 2015, increasing from 1.4 billion to 2.6 billion.

TABLE 4
Growth rates for livestock numbers and production in South America

	Annual growth rate (%)	
	1990–2000	2000–2015
Total livestock numbers	3.8	1.5
Total meat production (kg)	4.7	2.0
Total milk production (kg)	3.5	2.2
Total egg production (kg)	2.3	2.5

Source: FAO (2003b).

For meat, production will increase to 92 kg per capita and milk to 172 kg per capita in 2015. For comparison, the figures for the developed world are 87 kg per capita for meat and 267 kg per capita for milk in 2020. The expectations for South America compare very favourably with those for other developing countries. The growth rates over the period 1989-1991 to 1999/2001 are especially impressive for poultry meat for which output increased by 9.3 percent per annum. Growth in poultry meat output is expected to decrease significantly, to 2.3 percent per annum to 2015, with the highest growth rate (4.8 percent) being in Bolivia.

In Latin America overall, consumption of animal products (meat) has historically been higher than in other developing country groups and is predicted to increase further (FAO, 2003a). The per capita demand for meat products is projected to rise to 64.3 kg in 2020. Demand is very close to supply and this is also true for milk. During the next 20 years the intake of calories per capita is predicted to grow (van der Zijpp, 2003).

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 the US$1 day^{-1} and US$2 day^{-1} lines published by the World Bank. Data based on an international poverty line show the number of people who cannot purchase a roughly similar basket of commodities (Thornton *et al.*, 2002). National poverty lines reflect intercountry differences in economic and social status and are used to assess progress on a national scale. The figures presented in Table 5 utilize three different poverty lines: US$ 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. Poverty, especially rural poverty, continues to be a major problem in the subregion. In Latin America as a whole, economic growth rose only slightly though the 1990s, and poverty fell only slightly. Except for Uruguay and Brazil, at least one fifth of the population in South American countries live below the poverty line (defined as living on less than US$2 a day). Ecuador is the poorest country, with 20 percent of the population being extremely poor (living on less than US$1 a day). The rural poor are generally worse off than those in the urban areas (IFAD, 2002).

TABLE 5
Poverty rate by country

Country	TAC Definition	Less than 1US$/day	Less than 2US$/day
Argentina	16.0	*	*
Bolivia	60.0	11.3	38.6
Brazil	47.0	5.1	17.4
Chile	40.0	4.2	20.3
Colombia	42.0	11.0	28.7
Ecuador	56.0	20.2	52.3
Paraguay	35.0	19.4	38.5
Peru	32.0	15.5	41.4
Uruguay	13.0	2.0	6.6
Venezuela (Bolivarian Republic of)	31.0	14.7	36.4

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, livestock systems will be described according to the classification developed by Seré and Steinfeld (FAO, 1996). This classification distinguishes grassland-based systems, mixed rainfed systems, mixed irrigated systems and landless systems. The land-based systems are further distinguished on the grounds of agro-ecological zone: arid/semi-arid, humid/subhumid and temperate/tropical highland. A description of the classification system can be found in the Annex to this factsheet. All ten livestock production systems are present in the South America subregion. However, two are by far the most important in terms of total population and have, generally speaking, the highest production figures – the mixed rainfed system of the humid and subhumid zones, and the grassland-based systems of the humid and subhumid zones.

Grassland-based systems

Grazing systems are important in South America, with its low population density and relatively high degree of urbanization. Cattle are the most important livestock species in the subregion. Thirty-nine percent of the global production of meat coming from grassland-based systems of the tropics and subtropics originates from Latin America, and this percentage would probably be significantly higher if calculated for beef and veal alone (FAO, 2006a). The grassland-based systems can be found in the humid and subhumid lowlands of South America. The *llanos* of Colombia and the Bolivarian Republic of Venezuela as well as the *cerrados* of Brazil are examples, as are the estancias of Argentina, and the dual purpose (meat and milk) extensive ranching found in the *Llanos Nordorientales* of the Bolivarian Republic of Venezuela (FAO, 1996a). In the high-rainfall humid tropics, Amazonian ranching systems have developed – with beef and milk operations in Colombia and in Brazil producing under low input/low output conditions, where average annual rainfall is around 3 540 mm (ibid.).

The grassland-based system of the humid and subhumid zones has the largest share of cattle in South America – almost 160 million head. Criollo cattle (*Bos taurus* types, introduced by the Spaniards 400 years ago) constituted the main animal resource in tropical Latin America. However, over the last 50 years, Zebu cattle (*Bos indicus*) have largely replaced the Criollo cattle in the tropical areas of Latin America. In the subhumid and humid regions cattle are by far the dominant species. These systems tend to produce mainly beef. Milk is more important in subtropical areas and drier parts of the tropics, particularly where farms are smaller and access to markets is good. In very high rainfall areas, such as the Amazon delta, buffaloes are ranched. In the subtropics, wool sheep are an important component of the system, for example in Argentina and Uruguay (ibid.).

In the humid/subhumid grazing system in South America, approximately 6 billion kg of beef and veal and 16 billion kg of dairy milk is produced. Production technology is based on the use of abundant land,

some investments such as fencing are made to improve labour productivity, but very limited purchased inputs and labour are used. Where milk is produced, inputs and labour are used more intensively. Productivity levels tend to be low (e.g. 37 kg beef and buffalo meat per head and milk yields of 1209 kg/cow) (ibid.). This system is predominantly market oriented. When distance to the urban markets is large and/or when soils are poor, calves and lean steers are fattened in more convenient locations, leading to a certain degree of specialization (ibid.).

Grassland-based systems in temperate zones/tropical highlands, and arid/semi-arid tropics and subtropics are less important in South America. Grassland-based systems can be found in some of the subregion's tropical highlands. Typical examples are dairy systems close to Bogotá, Colombia, and camelid and sheep grazing systems in the Altiplano of Peru and Bolivia (ibid.). Temperate breeds perform well in tropical highland situations, except at very high altitudes as encountered in the Andes. Local breeds play an important role where subsistence objectives are still important, cash income is limited and few purchased inputs are used. In the tropical highlands, the grassland-based system is affected by seasonality of fodder supply which, in turn, largely depends on rainfall patterns (ibid.). Where milk markets generate the appropriate incentives, dairy cows are either fed cut-and-carry forages or, as is the case in the dairy system of the highlands of Bogotá, Colombia, pastures are irrigated. South American farmers in this system mainly produce for the domestic market (ibid.). The grassland-based systems of the arid and semi-arid zones can be found in some parts of the subregion, and include goat meat and milk production at medium altitudes in the Bolivarian Republic of Venezuela (ibid.).

Mixed systems

Mixed systems that include crops and livestock are widespread in Latin America on small and medium sized farms. On larger farms, such as those found in the South American savannahs, integration is becoming common despite traditional separation of crops and livestock (FAO/ILRI, 1995).

Mixed rainfed systems

The mixed rainfed system of the humid and subhumid zones (the most important mixed rainfed livestock production system in South America) is very heterogeneous in its composition, having a diverse range of socio-economic conditions, soils and climates. Examples include the large-scale commercial soybean–maize–pasture operations of the Brazilian *cerrados.* The system covers regions with especially difficult climatic conditions for livestock (high temperatures and high humidity). Adaptation of highly productive temperate breeds to these challenges has been poor. *Bos taurus* cattle, sheep and goats were introduced some four centuries ago. *Bos indicus* cattle were introduced a few decades ago and have now replaced the earlier-introduced cattle breeds in tropical areas. The system is far less densely populated in South America compared to Asia, having five times more agricultural land per inhabitant.

The mixed rainfed system of the temperate zones/tropical highlands can be found in the Andes. Typical cases include smallholder operations (traditional ley farming system with potatoes, barley and pastures as main elements) (ibid.). In the subtropical highlands (1 200–2 700 m), conditions are favourable for dairy production and small-scale intensive crop-dairy systems have developed based largely on pure-bred Holstein Friesians (ILRI, 1998). These systems are largely pasture-based, often in rotation with vegetables and potatoes, and also diversification into fruits and flowers for export (ibid.). Intensification has led to combining grazing and stall-feeding of planted forage, supplemented with agro-industrial by-products and increasingly by commercial feeds (ibid.). Liquid milk and cheese are the main marketed products: cheese making has increased particularly in more remote highland regions of Ecuador and Colombia (ibid.). Typical cases of the mixed rainfed system of semi-arid zones include the small ruminant–cassava systems of northeastern Brazil (FAO, 1996a).

Mixed irrigated systems are relatively unimportant important in South America compared to rainfed systems. Human population and total outputs of animal products are lower than in other systems, although productivity figures are mostly higher. Milk yield per cow, for example, is highest in the mixed irrigated system in the temperate zones and tropical highlands, at 3 100 kg/cow compared to 1 415 kg/cow on average in South America; as is the amount of beef and buffalo meat produced per head: 59 kg/head compared to 39 kg/head on average.

Landless systems

In South America, output of pig and poultry meat and eggs is highest in the monogastric landless system. This system is defined by the use of monogastric species, mainly chicken and pigs in a production system where feed, of high energy concentration such as cereals, oilseeds and their by-products, is introduced

from outside the farm. This system is an open system in terms of nutrient flow (ibid.). The landless monogastric system is almost exclusively based on hybrid and high-producing exotic breeds, and the expansion of this system is clearly a threat to traditional breeds. The system is frequently stratified, meaning that different enterprises specialize in the production of parent material, the production of young animals, or the fattening process. The short production cycle of these species allows a high turnover and, therefore, a capacity to rapidly adjust to changes in demand for products and in the prices of inputs. The system is very knowledge- and capital-intensive. It easily transferred across agro-ecological conditions, because of its minimal links to the land base.

The ruminant landless system is not important in South America. Output of beef and veal meat in this system is only about 1 percent of total beef and veal output in the subregion. The system is defined by the use of ruminant species, principally cattle and marginally sheep, in production systems where feed is mainly introduced from outside the farm system (ibid.).

Table 6 gives general data, production of main products and productivity of the different systems occurring in South America

TABLE 6

Resource base, production and productivity data by production system in South America

	Grassland-based			Mixed rainfed			Mixed irrigated			Landless	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)	49.5	84.3	37.3	7.2	110.9	34.7	0.7	24.9	1.6		351.0
a) Resource base											
a1. Permanent pasture (1 million ha)	65.7	202.7	30.3	2.6	169.9	30.4	0.1	9.4	1.7		512.8
a2. Arable land (1 million ha)	6.0	26.4	4.1	0.8	56.7	12.4	0.024	4.8	0.5		111.7
a3. Irrigated land (1 million ha)	1.0	1.7	2.7	0.1	2.1	1.1	0.018	0.8	0.5		10.1
a4. Livestock numbers (million head)											
cattle	23.8	156.9	11.9	2.4	89.8	16.8	0.034	10.6	1.4	0.7	314.4
dairy cows	4.4	13.3	2.1	0.6	8.4	1.7	0.002	1.7	0.3		32.6
buffalo					1.1			0.067			1.1
sheep and goats	19.7	21.3	10.9	1.4	25.0	11.0	0.012	3.1	0.765		93.1
b) Major outputs (1 million kg)											
beef and veal meat	654	5 747	416	105	4 081	713	2	424	63	159	12 364
buffalo meat											-
sheep and goat meat	49	77	29	4	100	48	0.04	14	2		323
pig meat	96	583	235	56	803	309	2	220	8	1 800	4 112
poultry meat	206	394	169	43	491	183	2	137	6	9 398	11 029
eggs	83	127	45	16	118	41	1	34	2	2 460	2 927
dairy milk	5 059	16 100	2 919	1 195	15 466	2 518	6	2 234	659		46 156
other milk	36	15	21	4	129	9		2	2		218
milk production total	5 095	16 115	2 940	1 199	15 595	2 527	6	2 236	661		46 374
c) Productivity and density indicators											
beef and buffalo meat kg/head	27	37	35	44	45	42	59	40	45	213	39
sheep and goat meat kg/head	2	4	3	3	4	4	3	5	3		3
milk yield kg/cow	1 143	1 209	1 393	1 969	1 842	1 456	3 100	1 298	2 003		1 415
d) Self-sufficiency of systems											
ruminant meat kg/inhabitant	14	69	12	15	38	22	3	18	40		36
monogastric meat kg/inhabitant	6	12	11	14	12	14	5	14	9		43
eggs kg/inhabitant	2	2	1	2	1	1	1	1	1		8
milk kg/inhabitant	103	191	79	168	141	73	9	90	411		132

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

2.2 Roles and functions of livestock in South America

In the grassland-based systems of South America, cattle are the most important livestock species. As discussed above, beef is the most important product in subhumid and humid regions, with buffaloes being ranched in very high rainfall areas. Milk is more important in subtropical areas and drier parts of the tropics. Wool sheep are important in some subtropical areas, for example, in Argentina and Uruguay. In the grassland systems of the arid/semi-arid zones goats are kept for meat and milk, for example at medium altitudes in the Bolivarian Republic of Venezuela (FAO, 1996a).

In mixed systems, livestock perform a series of functions, providing: a continuous flow of cash income; a means to concentrate nutrients through manure (typically for potato production in the Andean mixed rainfed system); fuel; animal traction; a cash reserve for emergencies; and a buffer to risks in crop production (ibid). In the African and Asian mixed rainfed system, the multiple roles of livestock have prevailed, particularly animal traction and manure. However, in South America, the system caters to large domestic markets and, particularly in the case of Brazil, it is also linked to export markets. Under smallholder conditions milk tends to be a more important output than meat (ibid.). Table 7 gives some general roles and functions of livestock in mixed systems.

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 in farming systems.
• 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).

The function of livestock in landless systems in South America is purely economic, comprising the output of animal products such as meat and eggs.

2.3 Projected changes in production systems

Future developments in Latin America will be influenced by environmental, farming and nature conservation policies. There may be moves to promote organic farming. Much will depend on the development of markets for more expensive organic products and the rigidity of enforcing environmental policies in Latin America itself and in the potential export markets. It is predicted that he Latin American continent should, during the next 20 years, achieve an improved nutritional status, less poverty, and more intensive agriculture (Van der Zijpp, 2003).

Grazing systems

The tropical highland grazing system in South America faces a problem of rangeland degradation arising from inappropriate range management practices. These rangelands are frequently part of watersheds, and range degradation causes problems such as flooding and siltation of rivers FAO, 1996a). The inability of grassland-based systems in Latin America to provide continuous and sufficient yields because of declining soil fertility, has contributed to the expansion of the agricultural frontier at the cost of natural forests (FAO, 2006a). The establishment of silvopastoral systems offers a valuable chance to restore the productivity of the land, which has become degraded. This is also a means to reduce the pressure for further deforestation (ibid). In marginal areas, the positive potential of silvopastoral systems is particularly significant, as environmental degradation is usually at its worst in areas, such as hillsides, foothills and highlands (ibid.).

The importance of the grassland-based system in the humid and subhumid zones is expected to decline in terms in importance as a source of livelihood for the rural population as interaction with crop cultivation leads to an evolution towards mixed systems. In rainforest regions, efforts are being made to incorporate perennial tree crops, frequently as silvopastoral systems. In the savannahs, this system is being converted into a mixed farming system by including annual crops, such as maize, soybeans,

sorghum (FAO, 1996a). The impact of ranching on deforestation of rainforest areas, particularly in Brazil, is one of the more notorious negative impacts associated with livestock. Horizontal expansion of the grassland-based system in the humid and subhumid tropics and subtropics will in future be limited in all agro-ecological settings. In the rainforest, environmental concerns, policies, and technical problems will generally discourage further clearing for pasture establishment. In the subhumid zones, the presence of this system is largely found where there are low population pressures, and where there are lands that are not attractive for crop production, either because of edaphic restrictions or distance to markets. The transformation of this system into a mixed one is induced by horizontal expansion of crop production driven by population growth and by agricultural research developing crops adapted to the frequently infertile acid soils (ibid.).

Mixed farming systems

In South America, extensive ranching systems are increasingly evolving into mixed systems as urban demand for crop staples and livestock products as well as road infrastructure expands (ibid.). Pastures have traditionally been established jointly with annual crops, mainly maize or rice. Problems with the sustainability of continuous annual cropping on acid infertile soils, typical for the large savannah ecosystems of South America, have increased incentives for the development of nutrient-efficient crop–pasture rotations (ibid.).

The major concern related to the mixed rainfed system of the arid/semi-arid zones is the degradation of land resources because of their limited production potential under growing population pressure. In livestock terms, this relates particularly to overgrazing and range degradation. Livestock in this system produce relatively high amounts of methane per animal kept, and more so per kilogramme of meat or milk produced. The resource base puts a ceiling to agricultural intensification. Alternative development strategies and the reduction of population pressure on the resource base are key elements for the sustainable development of these regions (ibid.).

Landless systems

Landless poultry and pig production systems account for the majority of the output in developed countries and the share is rapidly increasing in developing countries given their high supply elasticity in the short term (Steinfeld and Mäki-Hokkonen, 1995). The human population in South America will increase from today's 364 million to around 471 million by the year 2030 – an increase of more than 30 percent. With increasing incomes, urbanization and ageing populations, the demand for livestock products is increasing. Neither the grazing system nor the mixed farming system, as we know it, will be able to satisfy this increase in demand. The greatest part of the additional demand will have to be supplied by the industrial type of production (FAO, 1996b).

2.4 Impacts of production system trends on animal genetic resources

Grazing systems

Of particular importance from the point of view of biodiversity are the populations of Andean camelidae (alpaca, llama, vicuña and guanaco). In the humid and subhumid tropical grassland systems of Latin America, cattle predominate. The genetic resources have three origins: the original Criollo types, which are Bos taurus cattle with 500 years of adaptation to tropical conditions; Bos indicus breeds derived from imports from South Asia during the last century; and European and North American breeds, imported in recent times. Although the system has serious environmental problems such as pasture degradation and deforestation, the demand for breeds that are well adapted to the conditions of the local grasslands is unlikely to decline, and such breeds will generally not face great risk of extinction.

Mixed systems

The future of livestock populations in mixed farming systems is closely linked to crop integration. As human pressures increase, livestock's role as a source of draught, in the utilization of crop wastes, and as a source of dung for fuel and manure will be affected. If, for example, subsidized mechanization is encouraged by governments this will lessen the number of draught animals kept and therefore reduce the genetic base (FAO, 1996b).

Landless systems

Landless systems in South America will further increase. The external inputs used in these systems allow theto production environment to be controlled so that an animal's full genetic potential can be expressed. Therefore, especially with monogastrics, there is a significant reduction in the range of genotypes used. Nonetheless, prudent management of genetic resources for use in such systems still requires attention to be focused upon existing and potential genetic stocks (ibid.).

3 Animal genetic resources

3.1 Status

Table 8 illustrates the number of animals of each major species in the South America subregion and also gives an estimate of the number of breeds. Twenty-four percent of the world cattle population is found in South America, representing 11 percent of the cattle breeds in the world. Horses are also well represented in South America, 29 percent of the world horse population is found here, representing 7 percent of the world's breeds. Most camelids – llamas, alpacas, guanacos, and vicuñas – are only found in South America, 92 percent of the breeds are found here. Tables 9 and 10 show the transboundary mammalian and avian breeds in South America.

TABLE 8

Total population size and number of breeds of the major livestock species in South America 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	1 201	12	1	7
Cattle	326 764	296	24	11
Goat	20 464	74	3	6
Sheep	68 054	160	6	7
Pig	51 863	99	5	8
Ass	4 139	13	10	7
Horse	1 5809	98	29	7
Camelids[1]	6 400	23	100	92
Chicken	1 829 517	185	11	8
Duck[2]	7 285	23	1	6
Turkey	46 008	13	16	7
Goose (domestic)	335	5	0	2

Source for population figures: FAOSTAT estimates of 2005 live animal populations.

[1] Camelids: Llamas, Alpacas, Guanacos, and Vicuñas.

[2] Domestic duck and Muscovy duck.

TABLE 9
Transboundary mammalian breeds in South America

Cattle (1)	Cattle (2)	Horse	Pig	Buffalo
Aberdeen-Angus	Marchigiana	Andalusian	Belgian Landrace	Jafarabadi
Brown Swiss	Creole	Anglo-Arab	Berkshire	Mediterranean
Argentine Criollo	Montbéliarde	Appaloosa	Chester White	Murrah
Aubrac	Murray Grey	Arab	Duroc	Philippine Carabao
Ayrshire	Nelore	Belgian Draft	Hampshire	
Beefmaster	Normande	Argentine Criollo	Large Black	
Belgian Blue	Piedmont	Belgian Warmblood	Large White	
Belted Galloway	Pinzgau	Breton	Pelon	
Blonde D'aquitaine	Polled Hereford	Costeño	Pietrain	
Bonsmara	Red Angus	Falabella Pony	Poland China	
Braford	Red Brangus	Hanoverian	Tamworth	
Brahman	Red Poll	Holstein	Landrace	
Brangus	Red Sindhi	Lusitanian	Dalland	
Chaqueno	Romagnola	Mangalarga	PIC HY	
Charolais	Sahiwal	Morgan	Seghers	
Chianina	Salers	Paso Fino	Geneticporc	
Chusco	Santa Gertrudis	Percheron	Pen Ar Lan	
Devon	Senepol	Quarter Horse		
Galloway	Shorthorn	Shagya Arab		
Gascon	Siboney	Shetland Pony		
Gelbvieh	Simmental	Thoroughbred		
Gir	Sussex	Purebred Spanish		
Guernsey	Swiss Herens	Hackney		
Guzerat	Tabapua	Oldenburg		
Hereford	Tarentaise	American Paint		
Highland	Tuli	Iberoamericano		
Holstein (black and white)	Welsh Black	Anglo Normad		
Holstein (red and white)	Girolando			
Inra 95	Indo-Brasilian			
Japanese Native	Simbrah			
Jersey	South Devon			
Limousin	Milking Shorthorn			
Lincoln Red	Wagyu			
Maine-Anjou	Dairy Gir			

TABLE 9 *CONT.*
Transboundary mammalian breeds in South America

Sheep (1)	Sheep (2)	Goat	Rabbit	Guinea pig
Assaf	Lacaune	Alpine	Angora	Cuy peruano
Australian Merino	Lincoln Longwool	Anglo-Nubian	Rex	
Barbados Black Belly	Merino	Angora	California	
Bergamasca	Morada Nova	Boer	Chinchilla	
Blackface	Pelibuey	Creole	Dutch	
Blackhead Persian	Poll Dorset	Criollo	French Lop	
Border Leicester	Poll Merino	Damascus	New Zealand	
Cheviot	Polwarth	Murcia-Granada	New Zealand White	
Columbia	Polypay	Saanen	New Zealand Red	
Coopworth	Rambouillet	Toggenburg	Rheinische Schecken	
Corriedale	Red African	British Alpine	Mariposa	
Criollo	Romanov	French Alpine	Géant des Flandres	
Damara	Romney	Kalahari Red		
Dohne Merino	Santa Ines	Cashmere		
Dorper	South Down	Savanna		
Dorset Horn	Suffolk			
East Friesian	Targhee			
Finnish Landrace	Texel			
Friesian Milk	Wiltshire Horn			
Hampshire Down	Manchega			
Ile-De-France	Scottish Blackface			
Karakul	Warhill			
Katahdin				

Alpaca	Guanaco	Llama	Vicuña	Ass	Deer
Huacaya	Guanaco	Chaku	Vicuña	Mammoth Jack Stock	Fallow Deer (*Cervus dama*)
Suri		Kara			Red Deer (*Cervus elaphus*)
					Axis deer (*Axis axis*)

TABLE 10
Transboundary avian breeds in South America

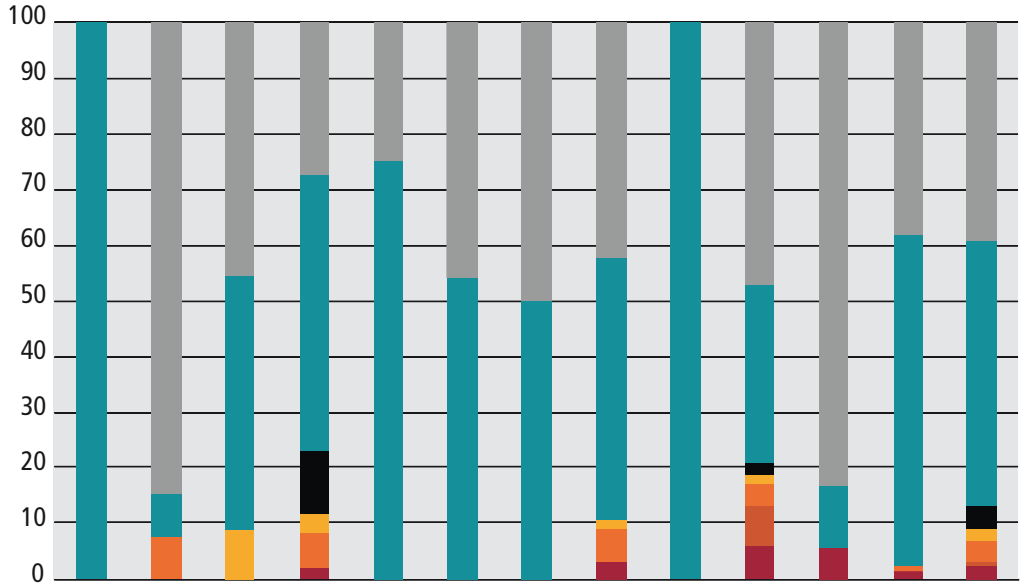
Chicken (1)	Chicken (2)
Commercial strain, broiler, Arbor Acres AA broiler	Brahma
Aseel	Dominique
Australorp	Faverolle
Plymouth Rock Barred	Frizzle
Commercial strain, layer, Cobb 500	Commercial strain, layer, Hubbard Golden Comet
Cornish	Commercial strain, layer, H&N
Commercial strain, layer, Dekalb	Commercial strain, layer, Euribrid Hisex
Derbyshire Redcap	Holland
Hamburg	Commercial strain, layer, Hy-Line
Commercial strain, layer, Euribrid Hisex Brown	Commercial strain, layer, Hy-Line White
Commercial strain, Hubbard	Commercial strain, broiler, Ross Indian River
Commercial strain, layer, Hy-Line Brown	Commercial strain, layer, Lohmann
Commercial strain, layer, ISA Brown	Malay Game
Japanese Bantam	Minorca
Jersey Giant	Modern Game
Commercial strain, layer, Leghorn	Old English Game
Light Sussex	Orpington
Commercial strain, layer, Lohmann Brown	Phoenix
New Hampshire	Plymouth Rock
Paduan	Commercial strain, Sebright
Plymouth Rock White	Shamo
Polish	Silkie
Rhode Island Red	Spanish
Commercial strain, broiler, Ross	Sussex Speckled
Commercial strain, layer, Shaver	Sultan
Appenzeller Spitzenhauben	Transylvanian Naked Neck
Sussex	Commercial strain, broiler, ISA Vedette
White Cornish	Wyandotte
Wyandotte White	Onagadori
Araucana	Langshan
Commercial strain, broiler, Avian	Commercial strain, broiler, Euribrid Hybro
Commercial strain, layer, Babcock	Orpington Buff
Commercial strain, layer, Hendrix Bovan Goldline	

Turkey	Emu	Muscovy duck	Goose	Duck	Pigeon
Bronze	Emu	Muscovy	Canadian	Pekin	White King
Commercial strain, Nicholas			Embden	Khaki Campbell	
Commercial strain, BUT			Sebastopol	Rouen	
Black			Toulouse		
White					
Commercial strain, Hybrid					

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 America subregion up to 2005. Only 10 percent (59 of 593) of extant mammalian and avian breeds in South America are categorized as at risk. However, this is probably an underestimate of the actual situation, primarily due to lack of information. Population data are available for only 30 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 America* up to December 2005: absolute (table) and percentage (chart) figures

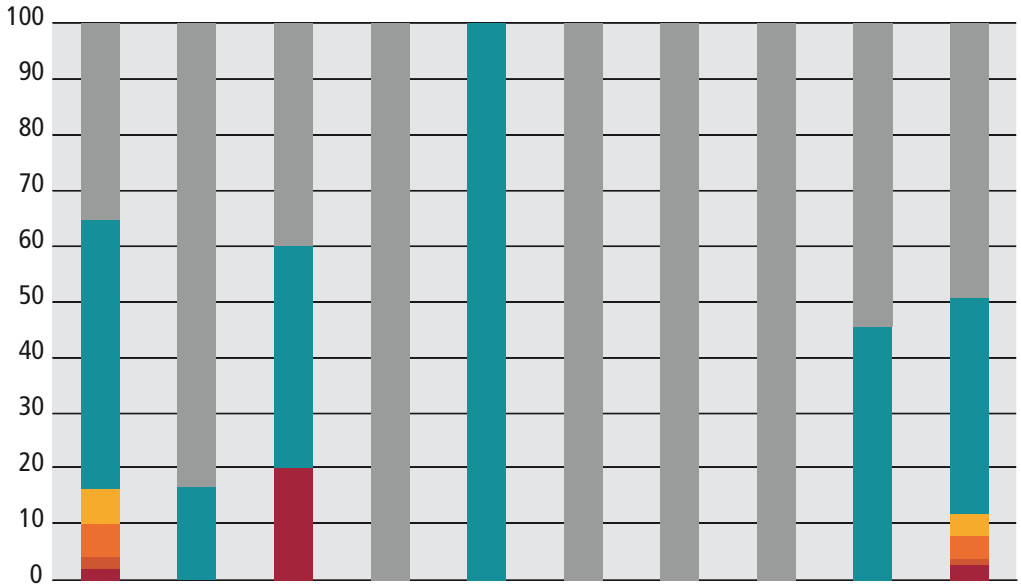


RISK STATUS	Alpaca	Ass	Buffalo	Cattle	Deer	Goat	Guinea Pig	Horse	Llama	Pig	Rabbit	Sheep	Total
critical	0	0	0	3	0	0	0	2	0	3	1	1	**10**
critical -maintained	0	0	0	0	0	0	0	0	0	4	0	0	**4**
endangered	0	1	0	10	0	0	0	4	0	2	0	1	**18**
endangered - maintained	0	0	1	6	0	0	0	1	0	1	0	0	**9**
extinct	0	0	0	18	0	0	0	0	0	1	0	0	**19**
not at risk	4	1	5	79	3	19	4	31	5	17	2	48	**220**
unknown	0	11	5	44	1	16	4	28	0	25	15	31	**180**
Total	**4**	**13**	**11**	**160**	**4**	**35**	**8**	**66**	**5**	**53**	**18**	**81**	**460**

* Breeds that are also recorded in countries outside Latin America and the Caribbean are excluded from the analysis

Not shown: one not at risk guanaco breed, one not at risk vicuña breed.

FIGURE 6
Risk status of avian breeds recorded in South America* up to December 2005: absolute (table) and percentage (chart) figures



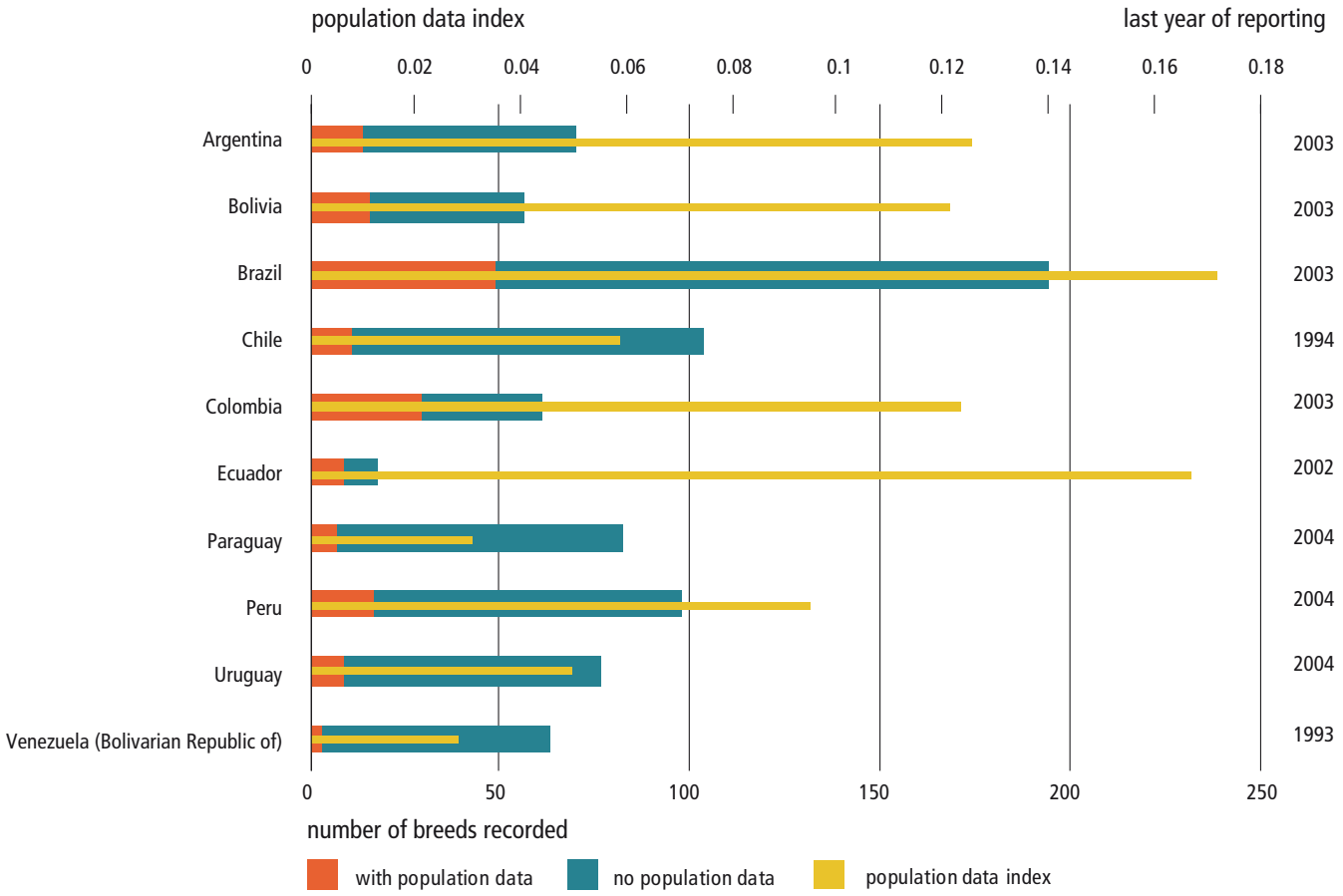
RISK STATUS	Chicken	Duck	Goose	Guinea fowl	Muscovy duck	Pheasant	Pigeon	Quail	Turkey	Total
critical	2	0	1	0	0	0	0	0	0	**4**
critical -maintained	2	0	0	0	0	0	0	0	0	**2**
endangered	6	0	0	0	0	0	0	0	0	**6**
endangered - maintained	6	0	0	0	0	0	0	0	0	**6**
not at risk	48	3	2	0	1	0	0	0	5	**60**
unknown	35	15	2	1	0	5	7	3	6	**76**
Total	**99**	**18**	**5**	**1**	**1**	**5**	**7**	**3**	**11**	**154**

*Breeds that are also recorded in countries outside Latin America and the Caribbean are excluded from the analysis.

Not shown: one emu breed of unknown risk status and one not at risk ñandu breed.

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. No information is displayed for those countries for which no breeds are recorded in the Global Databank for Farm Animal Genetic Resources. For all other 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 provides an indication of the completeness of the data provided by the country. Selected basic population data fields, regarded to be the most important and used in the calculation of risk status, are considered – 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 the countries of the South America subregion up to December 2005

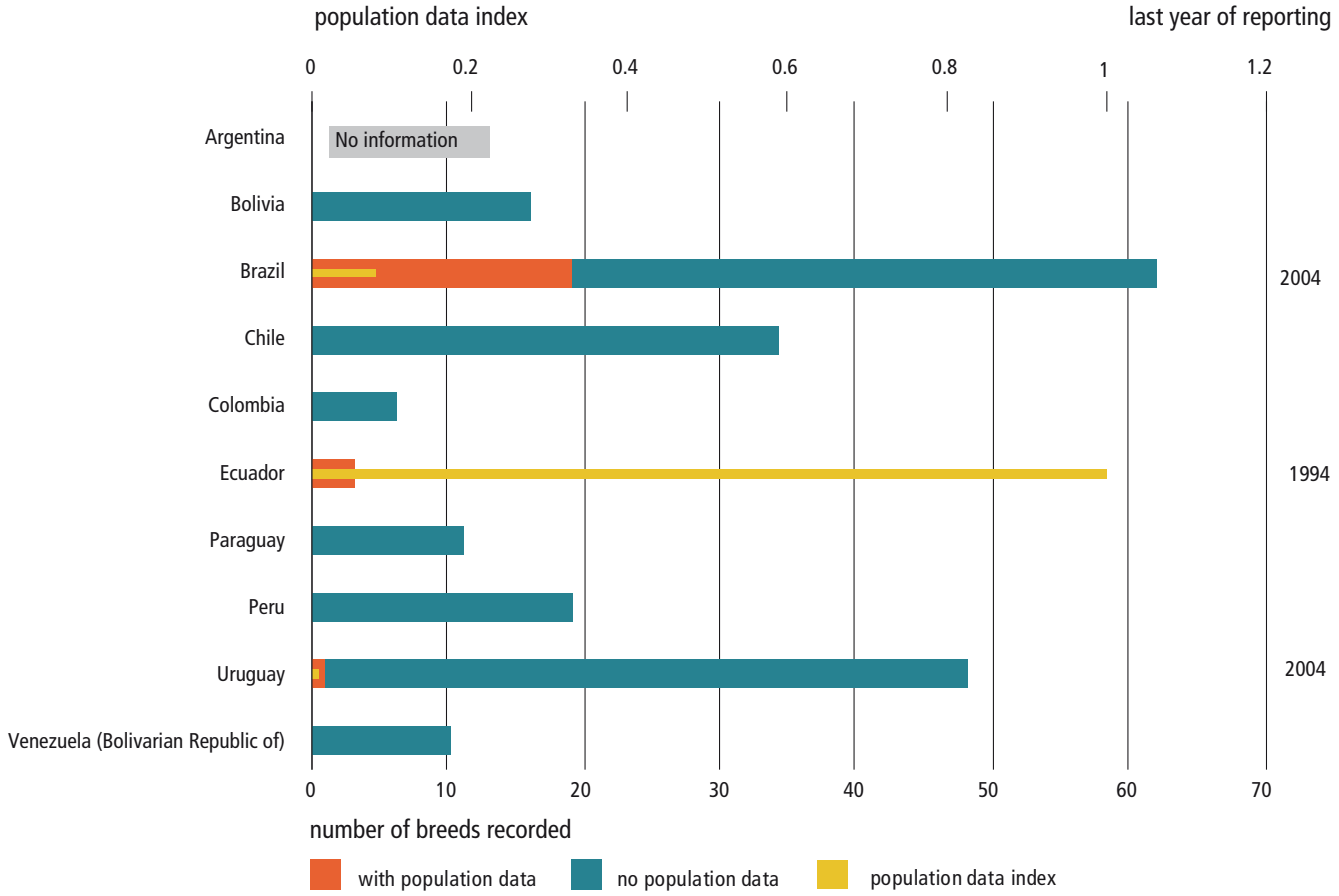


With population data: Those breeds with information recorded in one or more of the 16 population data fields.

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 American region 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 America

Among the threats to farm animal genetic resources in South America are natural disasters, environmental degradation, diseases and lack of appropriate livestock policies.

Deforestation, overgrazing, and other inappropriate agricultural activities have left enormous areas of land in Latin America moderately or severely degraded (IFPRI, 1995). More than 40 percent of the agricultural landscapes of South America have significant soil productivity constraints (Future Harvest Centers, 2004). Some of these constraints are a direct consequence of the conditions under which the soils themselves were formed – such as the low soil fertility of the vast tropical savannahs of the Amazon and Orinoco river basins. High Andean agro-ecosystems also represent challenging production environments, as do the overgrazed pastures and nutrient-depleted croplands of the pampas. Irrigated areas throughout the region are affected by waterlogging and the accumulation of harmful salts (ibid.).

Natural disasters and extreme weather conditions can be a threat to animal genetic resources in South America. In the winter of 2004 for example, extreme cold and heavy snowfalls led to the deaths of over 80 000 llamas and alpacas in eight departments of southern Peru and damaged the pastures needed for raising livestock (Maturana, 2006). Similar conditions in 2002 killed 50 percent of livestock in affected areas of Peru and more than 40 percent in affected areas of Bolivia (Kriner, 2002). Floods and mudslides are also a threat, in countries such as the Bolivarian Republic of Venezuela, Colombia and Bolivia. For example, heavy rains in Bolivia in early 2006 caused severe flooding in the highlands and the Amazon River basin causing serious damage to agriculture (LWR) 2006).

Animals are challenged by many diseases, especially in the warm humid regions. Foot-and-mouth disease (FMD) a debilitating and highly contagious disease which severely affects trade in livestock and livestock products is endemic in parts of the subregion. In 2001 Argentina was badly affected when, FMD broke out in a leading meat-producing area, the River Plate Basin, after an absence of several years from the country (Spazzuta, 2003). Culling programmes are implemented by some countries in response to disease outbreaks. Such measures have led to the deaths of hundreds or thousands of animals in recent years in countries such as Argentina, Brazil, Colombia, Paraguay and Uruguay (OIE, 2006).

Tick-borne infections such as babesiosis and anaplasmosis are becoming more widespread and pose particular problems for newly imported breeds. A number of bacterial and viral diseases can cause mortality, reproductive disorders or chronic loss of productivity – for example, anthrax, brucellosis, blackleg, mastitis, tuberculosis and rabies. Among pig populations classical swine fever is enzootic in many parts of the subregion. Its incursion between 1978 and 1980 into Brazil, together with some Central America countries, caused major losses. Venezuelan equine encephalomyelitis is also prevalent in the region resulting in considerable losses among horses and donkeys (FAO/UNEP, 2000). Currently, there is a risk that he H5N1 strain of the highly pathogenic avian influenza (HPAI) could spread to the subregion via migratory birds or as a result of the legal or illegal import of commercial or ornamental birds. In 2002 there was an outbreak of avian influenza in Chile, which caused significant losses (FAO, 2006b).

Toxicity both by minerals and plants represents a serious problem for some species. For example, the shrub Cestrum parqui (green cestrum) which is found in Argentina, Uruguay and the southern regions of Brazil can be fatally toxic to cattle, sheep, horses, pigs and poultry (FAO/UNEP, 2000).

3.3 Unique resources highlighted

Most domesticated livestock species in Latin America and the Caribbean were introduced to the region by successive waves of exploration and colonization. Few domesticated animals existed in pre-colonial times, although indigenous peoples did domesticate a number of species. These include guinea pigs, dogs, llamas, alpacas, Muscovy ducks, turkeys and black chickens (ibid.).

Introduced species adapted over to the environments in which they were kept and the early introductions now represent recognized breeds well adapted to local conditions (ibid.). Recently introduced European breeds are common in the mid-latitude pasturelands of the subregion, and in tropical zones Zebu cattle breeds are widely kept. Water buffalo have also been introduced to parts of Brazil.

The American camelids, native to the highland regions, play an important role in the rural communities of the Andes, providing food, wool and transport. They are the most efficient users of the grazing lands in the high Andean plateaus (> 4 000 m) that are unsuitable for cattle (ibid.). Wild camelid species, the vicuña and guanaco, are found at very high altitudes in the Andes. Guinea pigs are a widely kept in a number of countries of the subregion.

Apart from the major domesticated species, Latin America is host to a large number of micro-livestock which include a variety of ungulates as well as rodents and reptiles. The paca is a prolific rodent species which provides a valuable source of meat without destroying the forest regions in which it is kept. The capybara, also a prolific species, is noted for its meat and leather. This large rodent can be used to graze swampy grassland areas that are generally rejected by cattle. Other rodents such as the coypu, agouti and hutia also represent valuable sources of food. Among the ungulates, the collared and the white-lipped peccaries are prolific animals appreciated for their meat and leather. These species, as well as the capybara, are already being raised in captivity for commercial purposes. The iguana, an indigenous reptile, represents a popular source of meat, especially in areas of Central America and the northern parts of South America (ibid.). Green and brown iguanas are hunted for their meat and eggs, or for their commercially valuable hides. Newly-hatched iguanas are sometimes captured for the export pet trade. Iguana eggs are a highly prized local food (ibid.).

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Annex

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 America**

1 Inventory and characterization

The following main limitations to inventory and characterization of animal genetic resources (AnGR) were identified:

- lack of awareness on the part of political authorities regarding the importance of (particularly local) AnGR for the sustainable development of rural areas;
- lack of human, financial and physical resources for recognizing the phenotypical differences between gene types;
- insufficient cooperation between the institutions and technicians that work with AnGR;
- difficulties of access to certain regions for geographical reasons or because of armed conflicts.
- fear on the part of cattle raisers that information about the numbers of animals may be used to increase their tax burden; and
- lack of breed-related data in most existing livestock censuses.

The following priority actions were identified:

- increase the knowledge of political stakeholders about the need for inventory and monitoring of AnGR and their inclusion in rural development programmes;
- strengthen of breeders' associations data banks and carry out an inventory identifying breeds and genetic groups;
- form strategic alliances with institutions that coordinate zoosanitary campaigns, in order to so that attention is paid to AnGR-related information in control programmes;
- develop international training courses and support existing ones (CYTED[3] Network) in order to increase the capacity of human resources in this field;
- implement regional cooperation agreements in order to perform inventories and plan for conservation, improvement, and sustainable use of AnGR;
- enhance regional/subregional cooperation in the utilization of biotechnological advances and existing infrastructure.

Support from FAO

The following activities were identified as means by which FAO could support the management of AnGR in the subregion:

- establishment of a standardized methodology for inventory and characterization;
- financial support for the priorities identified by in the Country Reports;
- definition of new criteria for technical cooperation (TCPs) that enhance technical and financial support for characterization and inventory; and
- cooperation in the organization of regional/subregional courses and meetings for the dissemination of knowledge and training of human resources in the utilization of AnGR.

[3] Programa Iberoamericano de Ciencia y Tecnología para el Desarrollo.

2 Utilization

The following measures needed to support sustainable utilization were identified:

- control and eradication of diseases to allow entry into new markets;
- during sanitary campaigns, informing communities about the importance of sustainable utilization of their AnGR;
- control of the import of genotypes by assessing whether there are local resources capable of meeting the specific needs;
- emphasizing the quality of products derived from AnGR adapted to given production systems;
- promotion of fairer financial recompense for the breeders of these populations;
- establishment of a system that allows the products of locally-adapted AnGR to be identified according to their genetics, environment, ethnicity and production systems;
- strengthening agro-production chains by identifying markets and channels for commercialization;
- promotion of greater contact between breeders and urban populations so that the breeders can publicize the distinguishing characteristics of their products, and the urban dwellers can become more connected with the history and culture of their countries; and
- enhancement of the knowledge of the leaders of indigenous and rural communities regarding conservation and management of AnGR, so that they may identify forms of utilization that are suited to local conditions.

"Centres of excellence" should be formed in order to coordinate resources, and research and development activities:

- Colombia – criollo cattle;
- Brazil – Zebu cattle and goats;
- Guiana – ducks and turkeys;
- Peru – guinea pigs, vicuñas and alpacas;
- Uruguay -wool-bearing sheep;
- Bolivia – llamas;
- Argentina – guanacos and taurine cattle;
- Venezuela (Bolivarian Republic of) – capybaras.

3 Conservation

The following needs were identified:

- improved diffusion among the scientific community of research results, highlighting the social, environmental and economic importance of AnGR;
- improved processing and marketing of products derived from local AnGR;
- enhanced coordination between the agricultural and educational sectors;
- inclusion of conservation, and cultural and social significance of AnGR in university agriculture and social science courses;
- improved provision of educational materials at all levels to increase awareness of the importance of AnGR and of the need for their sustainable conservation;
- promotion of visits by students from urban areas to rural areas so that they learn about the relationships between AnGR the environment and rural populations, and get to know the cultural history of their countries;
- improved training of animal health workers to improve their knowledge of AnGR; and
- more effective involvement of the media.

The following actions to be implemented at subregional/regional level were identified:

- organization of events at which the most qualified scientists provide refresher courses for professionals from other countries;
- use of physical and administrative infrastructure in particular countries to enable training of personnel from other countries;
- presentation of a regional proposal for human-resource training to international financing institutions, highlighting the multiplying effect that will be achieved when the technicians return to their workplaces following the training;

- elaboration of conservation plans for shared AnGR at subregional level;
- creation of germplasm satellite banks;
- implementation of Regional Focal Points (RFP);
- sharing of experiences and research findings among stakeholders working in the field of AnGR conservation.

Support from FAO

The following activities were identified as means by which FAO could support conservation activities in the subregion:

- create centres of excellence to improve awareness at subregional/regional level and develop programmes that enhance knowledge of AnGR's contribution to food security and social stability; and
- strengthen the current structures (national focal points (NFP), national coordinators, and national coordinating committees) through advice to the member countries.

4 Policies, institutions and capacity-building

The following limitations were identified:

- In most countries the NFP exist but in very few are they really active.
- As a consequence of continuous changes at the political level, there are no long-term policies for the sector and very little institutional support.
- Stakeholders in the field of AnGR have very little knowledge about the activities of the NFP. This is characteristic of the lack of coordination within the sector.
- There is a lack of trained personnel working in the field of AnGR.

The following priority actions were identified:

- more integration of all countries with the CYTED XII-H Network as a way to strengthen the network and help to create more solid national-level structures; and
- establishment of mechanisms that allow real cooperation and integration at national level, helping to create a greater awareness of AnGR.

FAO might collaborate in the formation and strengthening of these structures through its representation offices and regional consultants. FAO should define the structures, functions and support it will supply to implement the RFP. The RFPs will facilitate communication, coordination and development of priority projects for the region. Argentina, Colombia and Peru have capacity and also human resources to host an RFP, but lack political desire and economic resources. The institutions that could support RFPs include IICA (Inter-American Institute for Cooperation on Agriculture), CIAT (International Center for Tropical Agriculture), and the CYTED Network.