Regional Report on Animal Genetic Resources: **Europe and the Caucasus**

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 set of priorities for action.

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 represent a summary of the views of European countries on Strategic Priorities for Action for the Europe and the Caucasus region, which are based on:

- discussions among National Coordinators for the Management of Animal Genetic Resources within the European Regional Focal Point; and
- input of the members of the FAO Intergovernmental Technical Working Group on Animal Genetic Resources (ITWG-AnGR) representing the European region, during the Fourth Session of the ITWG-AnGR, Rome, 13–15 December 2006.

Regional factsheet: **Europe and the Caucasus**

For the purpose of this report, the countries of Europe and the Caucasus region include Albania, Andorra, Armenia, Austria, Azerbaijan, Belarus, Belgium, Bosnia and Herzegovina, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Georgia, Germany, Greece, Hungary, Iceland, Ireland, Israel, Italy, Latvia, Liechtenstein, Lithuania, Luxembourg, Malta, Moldova, Monaco, The Netherlands, Norway, Poland, Portugal, Romania, the Russian Federation, San Marino, Serbia, Montenegro, Slovakia, Slovenia, Spain, Sweden, Switzerland, The Former Yugoslav Republic of Macedonia, Turkey, Ukraine and the United Kingdom.

The countries in the region cover a total of 23.7 million km2 of land area. The region is home to over 822 million people, equal to 13 percent of the world's total human population. Climates range from temperate in the western part through steppes in the south of the Caucasus to subarctic in Siberia. A summary of general information for this region can be found in Tables 1 to 3. The Russian Federation has the largest population size, followed by Germany and Turkey. Together, these countries account for one-third of the total population of the region. Between 1993 and 2003 the population of the region remained quite stable. The steepest absolute increases in population size during this period occurred in Turkey and France. Population densities in the region are very high – on average 149 inhabitants per km2 of land. The countries in the western part of the region are more densely populated. Malta, The Netherlands, Belgium and Israel are the most densely populated countries. In contrast, countries such as the Russian Federation and Iceland are among the least densely populated parts of the world (FAOSTAT).

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

Agriculture is the main source of income for almost 77 million people in Europe and the Caucasus. Among the countries of the region, the proportion of the population dependent on agriculture for their livelihood varies substantially from approximately 1 percent in Slovenia, up to 46 percent in Albania (FAOSTAT). The economic output of agriculture also differs substantially across the region. The economic contribution of agriculture to the gross domestic product (GDP) ranges from only 1 percent in the United Kingdom to 26 percent in Albania (World Bank Data). Agriculture is extremely diverse, ranging from large, highly intensive and specialized commercial holdings to subsistence farming using mainly traditional practices.

The region's livestock sector in general shows high productivity, and the total availability of food of animal origin for human consumption exceeds the demand of the region. The region's population has hardly increased in the last ten years. Until recently, there was still a natural increase in the population size (an excess of births over deaths) combined with added population growth through immigration. The natural growth rate is low in most European countries, even negative in some countries. The region's population is expected to decrease by approximately 5 percent within the next 45 years. The percentage of elderly people increases. The population of Russian Federation, the country with the largest population in the region, is expected to decrease by 30 million people during this period (UNFPA, 2005). Only the population of Turkey is expected to continue to grow strongly.

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TABLE 1
Land area and population

	Land area[1]	Population[1] 2004	Population density	Projected population growth rate[1] (%/yr)
	(1 000 km^2)	(million)	(per km^2)	2005–2015
Albania	27	3	117	0.13
Andorra	0	0	141	0.03
Armenia	28	3	108	-0.03
Austria	82	8	98	0.03
Azerbaijan,	83	8	102	0.17
Belarus	207	10	47	-0.13
Belgium	30	10	342	0.03
Bosnia and Herzegovina	51	4	82	-0.01
Bulgaria	111	8	71	-0.17
Croatia	56	4	79	-0.05
Cyprus	9	1	87	0.23
Czech Republic	77	10	132	-0.03
Denmark	42	5	127	0.05
Estonia	42	1	31	-0.06
Finland	305	5	17	0.05
France	550	60	110	0.07
Georgia	69	5	73	-0.15
Germany	349	83	237	0.00
Greece	129	11	85	0.02
Hungary	90	10	110	-0.07
Iceland	100	0	3	0.17
Ireland	69	4	58	0.27
Israel	22	7	303	0.34
Italy	294	57	195	-0.01
Latvia	62	2	37	-0.11
Liechtenstein	0	0	213	0.12
Lithuania	63	3	55	-0.09
Luxembourg	3	0	177	0.26
Malta	0	0	1 238	0.09
Monaco	0	0	17 949	0.30
Moldova	33	4	130	0.07
Netherlands	34	16	479	0.10
Norway	304	5	15	-0.02
Poland	306	39	126	0.07
Portugal	92	10	110	-0.05
Romania	230	22	97	-0.09
Russian Federation	16 996	142	8	-0.10
San Marino	0	0	467	0.15
Serbia and Montenegro[2]	102	11	103	-0.02
Slovakia	48	5	112	-0.01
Slovenia	20	2	98	-0.03
Spain	499	41	82	0.07
Sweden	410	9	22	0.07
Switzerland	40	7	179	0.02

TABLE 1 *CONT.*
Land area and population

	Land area[1]	Population[1] 2004	Population density	Projected population growth rate[1] (%/yr)
	(1 000 km^2)	(million)	(per km^2)	2005–2015
The former Yugoslav Republic of Macedonia	25	2	81	0.02
Turkey	770	72	94	0.27
Ukraine	579	48	83	-0.23
United Kingdom	242	60	247	0.06
Europe and the Caucasus	23 683	821	35	0.01

[1] Data from UN and FAO statistics.

[2] Since 2006, Serbia and Montenegro are separate countries.

TABLE 2
GDP and the economic contribution of agriculture

	GDP1 2003 (US$ billions)	GDP[1] per capita 2003 (PPP US$)	Value added in agriculture[2] 2003 (% of GDP)	Agricultural population[1] 2004 (%)
Albania	5.6	4978	26	46
Andorra	*	*	*	*
Armenia	2.8	4101	24	11
Austria	255.2	32276	2	4
Azerbaijan	7.3	4153	13	25
Belarus	17.8	6970	10	11
Belgium	304.2	31096	1	2
Bosnia and Herzegovina	7.1	7032	11	4
Bulgaria	19.9	8078	12	6
Croatia	28.8	12191	8	6
Cyprus	13.2	22805	*	7
Czech Republic	90.6	19408	3	7
Denmark	211.1	31914	2	3
Estonia	9.2	14555	4	10
Finland	161.8	29951	3	5
France	1789.1	29300	3	3
Georgia	4.0	2844	21	18
Germany	2443.4	28303	1	2
Greece	173.2	22205	7	12
Hungary	83.1	16814	3	10
Iceland	10.4	33051	*	8
Ireland	152.1	38827	3	9
Israel	110.3	24382	*	2
Italy	1468.3	28180	3	4
Latvia	11.2	11653	4	11
Liechtenstein	*	*	*	3
Lithuania	18.5	13107	6	13
Luxembourg	27.0	69961	1	2
Malta	4.9	18879	*	1
Moldova	2.0	1729	22	20

TABLE 2 *CONT.*
GDP and the economic contribution of agriculture

	GDP1 2003 (US$ billions)	GDP[1] per capita 2003 (PPP US$)	Value added in agriculture[2] 2003 (% of GDP)	Agricultural population[1] 2004 (%)
Monaco	*	*	*	3
Netherlands	512.7	31789	3	3
Norway	220.6	38454	1	5
Poland	216.5	12974	4	17
Portugal	147.3	19629	4	13
Romania	59.5	8480	13	11
Russian Federation	431.5	9902	5	9
San Marino	*	*	*	7
Serbia and Montenegro[3]	20.7	*	16	17
Slovakia	46.4	14623	3	8
Slovenia	28.1	20939	3	1
Spain	881.0	25047	4	6
Sweden	301.6	29541	2	3
Switzerland	321.8	33040	*	6
The former Yugoslav Republic of Macedonia	4.6	6610	13	10
Turkey	240.4	7753	13	28
Ukraine	50.1	6394	12	14
United Kingdom	1797.8	30821	1	2
Europe and the Caucasus	12712.9	*	*	9

[1] Data from UN and FAO statistics.

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

[3] Since 2006, Serbia and Montenegro are separate countries.

* No data available in data resources.

TABLE 3
Land use

	Arable[1] (%)		Permanent crops[1] (%)		Permanent pasture[1] (%)	
	1993	2003	1993	2003	1993	2003
Albania	21	21	5	4	15	15
Andorra	*	*	*	*	*	*
Armenia	17	18	3	2	24	30
Austria	17	17	1	1	24	23
Azerbaijan	21	22	4	3	29	33
Belarus	29	27	1	1	15	15
Belgium	0	28	0	1	0	18
Bosnia and Herzegovina	17	20	3	2	23	20
Bulgaria	37	30	2	2	16	16
Croatia	19	26	2	2	20	28
Cyprus	12	12	5	4	0	0
Czech Republic	41	40	3	3	11	13
Denmark	60	53	0	0	5	9
Estonia	25	13	0	0	6	6
Finland	7	7	0	0	0	0
France	33	34	2	2	20	18
Georgia	11	12	5	4	29	28
Germany	33	34	1	1	15	14
Greece	22	21	8	9	41	36
Hungary	53	51	3	2	13	12
Iceland	*	*	*	*	*	*
Ireland	15	17	0	0	49	46
Israel	16	16	4	4	7	6
Italy	29	27	10	9	15	15
Latvia	27	15	0	0	13	10
Liechtenstein	*	*	*	*	*	*
Lithuania	45	24	1	1	7	16
Luxembourg	0	24	0	0	0	25
Malta	*	*	*	*	*	*
Moldova	53	56	14	9	11	11
Monaco	*	*	*	*	*	*
Netherlands	26	27	1	1	31	29
Norway	*	*	*	*	*	*
Poland	47	41	1	1	13	11
Portugal	24	18	8	8	11	16
Romania	41	41	3	2	21	22
Russian Federation	8	7	0	0	5	5
San Marino	*	*	*	*	*	*
Serbia and Montenegro[2]	36	33	4	3	21	18
Slovakia	32	29	1	1	17	17
Slovenia	10	9	2	1	16	15
Spain	30	27	9	10	21	21
Sweden	7	7	0	0	1	1
Switzerland	10	10	1	1	29	27

TABLE 3 *CONT.*
Land use

	Arable[1] (%)		Permanent crops[1] (%)		Permanent pasture[1] (%)	
	1993	2003	1993	2003	1993	2003
The former Yugoslav Republic of Macedonia	24	22	2	2	25	25
Turkey	32	30	4	3	16	19
Ukraine	58	56	2	2	13	14
United Kingdom	25	23	0	0	47	46
Europe and the Caucasus	14	13	1	1	8	9

[1] Data from UN and FAO statistics.

[2] Since 2006, Serbia and Montenegro are separate countries.

* No data available in data resources.

1.1 Poverty

Although relatively scarce, poverty is present in Europe and the Caucasus. The poorest countries in the region are found in the eastern part of the region. 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. Table 4 shows the poorest countries in the region, as quantified by the international US$2 day^{-1} line.

TABLE 4
Poverty rate by country according to the US$2 day^{-1} line

Country	US$2/day (%)
Moldova	63.7
Armenia	31.1
Georgia	25.3
Turkey	18.7
Romania	12.9
Russian Federation	12.1
Albania	11.8

Source: World Bank (2006).

According to the poverty line figures shown in Table 4, Moldova, Armenia and Georgia are among the poorest countries in the region, with more than 25 percent of the population living below the US$2 day^{-1} poverty line (World Bank, 2006). The proportion of the national population in countries in the region living below the US$2 day^{-1} poverty line ranges from zero to 64 percent. Several countries have poor economic growth and depend largely on agriculture.

1.2 Agricultural policy

During the last 50 years countries in Europe and the Caucasus have been influenced by different political situations and agricultural policies. Broadly speaking, countries in the western part of the region have adopted market economies whereas those in the eastern part have embraced a more socialist ideology. However, within this general pattern, political and economical conditions differed substantially among countries. For a substantial number of countries across the region economies can be characterized as "mixed" economies. The different philosophies have had a significant effect on the region's agricultural sector. The economies of the EU-15[1] for example, have been directed by agricultural policies that have included the provision of subsidies and through market forces. In the former Union of Soviet Socialist

[1] The EU-15 included Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, Sweden and the United Kingdom.

Republics (USSR) on the other hand, the concept of socialist farming systems was developed, with the livestock industry being dominated by large state farms. Some significant agricultural political developments in the region are described in the following sections. The following discussion is limited to major policy developments in the European Union and the former USSR; there is of course substantial variation between countries. Furthermore, it should be clearly recognized that not all the countries of the region belong either to the European Union or the countries of the former USSR.

1.2.1 Agricultural policy and the European Union

Besides price and income policies, the EU-15[1] developed policies in the field of rural development, animal breeding, food safety, animal health and animal welfare. Standards have also been set for the production of meat and meat products in third countries. Although not all western European countries are part of the EU, non-EU countries in this part of the region went through similar developments as EU countries. Moreover, eastern and central European countries that had entered the EU by 2007 also have a history of extensive rural policy and zootechnical and veterinary legislation, although sometimes based on different principles. While food safety and animal health regulations in these countries followed the same strict standards found in the EU-15 countries, animal breeding was supervised and implemented by public sector institutions with state financial support. The role of breeders and their organizations in the decision making process was rather limited.

The Common Agricultural Policy

Shortly after the formation of the European Economic Community (EEC) in 1957, the EEC introduced a Common Agricultural Policy (CAP) in 1962. In this Treaty, the following goals of agricultural policy were described:

- increasing agricultural productivity by stimulating technical improvement and efficiency;
- ensuring proper incomes for the agricultural population;
- stabilizing markets;
- ensuring food availability;
- ensuring reasonable (low) prices for consumers; and
- harmonizing zootechnical and veterinary legislation.

The CAP resulted in the introduction of a common market organized by harmonized regulations. Measures introduced to comply with the goals of the CAP included price arrangements, subsidies for production as well as for trade, systems for product storage and common trade agreements to stabilize imports and exports. At the same time, the countries of the EEC agreed on three principles for trade in agricultural products: free trade in agricultural products within the EEC, protection of EEC products and financial solidarity. The CAP has been one of the important drivers of farm intensification, specialization and increased agricultural output and efficiency in the EU. Market pressures and technological developments have also contributed to these trends (EEA, 2003). Specialization and intensification have resulted in a decrease in the number of farm holdings and the number of people employed, as well as the abandonment of traditional practices and a reduction of diversity of local agricultural habitats.

By guaranteeing prices and levels of production through protectionist trade restrictions, the EU policy caused overproduction and became too costly. Most of the costs were related to the indirect subsidies involved in guaranteeing minimum prices for agricultural commodities. From the 1980s, the minimum prices were lowered several times and were substituted by direct subsidies to farmers, which are independent of production. In 1992, the McSharry Treaty determined that agricultural support should no longer be related to production or price level. This reform of the CAP, as well as the Agenda 2000 of the EU, aims to shift the emphasis of the policy from market-based support (e.g. intervention to maintain producer prices) towards direct income support (e.g. payment per hectare or unit of livestock). This measure was aimed at reducing the incentive to (over)produce. In 2003 the EU decided to further reform its agricultural policy, giving a new direction to the agricultural support system. It included a substantial reduction of trade-distorting domestic support and the elimination of export subsidies. The EU also aims to prevent an increase in agricultural expenditure as new countries join the EU, and to improve consumer and environmental protection (EU, 2005a). In 2007 the EU expanded to 27 countries[2]. Croatia, The former Yugoslav Republic of Macedonia and Turkey are candidate countries.

[2] The EU-27 includes Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden and the United Kingdom.

Rural development policy

The reforms, together with public concerns related to production methods, have encouraged the EU to provide new opportunities for rural development programmes (Petersen, 1998). Alongside market measures and the importance of a competitive EU agriculture, the EU has recognized the importance of rural development, the expectations of today's society and environmental requirements. To meet these needs, a new rural policy has been developed. The Rural Development Policy is the "second pillar" of the Common Agricultural Policy. The main principles of the Rural Development Policy are:

- the multifunctionality of agriculture, i.e. its varied role over and above the production of foodstuffs; this implies the recognition and encouragement of the range of services provided by farmers;
- a multisectoral and integrated approach to the rural economy in order to diversify activities, create new sources of income and employment and protect rural heritage;
- flexible aids for rural development, based on subsidiarity and promoting decentralization, consultation at regional, local and partnership level; and
- transparency in drawing up and managing programmes, based on simplified and more accessible legislation.

One of the main innovations in this policy is the method used to improve integration between the different types of intervention, to help ensure smooth and balanced development in all European rural areas. The main features of this development are defined as follows:

- strengthening the agricultural and forestry sector;
- improving the competitiveness of rural areas; and
- preserving the environment and rural heritage.

The policy aims at introducing a sustainable and integrated rural development policy governed by a single legal instrument, to ensure better coherence between rural development and the prices and market policy of the CAP. Part of the policy emphasizes that support for agricultural production methods designed to protect the environment and to maintain the countryside (agri-environment) is an essential element for achieving the Community's policy objectives with regard to agriculture and the environment (FAO, 2005). This policy also provides for financial support to be given to farmers rearing animals of "local breeds indigenous to the area and in danger of being lost to farming".

Veterinary legislation

The EU has identified food safety as one of its top priorities and has developed considerable legislation regulating the safety of food, including animals and animal products. Due to newly discovered health hazards and newly developed technologies, such as genetic engineering, EU legislation with regard to food has recently undergone significant reform. Particularly following emergencies like BSE (bovine spongiform encephalopathy) and dioxin contamination, considerable attention is being paid to mechanisms that promote safe and traceable meat products. The implementation of an integrated approach has involved the development of legislative and other actions with the following objectives:

- to ensure effective control systems and evaluate compliance with EU standards in the food safety and quality, animal health, animal welfare, animal nutrition and plant health sectors within the EU and in third countries in relation to their exports to the EU;
- to manage international relations with third countries and international organizations concerning food safety, animal health, animal welfare, animal nutrition and plant health; and
- to manage relations with the European Food Safety Authority (EFSA) and ensure science-based risk management (ibid.).

The EU legislative framework for food safety affects livestock production and marketing, and hence the utilization of animal genetic resources (AnGR). The European Union has built up a significant body of legislative texts governing the relationship between animal health, veterinary inspections and food hygiene. They are designed primarily to regulate imports and intra-Community trade involving animals and animal products.

Zootechnical legislation

A further body of EU legislation relates to animal breeding. The Community's zootechnical legislation aims to promote free trade in breeding animals and genetic material, considering the sustainability of breeding programmes and conservation of genetic resources. The basic aims of the legislation are:

- free trade in breeding animals and their genetic material; and
- legal right of entering a herd book of the same breed.

The aims are reached by harmonized recognition of breeding organizations, pedigree certificates, criteria governing entry in herd books, performance testing and genetic value assessment and acceptance for breeding purposes.

1.2.2 Agricultural Policy and the former USSR

During the socialist era in the former USSR, central government planning determined agriculture and food production with little regard to efficiency or the suitability of production for the environment. The area of land farmed and number of livestock in the former USSR increased as a result of land reforms. The development of huge irrigation and drainage schemes, farm specialization and investment in animal production were all associated with the wish to increase output, and resulted in a greater reliance on non-farm resources. Agricultural production and food consumption were subsidized (Swinnen, 2003).

The political changes initiated in 1989 in central and eastern Europe, followed by the introduction of a market economy resulted in a strong decline of the agricultural sector. The negative effect on output caused by institutional disruption was reinforced by declining trade, caused by price and trade liberalizations and subsidy cuts. Output tumbled in the mid 1990s in many east European countries and then started to recover in some, while agricultural output continued to fall for much of the 1990s in the Russian Federation, Ukraine and some other Newly Independent States (NIS). The 1998 financial crisis in the Russian Federation represented the worst moment. Since then, recovery has set in the Russian Federation , as well as in Ukraine, and agricultural production has grown continuously. While livestock production stabilized, crop production increased by 30 percent between 1998 and 2001 in the Russian Federation and by more than 20 percent between 1999 and 2001 in Ukraine (ibid.). Transition caused major changes in input use. Capital inputs declined strongly, in particular fertilizer. Fertilizer use, initially highly subsidized, declined by 80 percent on average in transition countries. In contrast, land use remained relatively stable. While these adjustments have been relatively similar across countries, labour adjustment has differed strongly.

During the first five years of transition, labour employment in agriculture increased in the Russian Federation and Ukraine. In contrast, agricultural employment declined dramatically in central European countries such as the Czech Republic, Slovakia and Hungary. Countries have introduced new policies to support agricultural producers, including both domestic support and trade restrictions (Hartell and Swinnen, 1998).

After years of transition, the economies, policies and international institutional environment differ significantly between countries in the eastern part of the region. Many countries have made significant progress in economic and institutional reforms and some joined the EU in 2004 and 2007. This had profound implications for their agricultural policies as they were integrated in the CAP of the EU. The most important countries in terms of the size of their agricultural markets are the Russian Federation and Ukraine. Some other former Soviet countries have not moved as far in terms of reform and integration into the global economy (Swinnen, 2003).

Besides agricultural policies, domestic and multinational companies have been important drivers of change and growth in the agri-food chains, including farm level restructuring, and productivity and quality improvements. Investments by Western companies have played an important role. The result has been dramatic changes in management, technology and capital investment at company and farm level. There is a large untapped agricultural potential in Eastern Europe and the Caucasus that may give rise to intensification as their economies strengthen (EEA, 2003).

1.3 Production and supply

Livestock production in Europe and the Caucasus contributes substantially to total world production. The main products are meat, milk and eggs. Production systems in the region are highly specialized and utilize high-output breeds.

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1.3.1 Production

Although the agricultural population in Europe and the Caucasus is relatively small, the average production per capita is well above the world level. The region produces of 52.7 billion kg of meat, 227.3 billion kg of milk and 10.8 billion kg of eggs annually (FAOSTAT). The meat, milk and eggs produced in the region contribute 20, 36 and 17 percent respectively to world production totals for these products. Total meat production in the Europe and the Caucasus region remained nearly stable during the last decade, while egg production showed little growth and milk production decreased slightly (FAOSTAT). As total world production increased substantially, the region's share of total world production decreased during the last decade (Table 5).

The Russian Federation, Germany and France have the highest absolute production of livestock products in the region. Germany has the highest meat production, followed by France and Spain, while the Russian Federation has the highest milk and egg production. However, Germany and the Russian Federation are not leading countries with respect to the average production per capita. Denmark generally has the highest productivity per capita for meat, Ireland for milk and The Netherlands for eggs (FAOSTAT).

Approximately 53 billion kg of meat is produced annually in Europe and the Caucasus. The meat sector returned to a more normal situation after the market disruptions caused the second BSE scare and the foot-and-mouth disease (FMD) outbreak in 2001 and the avian flu in 2003. Pork, chicken meat and beef (45, 23 and 22 percent, respectively) make the greatest contribution to meat production in the region. The Russian Federation contributes most to the total production of beef and chicken meat, whereas Germany is the main producer for pork. Other types of meat (turkey, sheep, rabbit, duck, horse, goat, game, goose, guinea fowl and buffalo) contribute around 10 percent to the total regional production, varying substantially in importance among countries. For example, France accounts for nearly one-third of the total turkey production in the region.

The Europe and the Caucasus region produces approximately 227 billion kg of milk. The milk in the region is mainly produced by cows (97 percent), but also originates from sheep and goats. The Russian Federation, Germany and France produce significantly more cow milk compared to the other countries in the region, together accounting for more than one-third of the total regional production. Ireland has the highest cow milk production per capita in the region, followed by Denmark and The Netherlands. Cyprus and Greece are the main producers of goat and sheep milk.

The countries with centrally planned economies (former Soviet Union and Eastern Europe) experienced a sharp decline in the livestock sector as it went through dramatic structural change and the purchasing power of consumers declined rapidly. With consumer purchasing power rising again, countries are recovering at different speeds, and increasing demand is not always met by domestic supply. the Russian Federation's chicken meat production in 2002, for example, is still 35 percent lower than in 1992 (935 000 tonnes down from 1 428 000 tonnes) but her imports have surged to 1 205 000 tonnes. In 2002, imports contributed 56 percent to total food supply of chicken meat. The central/eastern European countries that have entered the EU had to go through rapid adjustments in order to prepare for accession. However, these countries now have access to markets in the older EU member states. Structural changes have been completed in central/eastern European countries and consumption levels are high.

TABLE 5
Annual growth rates of meat, milk and eggs in Europe and the Caucasus and the world

Region	Item	Annual growth rate (%)
Europe and the Caucasus	Meat	0.1
	Milk	-0.4
	Eggs	0.7
World	Meat	2.3
	Milk	1.4
	Eggs	2.9

Source: FAOSTAT.

1.3.2 Consumption

The average food consumption in Europe and the Caucasus is 3 250 kcal per capita per day (figures for 2002 from GLiPHA), which is far above the world average of 2 800 kcal (FAO, 2003). Portugal has the highest food consumption in the region (3 740 kcal), whereas The former Yugoslav Republic of Macedonia, Georgia and Armenia are below the average developing country level of 2 681 kcal per capita per day.

For each person in the region, egg consumption is 32 grams/day, (bovine, pig and/or chicken) meat 137 grams/day and milk 579 grams/day (FAOSTAT). Of the total meat consumption per capita, most is pork (61 grams), followed by poultry meat (43 grams) and beef (33 grams). At country level, meat consumption is the highest in Israel, Spain and Poland. Israel has exceptionally high consumption levels of chicken and turkey meat. Ireland and Italy have the highest consumption levels for beef, while for pork; Poland and Germany have the highest consumption levels per capita. Pork consumption varies greatly across the region, ranging from 0.2 grams per capita per day in Turkey up to 143 grams per capita per day in Poland. Because of religious sensitivities, pork consumption is especially low in countries in the southeastern part of the region. The highest consumption levels of milk are found in Ireland, Belgium and Switzerland.

As a rule, the share of expenditure on food in total expenditure is inversely related to income. For example, in EU countries household expenditures on food increased during the past decade, but the share of household budget spent on food consumption decreased. In developing countries, there is an increasing consumption of livestock products. In the more developed markets, concerns with the availability of food have been replaced by concerns regarding food attributes, quality and safety. Continuous high-level consumption of animal products is associated with a series of cardio-vascular diseases and certain types of cancer. Other perceived health problems associated with animal products sporadically and sometimes permanently suppress demand. These include the presence of residues (of antibiotics, pesticides, dioxins) and of pathogens (E. coli, Salmonella, BSE).

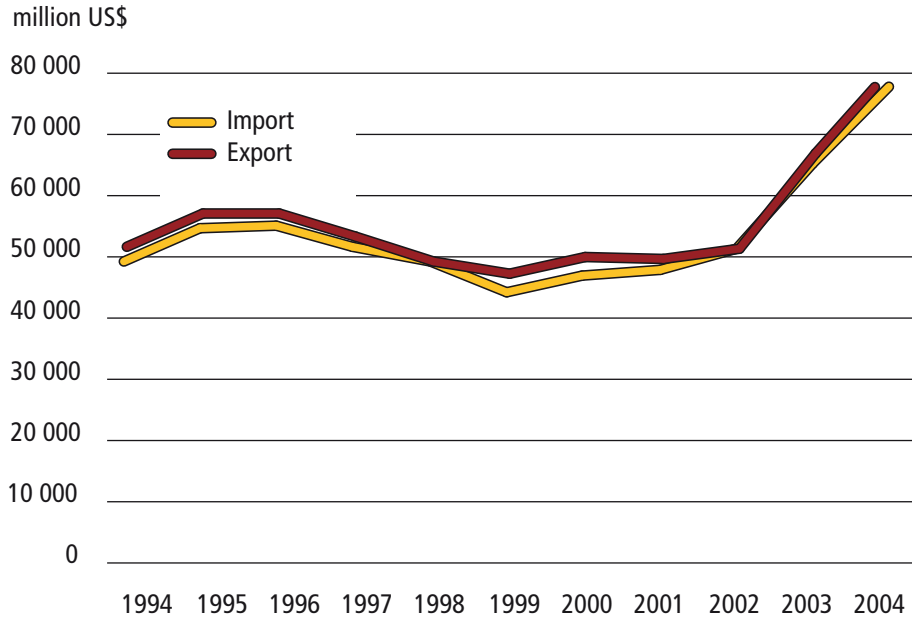
1.4 Imports and exports

Excluding intra-EU trade, the EU is the largest exporter and the second largest importer of general merchandize trade in the world. In 2003, the EU exported 10.9 percent of agricultural products to and imported 13.6 percent from the rest of the world (WTO, 2004). During the last ten years the exports and imports of live animals and primary livestock products in EU countries showed a similar trend, because much of the agricultural trade is intra-EU trade (Figure 1). Especially Germany, France, The Netherlands and the United Kingdom are among the main traders, showing high import figures as well as export figures. Although most of the countries in the region are net importers (Table 6), the region as a whole is a net exporter of live animals as well as of livestock products. In 2003 and 2004 trade increased substantially, especially for meat and dairy products.

Trade flows in agricultural and food products between western Europe and the central and east European countries have increased strongly since 1990, in both directions. Early predictions that the EU markets would be flooded by cheap eastern imports turned out to be misplaced. While agri-food imports from central and east European countries doubled over the 1990s, exports from the EU to the east increased ten-fold. Product quality has increased strongly in central and east European countries. This is due to a combination of public regulations related to hygiene and minimum quality standards, and private sector investments throughout the agri-food chain (Swinnen, 2003).

In addition to market-access gains achieved under global trade agreements over the past decade, growth in international trade in livestock products has become increasingly dependent on demand from developing countries. In contrast, demand in developed-country markets is either stable or falling for some products (Silvis, 2006).

FIGURE 1
Total imports and exports (in million US$) of live animals and primary livestock products in Europe and the Caucasus: 1994–2004



Source: FAOSTAT.

TABLE 6
Net importers and exporters of primary livestock products and live animals in 2004

Primary livestock products		Live animals	
Net importers	**Net exporters**	**Net importers**	**Net exporters**
Albania	Austria	Albania	Bulgaria
Armenia	Belarus	Armenia	Cyprus
Azerbaijan	Belgium	Austria	Czech Republic
Bosnia and Herzegovina	Denmark	Azerbaijan	Denmark
Bulgaria	Estonia	Belarus	Estonia
Croatia	Finland	Belgium	France
Cyprus	France	Bosnia and Herzegovina	Germany
Czech Republic	Germany	Croatia	Hungary
Georgia	Hungary	Finland	Iceland
Greece	Iceland	Georgia	Ireland
Israel	Ireland	Greece	Lithuania
Italy	Lithuania	Israel	Luxembourg
Latvia	Netherlands	Italy	Moldova
Luxembourg	Norway	Latvia	Netherlands
Malta	Poland	Malta	Poland
Moldova	Slovenia	Norway	Romania
Portugal	Spain	Portugal	Slovakia
Romania	Ukraine	Russian Federation	Sweden
Russian Federation		Serbia and Montenegro*	United Kingdom
Serbia and Montenegro*		Slovenia	
Slovakia		Spain	
Sweden		Switzerland	

TABLE 6 *CONT.*
Net importers and exporters of primary livestock products and live animals in 2004

Primary livestock products		Live animals	
Net importers	**Net exporters**	**Net importers**	**Net exporters**
Switzerland		The former Yugoslav Republic of Macedonia	
The former Yugoslav Republic of Macedonia		Turkey	
Turkey		Ukraine	
United Kingdom			

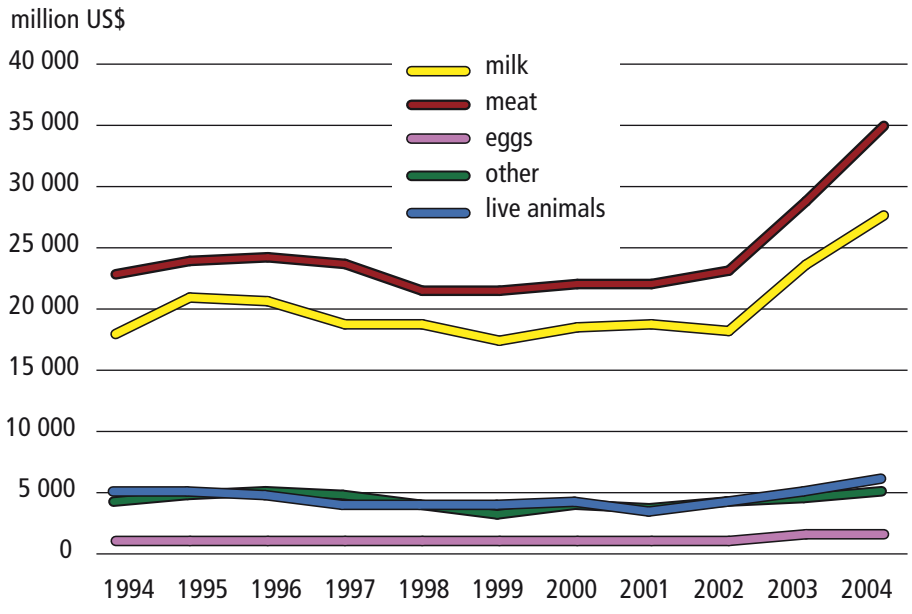
Source: FAOSTAT.

*Since 2006 Serbia and Montenegro are separate countries.

1.4.1 Exports

In 2004, the total value of exports of live animals and primary livestock products from countries in Europe and the Caucasus was US$75 billion (including intraregional trade). Trade in meat products has been frequently affected in the last decade by animal disease outbreaks and their after-effects (i.e. delays in lifting trade embargoes by importing countries, and investment decisions in the sector). Nonetheless, export of meat (US$35 billion in 2004) contributed the most to the total exports of live animals and animal products (Figure 2). Pork, beef and poultry meat formed the main components of the total exports of meat, respectively. The main exporters of pork are Denmark, Germany and The Netherlands. The Netherlands, France and Belgium are the main exporters of poultry meat and The Netherlands, Germany and Ireland are the main exporters of beef. Fifty percent of the export of dairy products consists of cheese of whole cow milk, mainly exported by France, Germany and The Netherlands. Exports of live animals from countries in the region contribute nearly 9 percent (US$6.5 billion) to the total export value of live animals and primary livestock products. France (80 percent cattle), The Netherlands (56 percent pigs), Germany (48 percent cattle) and the United Kingdom (77 percent horses) together export nearly two-thirds of the total export value of live animals in the region. Exports of cattle are highest, followed by pigs, horses and chickens (44, 20, 18 and 12 percent, respectively). Other live animals exported are sheep, turkeys, rabbits, goats, pigeons, ducks, geese and asses, together accounting for 7 percent of the total exports (FAOSTAT).

FIGURE 2
Total exports of live animals and primary livestock products in Europe and the Caucasus: 1994–2004

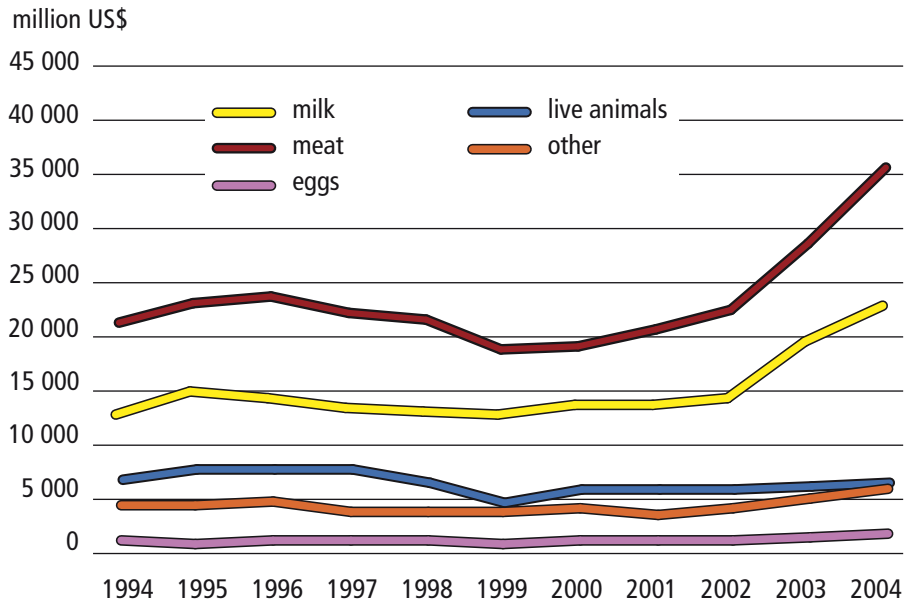


Source: FAOSTAT.

1.4.2 Imports

In 2004, the total value of imports of live animals and primary livestock products in the countries of Europe and the Caucasus was US$73 billion. More than 90 percent of the import value in 2004 concerned livestock products. In line with the export figures, meat and milk were the main import products during the last decade, and pork, beef and poultry meat are the main components of total meat imports. The United Kingdom, Germany and Italy are the main importers of pork, while for beef, Italy, France and the United Kingdom are the main importers. The United Kingdom has exceptionally large imports of poultry meat. In this respect it is followed by Germany, The Netherlands and the Russian Federation. Imports of live animals into countries in the region contribute 7 percent (US$5.7 billion) to the total import value of live animals and primary livestock products. Live exports involve mainly cattle, pigs, horses and chickens (38, 22, 20 and 12 percent, respectively). Italy imports the largest number of live animals, nearly 30 percent. The United Kingdom and Germany are also large importers, both importing 12 percent of the total imports of live animals. The type of imported animals varies substantially. 80 percent of Italy's imports are cattle, whereas 70 percent of Germany's imports are live pigs and 90 percent of the United Kingdom's imports are horses.

FIGURE 3
Total imports of live animals and primary livestock products in Europe and the Caucasus: 1994–2004



Source: FAOSTAT.

1.5 Projected demand for livestock products

On a global scale, the geographical distribution of the demand for animal-derived foods broadly follows that of human populations. However, people have quite different demand patterns, depending on income and preferences. Food preferences are undergoing rapid changes. While growing incomes in developing countries result in increasing intake of proteins and fats, some higher-income sections of the population in developed countries are cutting down on these components for a number of reasons including health, ethics and an altered level of trust in the livestock sector. On average, per capita consumption of animal-derived food is highest among high-income groups and growing fastest among lower- and middle-income groups in countries experiencing strong economic growth. People in

industrialised countries currently derive more than 40 percent of their dietary protein intake from food of livestock origin, and there was little change in this proportion between 1980 and 2002 (FAO, 2006).

For Europe and the Caucasus, stagnation in population growth and moderate economic growth are expected. A decline in population is even expected after 2020. For the time being, the population is stable, and for this reason no major changes in demand can be expected (Table 7). However, trade balances are expected to alter strongly due to factors such as growing demand in developing countries and EU policy reforms. The proportion of world exports supplied by the region is projected to decrease. Moreover, the omnipresent threat of disease outbreaks and their after-effects are a dampening factor affecting otherwise generally positive prospects for world meat trade, driven by an expectation of rising per capita incomes in a range of importing countries over the outlook period (Silvis, 2006).

The medium-term perspectives for the meat sector in the EU are positive for poultry and pig meat markets, while beef meat production is expected to decline as a consequence of the CAP reform and strong competition from the world market. Overall per capita meat consumption is projected to increase (EU, 2005b; Silvis, 2006). Milk production in the EU is projected to increase slightly between 2005 and 2012. In the short term, butter production in new member states is expected to increase in response to higher prices in EU-15 markets, but in the longer term there is expected to be a shift towards the use of milk for higher-value dairy products and a dramatic reduction in EU production of milk powders and butter. Cheese production and consumption in EU-25 countries is projected to increase. There will be a small expansion in EU exports of cheese, and a large decline in exports of butter and skimmed milk powder. In a context of increased yields per head and strict quota rules, the EU dairy herd is projected to fall. It is this that is driving the decline in EU beef production (EU, 2005b). The EU remains one of the biggest exporters in world dairy markets (EU, 2004; Silvis, 2006).

Meanwhile, EU accession with new members in the eastern part of the region is expected to lead to a redirection of trade according to the relative competitiveness of the individual member states. The EC Commission indicates that the poultry and pig meat sectors will be influenced by growing competitiveness in poultry operations in eastern Europe as a result of foreign direct investments into production and processing; and increasing imports of pig meat by the same countries driven by uncompetitive feed prices and relatively poor pig meat quality compared to old EU member countries (FAO, 2003).

TABLE 7
Total meat and dairy projections to 2010*

MEAT		Production (million tonnes)		Total consumption (million tonnes)		Consumption / capita (kg/person)	
		1998-2000	Projected	1998-2000	Projected	1998-2000	Projected
Region	Country	Average	2010	Average	2010	Average	2010
Western Europe		35.8	40.1	34.1	38.5	87.9	98.9
Central/eastern Europe		7.1	8.1	7.0	8.0	58.0	66.5
	Hungary	1.1	1.3	0.9	1.1	84.8	110.3
	Poland	2.9	3.5	2.8	3.3	72.4	85.0
	Czech Republic	0.8	0.9	0.8	0.9	76.2	89.5
CIS		8.4	9.8	10.8	13.3	37.9	46.3
	Russian Federation	4.4	5.0	6.6	8.3	45.0	57.2
	Ukraine	1.7	2.0	1.6	2.0	32.2	41.7

TABLE 7 *CONT.*
Total meat and dairy projections to 2010*

DAIRY		Production (1 000 tonnes)		Total consumption (1 000 tonnes)		Consumption / capita (kg/person)	
		1998-2000	Projected	1998-2000	Projected	1998-2000	Projected
Region	Country	Average	2010	Average	2010	Average	2010
Western Europe		132 072	130 674	122 480	126 091	251.0	264.8
Central/eastern Europe		29 848	32 176	28 629	30 488	192.1	212.6
	Hungary	2 142	2 293	2 052	2 251	175.5	211.3
	Poland	12 381	13 867	11 240	12 176	199.8	228.8
	Romania	4 791	4 896	4 860	4 908	199.3	210.1
	Czech Republic	2 746	3 020	2 365	2 644	202.5	243.2
CIS		62 893	68 954	63 408	70 970	152.8	172.2
	Belarus	4 905	5 072	4 466	4 716	223.9	229.5
	Russian Federation	32 600	35 589	33 651	37 667	152.3	181.4
	Ukraine	13 493	15 243	13 201	14 998	162.8	184.4

Source: FAO (2003).

* Classification FAO, 2003:

"Europe" comprises EU-15, Norway, Switzerland, other west European countries.

"Central/eastern Europe" comprises Albania, Bulgaria, the Czech Republic, Hungary, Poland, Romania, Slovakia and the countries of former Yugoslavia.

"CIS" comprises Armenia, Azerbaijan, Belarus, Georgia, Kazakhstan, Kyrgyzstan, Moldova, Russian Federation, Tajikistan, Turkmenistan, Ukraine and Uzbekistan..

"Baltic States" comprises Estonia, Latvia and Lithuania.

2 Livestock production systems

In the past ten years numbers of pigs, cattle and sheep in the region decreased by 10, 24 and 24 percent respectively, while the number of chickens remained constant. In the western part of the region, industrialization and specialization of livestock systems occurred in cattle, pig and poultry production. In large parts of Europe, small family farms with cattle and sheep still dominate. The southeastern part of the region is characterized by small-scale low-input farming with sheep and goats. In the eastern part of the region, after 1990, large-scale state farms have been privatized, resulting in small-scale farming systems and a drastic reduction of up to 70 percent in the number of animals. In the western and northern part of the region, agricultural land is abandoned by farmers and is being to nature.

2.1 Overview of production systems

In this report, livestock production systems are described according to the classification developed by Seré and Steinfeld (FAO, 1996). The statistics presented are based on updated figures (FAO, 2004). The classification system distinguishes grassland-based systems, mixed rainfed systems, mixed irrigated systems and landless systems. The production systems are further classified by 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.

Table 8 provides general production and productivity data, for the main livestock products, in the various production systems of the region. Most people in the region live in the temperate zones of the mixed rainfed system. This system covers 85 percent of the total land area in the region. Most of the milk (81 percent) and ruminant meat (70 percent) is produced in the mixed rainfed system, whereas the

landless system accounts for 60 percent of monogastric meat and 58 percent of total egg production. Pork production is a large sector in Europe and the Caucasus, and is mainly concentrated in the landless production system (FAO, 2004). The same is true for poultry meat and egg production. The quantity of animal products produced in the mixed irrigated systems is much lower and production from grassland-based production is relatively negligible. Generally speaking, most of the production is found in the temperate zones.

2.1.1 Grassland-based system

In developed countries grassland-based system is extremely labour-extensive (FAO, 1996). Dairy milk, and beef, veal, sheep, goat and pork are the main products generated in this system (Table 8). The breeds of animals found in grassland-based systems are well adapted to nutritional and climatic stress and to the challenge posed by a number of endemic diseases (FAO/UNEP, 2000). Productivity is relatively high, especially for sheep and goat meat, but also for cow milk production.

2.1.2 Mixed rainfed system

The mixed rainfed system is the dominant system in most of Europe. The system covers 200 million ha of permanent pasture and another 335 million ha of arable land. It also largest in terms of stock numbers of cattle and small ruminants as well as their meat and milk outputs. It provides 70 percent of the beef and veal production, 66 percent of the sheep and goat meat production and 82 percent of the cow milk production (Table 8). To compare: globally, the mixed rainfed system alone produces 62.6 percent of the total cow milk production.

The mixed rainfed system has rapidly evolved in the past decades in reaction to unprecedented rates of economic growth in the developed countries. The relative importance of livestock versus crops in terms of income generation grows with rising per capita incomes. Given the significance of this system, policies have been implemented to steer its development. Among the land-based systems, the mixed rainfed system is certainly the one where technical change has had the largest impact in terms of changes in intensity of production, land use, input use and genetic make-up of breeds. Thus, impacts in terms of loss of domestic animal biodiversity, use of agrochemicals to sustain feed production and waste disposal are substantial (FAO, 1996).

Temperate zones

The temperate zones of the mixed rainfed system account for 68 percent of the cattle, 74 percent of the dairy cows and 43 percent of the sheep and goat stock in the region. Together with relatively high productivity rates, this system has the highest output of ruminant and poultry products in the region. In developed countries, farms in the mixed rainfed system produce one or a few livestock products almost exclusively for the market. The relative importance of livestock versus crops in terms of income generation grows with rising per capita incomes in the country concerned.

The mixed rainfed system supports a relatively small and declining number of farmers in developed temperate countries, but additional people are employed in processing, marketing, transportation, supply of inputs, etc. There has been substantial pressure on the mixed rainfed system to increase labour productivity. This has been achieved through mechanization, specialization, increased use of inputs and increased scale of operations. These increases in labour productivity have been achieved at the price of opening the system. Feeds, fertilizers and fossil fuels are imported. Large amounts of nutrients are extracted via increased outputs or are accumulated as manure beyond the quantities which can be efficiently utilized to maintain soil fertility. This has resulted in the contamination of groundwater and other environmental problems (ibid.).

Moreover, climatic conditions in temperate regions require substantial active interventions by farmers to feed their animals during the harsh winter period. These necessities make it economic to maintain animals selected for relatively high levels of productivity. Multipurpose cattle (meat, milk and traction) were bred over the last 50 years for higher productivity in specialized traits, as rapid economic development required increased labour productivity in the rural sector of developed countries. These breeds (Holstein-Friesian being a very good example) have been introduced into many livestock systems with very different resources and requirements (ibid.). The highest productivity and self-sufficiency figures for meat, milk and egg production are found in this system. Beef (and buffalo) productivity in the temperate areas of the mixed rainfed system is far higher than in the arid/semi-arid zones, at 77 kg meat per head. Dairy milk yields in these areas (4 278 kg/cow/year) are among the highest in the region (although there is marked variation within the region). At the same time, smaller, less productive

but better adapted breeds have developed under frequently harsher conditions (lower quality feeds, seasonal feed stresses, higher disease challenge) (ibid.).

Arid and semi-arid zones

The mixed rainfed system of the arid/semi-arid zones is also present to a limited extent in the Europe and the Caucasus region (e.g. in Turkey). This system accounts for the production of a substantial share of the total amount of buffalo, sheep and goat meat. Milk production, other than dairy (cow) milk, is also relatively high. Grazing land not suited for crop production is the main feed resource of this system, supported by strategic use of crop stubbles and straw. The more arid the conditions become the greater the necessity for farmers to keep livestock as an asset. In addition to the production of meat and milk, livestock can have a range of simultaneous roles in this system, including animal traction, production of manure and use as cash reserve. The major environmental concern related to this system is the degradation of land resources, due to their limited production potential under growing population pressure. In livestock terms, this relates particularly to overgrazing and range degradation. This is connected to increasing stock numbers, but also to crop production being expanded into increasingly marginal lands (ibid.).

2.1.3 Mixed irrigated system

The mixed irrigated system is found particularly in the temperate zones of the Mediterranean region (Albania, Bulgaria, Greece, Italy, and Portugal). These are agro-ecosystems in the transition between subtropical and temperate conditions, where plant growth is limited, both by low temperatures in the cold season and by shortage or lack of precipitation during the vegetation period. Examples include south European family farms combining one cycle of irrigated crop production with livestock production based on the grazing of dry lands, crop stubbles and some irrigated alfalfa. In Mediterranean areas, the main feed resource has traditionally been the silvopastoral system, supplemented by crop by-products (ibid.).

In contrast to the mixed rainfed system, the mixed irrigated system has a relatively large sheep and goat stock and produces much of the milk, other than cow milk, produced in the region. Most of the buffaloes in the region, 0.5 million, are found in this system.

Temperate zones

More than 90 percent of the production in the mixed irrigated system is found in temperate zones. Besides a substantial production of beef and veal, dairy milk and poultry products, the area has a large share of the total sheep and goat meat production and more than half of the milk, other than cow milk, is produced in this area. Traditional local sheep and cattle breeds have been largely displaced as management practices and product prices have allowed for more intensive production and the associated increase in the use of external inputs (energy for water pumping, fertilizers and agrochemicals.) Livestock production technology is basically the same as that utilized in the mixed rainfed system. Like in the rainfed system, the mixed irrigated system shows the highest productivity and self-sufficiency figures for meat, milk and egg production, particularly in the temperate zones. High product prices and a high opportunity cost of labour make intensive production systems viable. It implies a heavy effort to actively adjust seasonal feed supply to the rather constant requirements of the herds and flocks. This is achieved through forage conservation (hay, silage) and through the feeding of grains and grain by-products. Manure is actively allocated to the more productive irrigated fields, thus transferring nutrients from other parts of the farm to the irrigated fields. Weeds are fed to ruminants. Meat and milk, the main outputs of this system, are mainly produced for the market. Animal traction has been displaced almost completely by mechanization (ibid.).

Arid/semi-arid zones

Only a small part of the production originates from the arid/semi-arid zones. Productivity and self-sufficiency in these areas are low. For example, milk yield per cow in arid/semi-arid zone is only half of the yield found in the temperate zone.

2.1.4 Landless systems

Over time, the mixed rainfed system has been under strong pressure to specialize in meat or dairy production, particularly in the case of pigs and poultry, where the links to the land are not as direct as in the case of ruminants. This has given rise to the large and dynamic sector of landless monogastric

(pig and poultry) production. Globally, the landless system accounts for more than half (52.3 percent) of monogastric meat production. Egg production is even more concentrated: more than two-thirds of total production is found in the landless system. Landless systems in Europe and the Caucasus follow the same trend. Twelve percent of the region's beef and veal meat, 62 percent of pork, 55 percent of poultry meat and 58 percent of eggs are produced in the landless system. The productivity in the landless system is the highest in the region compared to the other production systems. For example. the average productivity of beef is 105 kg/head. The relative amount of pork in total meat production is high in the western part of the region. Conversely, the relative contributions of poultry meat and eggs from these systems are much higher in the eastern part of the region.

Landless systems are open systems, in which feed is introduced from outside the farm. Decisions regarding feed use are thus separated from those concerning feed production on fields to produce feed and/or cash crops. In developed countries with abundant road and cooling infrastructure, large-scale landless farms are located close to ports in net grain-importing countries. Examples include pig operations in The Netherlands or northern Germany. In grain exporting countries, landless systems tend to be located in grain producing areas. In countries with less developed infrastructures, landless operations are situated close to major urban centres, reflecting the ease of transporting grains as compared to animal products.

The system is characterized by an ample use of high energy concentrate feeds (mainly cereals, oilseeds and their by-products). This feature is central to understanding the rapid growth of the system worldwide. Economically speaking, high energy concentration allows transport of feeds over longer distances. Transportation of concentrate feeds can be achieved at substantially lower costs than that of perishable animal products, even though the quantities are larger. This allows for expansion of production based on imported feeds in response to market incentives. Consumers tend to pay a premium to obtain fresh animal products rather than frozen/preserved products. Seasonality of feed production is easily overcome through grain storage and/or deferred purchasing on the market.

The system is very knowledge- and capital-intensive. As links to the land base are limited, it is easily transferred across agro-ecological zones. Production efficiency is high in terms of output per unit of feed or per worker-hour, less so when measured in terms of energy units. Concentrate conversion rates range between 2.5 and 4 kg dry matter (DM)/kg of pork, 2.0 to 2.5 kg DM/kg of poultry meat, and even lower for eggs. Capital intensity is high in all cases, but wide variations exist. Very sophisticated automated systems are used in developed countries, responding to high labour costs. Variability of production within individual enterprises over time is low as long as the management systems put in place to control exogenous factors (disinfection, isolation from animals external to the system, effective quality control of feed inputs, etc) operate correctly. As the products of this system are almost exclusively produced for urban markets, they have to comply with standardization and other specific quality criteria that enable them to be efficiently transported, processed and marketed. Many of these criteria are determined by the processing industries, rather than by the final consumers per se (ibid.).

TABLE 8

Resource base, production and productivity data by production system in Europe and the Caucasus

	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)	0			566	0	70	169	2	15		822
a. Resource base											
a1. Grazing land (million ha)	2			189	0	13	32	0	4		239
a2. Arable land (million ha)	0			310	0	25	42	0	2		380
a3. Irrigated land (million ha)				13	0	5	14	0	1		33
a4. Livestock numbers											
cattle (million heads)	0			106	0	11	23	0	2	14	156
dairy cows (million heads)	0			41		5	8	0	1		55
buffalo (million heads)				0		0	1		0		1
sheep and goats (million heads)	0			86	0	35	77	0	2		201
b) Major outputs (million kg)											
beef and veal meat	4			8 186	0	349	2 106	7	103	1508	12 263
buffalo meat						3	1				4
sheep and goat meat	9			864	0	345	582	1	31		1 832
pig meat	2			7 981	1	6	1 773	9	74	15887	25 733
poultry meat				4 169	0	112	1 596	5	241	7488	13 611
eggs				2 961	0	92	1 179	2	67	6048	10 349
dairy milk	108			174 198	0	7 737	37 745	25	2602		222 415
other milk				1 884		1 000	3 620	1	133		6 638
milk production total				176 082	0	8 737	41 365	26	2735		228 945
c) Productivity indicators											
beef and buffalo meat kg/head	59			77	44	33	90	50	56	105	78
sheep and goat meat kg/head	19			10	10	10	8	8	13		9
milk yield kg/cow	4 154			4 278		1 694	4 447	926	2.376		4 049
d) Self-sufficiency of systems											
rum meat kg/inhabitant	46			16	3	10	16	5	9		17
monogastrics meat kg/inhabitant	7			21	7	2	20	9	21		48
eggs kg/inhabitant				5	1	1	7	1	4		13
milk kg/inhabitant				311	2	125	245	17	179		279

Source: FAO (2004); FAO (1996).

2.2 Roles and functions of livestock in Europe and the Caucasus

The most important livestock species in the region are pigs, cattle, sheep and chickens. Their main function is food production. Sometimes cattle and sheep are kept for nature management or as hobby animals. The latter is also an important function of chickens. Grazing animals, particularly local and well-adapted breeds of sheep, cattle and horses play an important role in nature management. In the eastern part of the region horses are still used for draught and transport. Throughout the region horses are kept for leisure purposes. Goats are not numerous and are used for milk (cheese) and meat production. In less-developed countries, livestock can perform a series of functions, including a continuous flow of cash income, means to concentrate nutrients through manure, animal traction, a cash reserve for emergencies or as a buffer to risks in crop production.

National governments may be motivated to support conservation and sustainable use of less widely used livestock breeds for different reasons, e.g. socio-economic or cultural and historic reasons. There are many types of private and governmental institutions such as research institutes or universities, therapeutic farms, prisons, demonstration farms, farm parks and museums at which local breeds may be kept. The number of animals conserved in such locations is generally low.

2.3 Projected changes in production systems over time

There is a broad set of influences that are of importance to the present and future status and development of farming systems. This section focuses on the effects of predicted changes in mixed rainfed, mixed irrigated and landless systems.

Mixed rainfed system

In the course of the development process, with increasing urbanization and growing incomes, production technology has evolved, leading to higher specialization, more use of external inputs and more open systems. The growing negative externalities of these systems for the environment are inducing important shifts in the type of technologies being developed. An example is the use of purchased feeds in the land-scarce mixed rainfed system of western Europe. This allows an increase in the number of stock kept per farm, thus leading to a manure disposal problem as increasing amounts are spread on a limited farm area. As a consequence, water and air pollution are increasing. In response to these problems, a series of regulations and technologies have been adopted to improve the handling of animal wastes.

Mixed irrigated system

This system tends to be found in regions with rather high population density. The major issue in environmental terms is the use of water, with agriculture competing with use for urban supply. Another important issue is the management of the lands that are not irrigated. Particularly in the Mediterranean region, complex silvopastoral systems have been developed combining rainfed tree crops (e.g. olive trees, hazel nuts, cork-oaks) with extensive grazing, mainly of small ruminants. This system is clearly associated with very intensive agriculture in temperate regions with a high population density. This is the case in southern European areas, where the typical commodities of temperate environments are produced at very high levels of intensity. This situation is related to historical land scarcity and to policies heavily protecting domestic agriculture. It can be expected that these systems will become less and less viable, as they have to compete with very efficient rainfed systems producing the same commodities. The system can be expected to shift to more extensive production, using less water and chemical inputs. This will reduce the negative impacts of the system on the environment. The expansion of international trade and particularly the incorporation of southern European countries into the EU, has led to an increase in the intensive production systems of off-season vegetables and fruits on the best irrigated land. Integration with livestock has been reduced. Ruminant grazing systems are declining in absolute terms and are becoming increasingly concentrated on marginal sites.

Landless

The most important interactions with the environment are generation of large volumes of wastes and air pollution, as well as the impacts of increased demand for cereals on the land resource base. In addition, the genetic erosion related to traditional breeds of chicken and pigs is of concern. Finally, as poultry and pork are substitutes for ruminant meats, it can be argued that the rapid development of "modern" landless monogastric systems has reduced market incentives to expand ruminant production, thus reducing pressures for deforestation and rangeland degradation. The system is competing with traditional land-based production (including ruminant production) for market share in the urban

markets. In a broader sense, the demand for cereals created by these systems is also competing for land resources with land-based ruminant systems. Given the strong demand for these commodities, production can be expected to continue growing rapidly, particularly in less developed countries. Landless poultry and pig production systems account for the majority of the output in developed countries and are rapidly increasing their share in less developed countries given their high supply elasticity in the short run. The landless monogastrics system is an open system in which important market failures give rise to a need for regulation. Regulations as well as technological innovations are mitigating negative effects related to waste management, particularly in developed countries. An important trend is the move to select sites that are more distant from urban centres, where there is enough land to make manure disposal through farming feasible. The environmental impacts of these systems related to their high demand for cereals are of a global nature, given the links they have to the international grain markets (FAO, 1996).

2.4 Impact of production system trends on animal genetic resources

Due to intense selection between and within breeds, genetic diversity in several species is under threat. Animal diseases, changes in consumption patterns and market circumstances, and wars/political instabilities are also considered as a threat to farm animal genetic diversity.

Intensification and specialization

In cattle, pigs and poultry many dual purpose breeds were developed after the Second World War. As a result of the intensification and specialization process, only a limited number of breeds and lines dominate the market and they push away the dual purpose and locally adapted breeds. In Europe and the Caucasus, the greater emphasis given to production levels has led to increased specialization for traits such as high milk and egg yield and high meat quality and finer wool. In the western and northern part of the region, environmental concerns and the introduction of quotas for milk resulted in an increase in the costs of production. This led to further intensification and specialization to maintain profitability.

The capacity of traditional breeds to cope with exogenous challenges has been substituted by the ability of a narrower range of genetic resources to perform at high levels of efficiency in terms of desired outputs, as long as external challenges are controlled by management. Management and infrastructure requirements generate large economies of scale in these systems. This implies large herd/flock sizes, large volumes of wastes and high animal health risks. The system is frequently stratified, implying that different enterprises specialize in the production of parent material, the production of young animals or the fattening process. The short production cycle of monogastric species implies a high turnover and therefore a capacity to rapidly adjust to changes in demand for the products and to prices of inputs. The landless monogastric system is almost exclusively based on hybrid and high-producing breeds. This genetic material is widely traded internationally. The poultry and pig industries are a good example of this: the White Leghorn breed now accounts for practically all of the commercial hybrid layers of white eggs. Commercial piggeries tend to rely on only a handful of specialized breeds such as Large White, Duroc and Landrace. This process of hybridization has continued unabated and has resulted in the increased reliance on a small number of breeds to meet the region's food requirements.

The expansion of this system is clearly linked with the extinction of traditional breeds. A large number of European breeds are threatened with extinction because of their perceived lack of economic competitiveness. Ancient breeds have only survived in marginal areas where conditions are unfavourable for intensification and views on breeding and the economy are more conservative. Parallel to the intensification process, new opportunities are emerging for native breeds involving alternative or non-agricultural functions.

Animal diseases

Many countries have been faced with disease outbreaks in recent years: swine fever, foot-and-mouth disease, BSE and avian influenza. This has resulted in changed consumption patterns and has tarnished the image of intensive animal production.

Changing consumption patterns

Changing consumer tastes, product specification and market segregation are stimulating a greater variety in livestock products. This trend is projected to continue. Consumer trends, such as the desire to eat leaner meat or the demand for specialized milk products, also affect breeding policy. Breeds that meet such specified market requirements tend to be favoured. For example, the concentration on Holstein-Friesian cattle across the region has narrowed the genetic base of the milking cattle populations in the region. The growing demand for carpets and luxury items led to the specialization of a range of sheep breeds, from coarse to fine wool types. In many cases local breeds have been mixed with exotic breeds to produce the desired phenotypes.

Political instability

In eastern Europe, large farms were developed under the previous socialist ideology in order to increase and standardize production. Indigenous breeds, often well-adapted to local conditions, were upgraded with a small number of highly specialized exotic breeds, thus considerably narrowing the genetic base. State-owned farms developed new breeds by crossing internationally recognized breeds with indigenous animals in an attempt to improve production. Many competitive breeds and lines of cattle, pigs and chicken were developed in the Soviet Union, and were fully separated from the breeds and lines of the "Western World". As a result, breeds such as Black Pied cattle and Ukrainian Spotted Steppe pigs were developed. Many other local populations, such as the Mingrelian, Mezen and Pechora horse breeds were driven close to extinction by extensive cross-breeding programmes. Introduction of market economies, economic pressures and political instability in the eastern part of the region and the disintegration of the Soviet Union had a serious impact on livestock systems and animal numbers. Many existing breeding and conservation programmes and participating institutions were destroyed. Most breeds and lines still exist, but are threatened by the introduction of the Western breeds and lines.

3 Animal genetic resources

As was explained in the previous chapters, many factors, including agricultural policy, and social and economic developments, have played a role in shaping contemporary breeds. As a result of these processes, the number of breeds for animal production in Europe and the Caucasus has decreased, threatening the genetic diversity of the region's livestock systems. This chapter provides an overview of population data, genetic diversity and risk status in the region.

Table 9 illustrates the number of animals of each major species in Europe and the Caucasus and also gives an estimate of the number of breeds. All names of regional and international transboundary mammalian and avian breeds in Europe and the Caucasus can be found in annex B. Besides the transboundary breeds, 2 917 local breeds are found in the region.

TABLE 9
Total population size and number of local and transboundary breeds of the major livestock species in Europe and the Caucasus 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	719	12	0.4	9.1
Cattle	144 754	305	11.0	30.9
Yak	n/a	1	n/a	n/a
Goat	25 925	183	3.7	32.7
Sheep	171 846	537	18.1	47.6
Pig	191 891	182	20.0	32.2
Ass	1 536	42	3.7	28.0
Horse	6 591	307	12.8	48.4
Dromedary	1 469	1	2.2	3.1
Chicken	2 239 379	653	14.0	57.8
Duck[1]	54 684	74	6.6	35.9
Turkey	126 086	36	43.1	42.4
Goose (domestic)	26 823	107	6.1	64.5

[1] Domestic duck and Muscovy duck.

n/a – not available.

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

Most important species in the region are pigs, cattle, sheep and chickens. The pig population in the region represents 20 percent of the world stock and 32 percent of the number of breeds in the world. As pork production in this region is highly industrialized and only a few multinational breeding companies dominate pork production chains, relatively few native pig breeds exist. The cattle population is smaller, but there is large variety between breeds. For the high input systems, specialized breeds for dairy or beef have been developed. Holstein-Friesians dominate the dairy sector and the French beef breeds the beef sector. The region also accommodates a large number of sheep breeds. The future use of this species in many countries seems to be nature management.

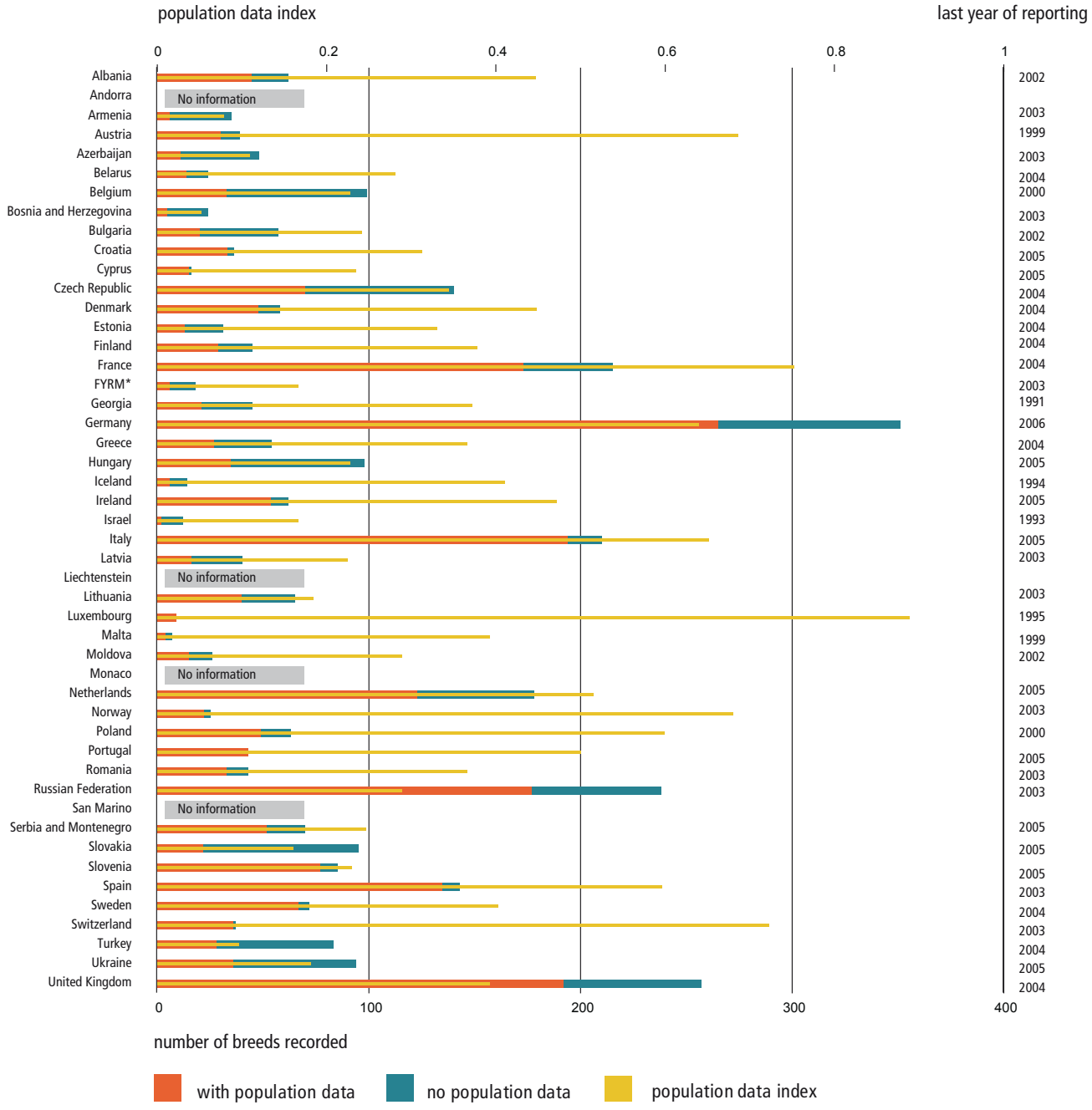
The fact that Europe and the Caucasus accounts for 58 percent of the world's chicken breeds reflects the advanced inventory and description of breeds in this region. Breeding and production of this species is the most specialized and industrialized of all animal species. Three multinationals are active selling highly specialized layers and broilers. The White Leghorn breed accounts for practically all of the commercial layers of white eggs. In the Eastern part of Europe many highly selected lines, bred in the period of the "Cold War", are still available. The importance of turkey in the region is reflected by the relatively large share of the world stock. Nearly half of the region's turkey population is found in France and Italy. The region also accounts for 64 percent of the world's goose breeds.

3.1 Population data

Population data are relatively well available for mammalian and avian breeds in Europe and the Caucasus as compared to the world as a whole. Figure 4 provides a general overview 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 provides an indication of the completeness of the data provided by the country. Selected basic population data fields, regarded as being 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).

The registration of breeds in Europe and the Caucasus is generally very accurate, but varies greatly among the countries of the region (Figure 4). For example, in the case of mammalian breeds Luxembourg has a PDI of almost 90 percent, whereas Turkey has a PDI that is under 10 percent. Besides Luxembourg, high PDIs are also found in France and Switzerland. Germany holds most records of mammalian breeds, followed by the United Kingdom and the Russian Federation. The Netherlands has recorded a surprisingly large number of mammalian breeds given the small size of the country. In the case of avian breeds, the United Kingdom has the highest number of recorded breeds in the region. France and Germany have also recorded many avian breeds. Although nearly all breeds from the United Kingdom have data fields with information, the PDI is under 50 percent.

FIGURE 4A.
Population data status and index for mammalian breeds recorded by countries of Europe and the Caucasus up to December 2005



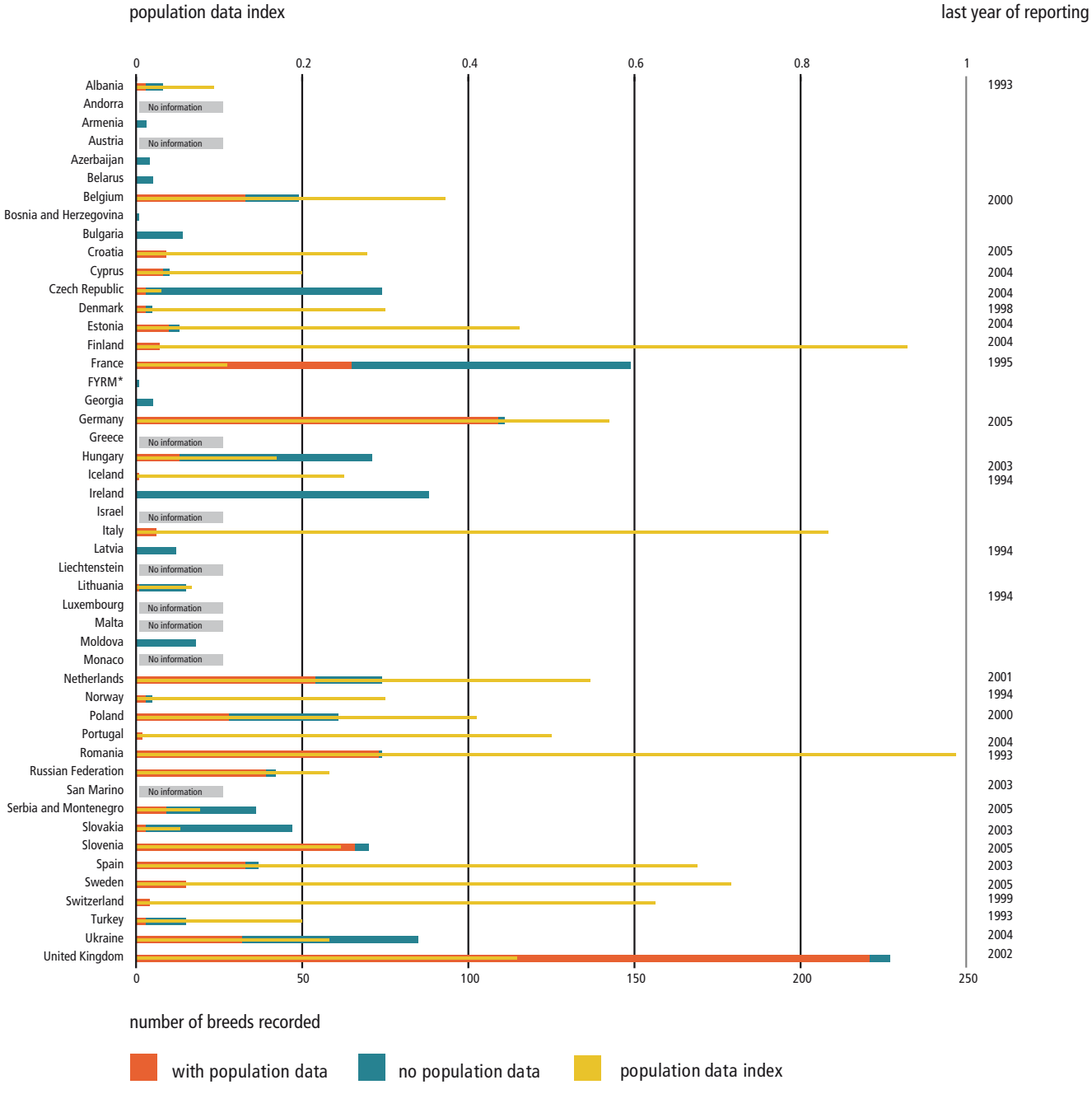
* The former Yugoslav Republic of Macedonia.

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 4B
Population data status and index for avian breeds recorded by countries of Europe and the Caucasus up to December 2005



* The former Yugoslav Republic of Macedonia.

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 Genetic diversity and risk status

The region has a long history of animal breeding. During the last decades of the twentieth century, animal production became dominated by a limited number of high producing, specialized, international breeds. Currently, multinational breeding companies dominate the market for cattle, pigs and poultry. In many countries in the region, national breeding activities have been replaced by private or cooperative breeding companies with an international scope/market. Replacement of local breeds by specialized, international breeds is an important and ongoing trend in the region.

A large number of European breeds are at risk. The definition of risk status categories can be found in Annex C. The risk status for each breed is extracted from the population data, which are recorded in the Global Databank for Farm Animal Genetic Resources (DAD-IS). Figures 5a and 5b illustrate the structure of the data recorded in the databank, showing the risk status of the mammalian and avian breeds recorded for each species up to 2005.

The region has an advanced state of reporting. An almost complete coverage of existing breeds has been achieved. Measuring diversity on the basis of the number of breeds, however, tends to overestimate genetic diversity in Europe and the Caucasus, where a long tradition of breeder's associations has led to the distinction of breeds that in some cases are very closely related. The contribution of some breeds to genetic diversity may therefore be quite small.

Besides local breeds, 8 percent of the breeds in Europe and the Caucasus are classified as "regional transboundary" breeds and 12 percent as "international transboundary" breeds[1]. Table 10 shows the number of breeds in each classification by species. For the identification of trends in erosion, the status of local breeds gives a better indication than that of transboundary breeds. In figures 5a and 5b, "international transboundary breeds" are excluded from the analysis. Among international transboundary breeds, breeds of European descent account for eight of the top ten breeds on a global scale, and 49 of the top 82 breeds (Holstein-Friesian is by far the most widespread breed). Almost all of the most successful European breeds originate from north-western Europe. By 1950, most European breeds had been exported to other countries in the developed countries. European breeds have also been successful in temperate areas of South America and in Southern Africa as well as in the dry tropics.

In Europe and the Caucasus, 36 percent (1 171 out of 3 266) of existing mammalian and avian breeds are categorised as at risk. From a total of 2 628 mammalian breeds, 97 are extinct. Figure 5a shows that there are at-risk breeds among all widely kept mammalian species except the dog (for which few breeds are recorded); other exceptions are minority species such as camels and yaks. Most breeds at risk are categorized as endangered. This category particularly includes a large number of horse, sheep and pig breeds. There are breeds with a critical risk status among all widely kept species except the dog (for which few breeds are recorded); other exceptions are minority species such as camels and yaks. Horses, rabbits and cattle have most breeds with a critical risk status. Seventy percent of the recorded avian breeds are chicken breeds. Among widely kept avian species, 51 percent of ducks, 46 percent of chickens, 41 percent of geese and 36 percent of turkeys are at risk. There are also at-risk breeds among pigeons, ostriches, cassowaries, pheasants, Muscovy ducks and ñandus (Figure 5b). More than half of the breeds with a critical risk status are chicken breeds.

[1] The transboundary breeds are classified as "regional transboundary" breeds if they are restricted to a single region, or as "international transboundary" breeds if their distribution crosses regional borders.

TABLE 10
Number of breeds by breed category and species in Europe and the Caucasus*

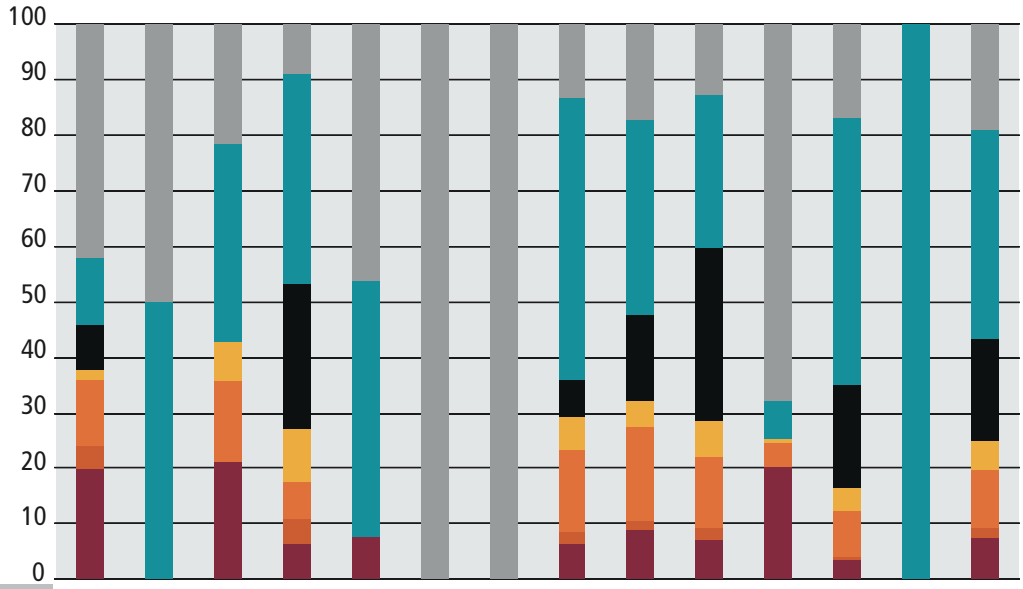
Species	Regional transboundary breeds	International transboundary breeds	Local breeds
Ass	2	3	44
Bactrian Camel	-	2	2
Buffalo	1	1	11
Cassowary	-	1	-
Cattle	30	72	416
Chicken	45	92	642
Deer	1	6	4
Dog	-	-	13
Dromedary	-	-	1
Duck (domestic)	12	12	65
Duck (domestic)/Muscovy duck	-	-	4
Emu	-	1	-
Goat	13	25	186
Goose (domestic)	7	13	100
Guinea fowl	-	2	7
Horse	40	63	338
Muscovy duck	-	1	6
Ñandu	-	1	-
Ostrich	-	1	4
Partridge	-	-	3
Pheasant	-	-	5
Pig	18	28	265
Pigeon	-	-	30
Quail	-	-	8
Rabbit	32	22	125
Sheep	80	78	605
Turkey	7	16	31
Yak (domestic)	-	-	1
Total	288	440	2 916

Source: DAD-IS.

* The transboundary breeds are classified as "regional transboundary" breeds if they are restricted to a single region, or as "international transboundary" breeds if their distribution crosses regional borders.

FIGURE 5A

Risk status of mammalian breeds recorded in Europe and the Caucasus* up to December 2005: absolute (table) and relative (chart) figures



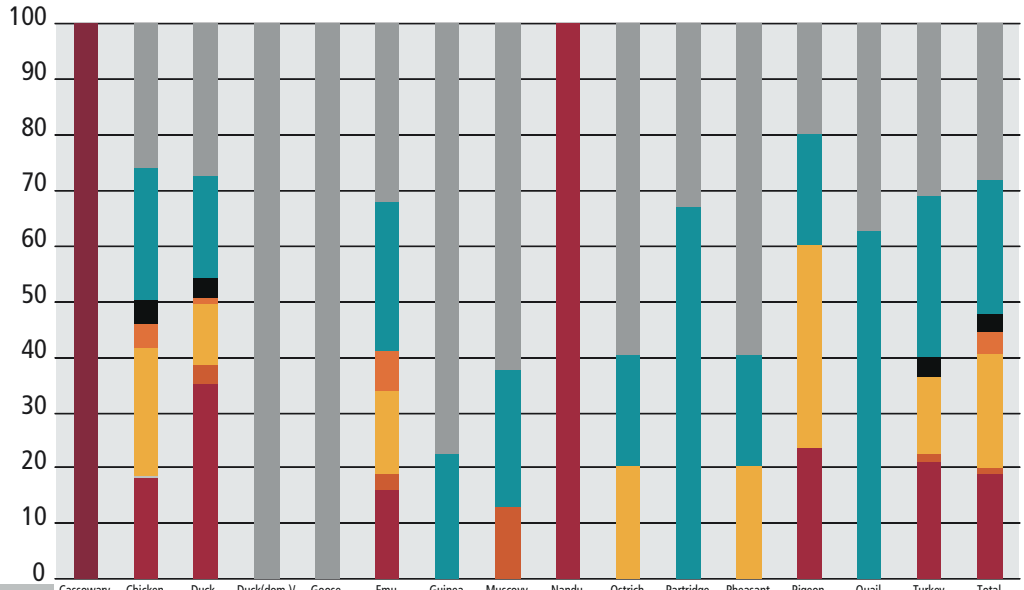
RISK STATUS	Ass	Bactrian Camel	Buffalo	Cattle	Deer	Dog	Dromedary	Goat	Horse	Pig	Rabbit	Sheep	Yak (domestic)	Total
critical	10		3	35	1			15	41	23	38	26		**192**
critical -maintained	2			24				5	8	7		5		**51**
endangered	6		2	37				34	78	42	8	65		**272**
endangered -maintained	1		1	51				13	22	21	1	32		**142**
not at risk	6	2	5	205	6			117	163	90	13	375	1	**983**
extinct	4			142				16	72	102		148		**484**
unknown	21	2	3	48	6	13	1	30	79	41	127	133		**504**
Total	**50**	**4**	**14**	**542**	**13**	**13**	**1**	**230**	**463**	**326**	**187**	**784**	**1**	**2628**

Source: DAD-IS.

* International transboundary breeds are excluded from the analysis.

FIGURE 5B

Risk status of avian breeds recorded in Europe and the Caucasus* up to December 2005: absolute (table) and relative (chart) figures



RISK STATUS	Cassowary	Chicken	Duck (domestic)	Duck(dom.)/ Muscovy duck	Goose (domestic)	Emu	Guinea fowl	Muscovy duck	Nandu	Ostrich	Partridge	Pheasant	Pigeon	Quail	Turkey	Total
critical	1	145	32			20			1				7		12	**218**
critical -maintained		3	3			4		1							1	**12**
endangered		189	10			19				1		1	11		8	**239**
endangered -maintained		35	1			9										**45**
not at risk		192	17			34	2	2		1	2	1	6	5	17	**279**
extinct		34	3												2	**39**
unknown		212	25	4	1	41	7	5		3	1	3	6	3	18	**329**
Total	**1**	**810**	**91**	**4**	**1**	**127**	**9**	**8**	**1**	**5**	**3**	**5**	**30**	**8**	**58**	**1161**

Source: DAD-IS.

* International transboundary breeds are excluded from the analysis.

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Annex A Classification of livestock production systems:

FAO (1996)[4] used the agro-ecological zones (AEZ) described by the Technical Advisory Committee (TAC, 1994)[5] 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.

[4] **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.

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

Annex B1 International transboundary mammalian breeds in Europe and the Caucasus

Mammalian breeds			
Ass	**Cattle *cont.***	**Deer**	**Horse**
Damascus	Kalmyk	Chinese water deer	Barb
Hamadan	Kazakh	Fallow Deer	Belgian Draft
Syrian	Kerry	Muntjac deer	Belgian Warmblood
	Kurdi	Red Deer	Breton
Bacterian camel	Latvian Brown	Reindeer/Caribou	Caspian
Kazakh Bactrian	Lebanese	Sika deer	Cleveland Bay
Mongolian Bactrian	Limousin		Clydesdale
	Lincoln Red	**Goat**	Connemara Pony
Buffalo	Longhorn	Alpine	Costeño
Murrah	Luing	Altai Mountain	Dales
	Maine-Anjou	Anglo-Nubian	Danish Warmblood
Cattle	Marchigiana	Angora	Dartmoor Pony
Aberdeen-Angus	Mirandesa	Bezoar	Don
Abondance	Modicana	Boer	Dutch Warmblood
Ankole	Montbéliarde	British Alpine	Exmoor Pony
Asturian Valley	Murray Grey	Bunte Deutsche Edelziege	Falabella Pony
Aubrac	Normande	Cashmere	Fjord
Ayrshire	Norwegian Red	Creole	Flamand
Bazadais	Piedmont	Cyprus	Friesian
Belgian Blue	Pinzgau	Damascus	Hackney
Belted Galloway	Polled Hereford	French Alpine	Haflinger
Blonde D'aquitaine	Polled Sussex	German Improved Fawn	Hanoverian
Brahman	Puerto Rican	Guadalupe Island	Highland Pony
Brangus	Pustertaler Sprinzen	Kurdi	Hispano-Arabe
British White	Red Angus	Murcia-Granada	Holstein
Brown Swiss	Red Poll	Norwegian Landrace	Iceland Pony
Bushuev	Red Steppe	Oberhasli	Irish Draught
Charolais	Romagnola	Ovambo	Kabarda
Chianina	Salers	Saanen	Karabakh
Creole	Santa Gertrudis	Sinai	Kurdi
Dairy Shorthorn	Sarda	Syrian Mountain	Lipitsa
Devon	Shorthorn	Toggenburg	Lusitanian
Dexter	Simford	West African Dwarf	Mangalarga
Dutch Belted	Simmental		Morgan
Galloway	South Devon	**Horse**	New Forest Pony
Gascon	Sussex	Akhal-Teke	Oldenburg
Gelbvieh	Swedish Red and White	American Paint	Orlov Saddle Horse
Guernsey	Swiss Herens	American Saddle Horse	Orlov Trotter
Hereford	Tarentaise	American Trotter	Palomino
Highland	Welsh Black	Andalusian	Paso Fino
Holstein (black and white)	White Park	Anglo Normad	Percheron
Holstein (red and white)		Anglo-Arab	Przewalski Horse
Jersey		Appaloosa	Purebred Spanish
		Arab	Quarter Horse

Annex B1 *CONT.* International transboundary mammalian breeds in Europe and the Caucasus

Mammalian breeds			
Horse *cont.*	**Pig**	**Sheep**	**Sheep *cont.***
Russian Trotter	Alentejana	Assaf	Lincoln Longwool
Shagya Arab	American Hampshire	Australian Merino	Makui
Shetland Pony	Belgian Landrace	Awassi	Manchega
Shire	Berkshire	Barbados Black Belly	Martinique
Soviet Heavy Draft	Chester White	Bergamasca	Merino
Suffolk	Dalland	Berrichon Du Cher	Mongolian
Swedish Warmblood	Danish Landrace	Black Welsh Mountain	Oxford Down
Tennessee Walking Horse	Duroc	Blackface	Perendale
Thoroughbred	Dutch Landrace	Blanc Du Massif Central	Poll Dorset
Welsh Pony	German Landrace	Bleu Du Maine	Polwarth
	Gloucestershire Old Spot	Bluefaced Leicester	Rambouillet
Rabbit	Hampshire	Booroola Merino	Red Karaman
Angora	Kunekune	Border Leicester	Red Sheep
Angora German	Landrace	Canaria	Romanov
Belgian Hare	Large Black	Castilian	Romney
Blauer Wiener	Large White	Caussenard Du Lot	Ryeland
Bouscat	Meishan	Charmois	Sary-Ja
Butterfly	Middle White	Charollais	Scottish Blackface
California	Pen Ar Lan	Cheviot	Shetland
Chinchilla	PIC HY	Chios	Shropshire
Dutch	Pietrain	Clun Forest	Soay
Fauve de Borgogne	Seghers	Coopworth	South Down
Flemish Giant	Spotted	Corriedale	Soviet Merino
French Lop	Sus scrofa	Cotswold	Spanish Churro
French Silver	Tamworth	Criollo	St. Croix
Japanese	Ukrainian White Steppe	Dorper	Suffolk
Marten	Welsh	Dorset Down	Sussex
New Zealand	Wessex Saddleback	Dorset Horn	Swedish Fur
New Zealand Red		Drysdale	Texel
New Zealand White		East Friesian	Tsigai
Rex		Finnish Landrace	Vendeen
Rheinische Schecken		Friesian Milk	West African Dwarf
Soviet Chinchilla		German Mutton Merino	White Karaman
White Giant		Hampshire Down	Wiltshire Horn
		Herki	
		Ile-De-France	
		Jacob	
		Karakul	
		Kazakh Fat-Rumped	
		Khangai	
		Lacaune	
		Lacha	
		Leicester Longwool	
		Limousin	

Annex B2 International transboundary avian breeds in Europe and the Caucasus

Avian breeds			
Chicken	**Chicken *cont.***	**Chicken commercial strains**	**Duck (domestic)**
Ancona	Orpington Buff	broiler, Arbor Acres AA broiler breeders	Aylesbury
Andalusian	Paduan	broiler, Euribrid Hybro	Blue Swedish
Appenzeller Spitzenhauben	Phoenix	broiler, Ross	Cayuga
Araucana	Plymouth Rock	broiler, Ross 208	Crested
Aseel	Plymouth Rock Barred	broiler, Ross 308	Indian Runner
Australorp	Plymouth Rock White	broiler, Shaver Redbro	Khaki Campbell
Barnevelder	Polish	broiler, Shaver Starbro	Orpington
Brahma	Rhode Island Red	Hubbard	Pekin
Campine	Satsuma-Dori	layer, Anak	Rouen
Catalana Del Prat	Shamo	layer, Babolna Harco	Saxony
Cochin	Silkie	layer, Babolna Tetra-SL	Welsh Harlequin
Cornish	Spanish	layer, Cobb 500	White Pekin
Crèvecoeur	Sultan	layer, Euribrid Hisex	
Croad Langshan	Sumatra	layer, Euribrid Hisex Brown	**Turkey**
Derbyshire Redcap	Sussex	layer, Hendrix Bovan Goldline	American Bronze
Dominique	Sussex Speckled	layer, Hy-Line	Beltsville
Dorking	Transylvanian Naked Neck	layer, Hy-Line Brown	Black
Faverolle	Welsummer	layer, Hy-Line White	Blue
Fayoumi	White Cornish	layer, ISA Brown	Bourbon Red
Frizzle	Wyandotte	layer, Leghorn	Broad Breasted Bronze
Hamburg	Wyandotte White	layer, Lohmann	Broad Breasted White
Hampshire		layer, Lohmann Brown	Bronze
Holland	**Cassowary**	layer, Lohmann White	Buff
Houdan	Cassowary	layer, Shaver	Dutch White
Hungarian Yellow		layer, Shaver 579	Mammoth Bronze
Indian Game	**Muscovy Duck**	layer, Shaver Starcross	Narragansett
Japanese Bantam	Muscovy	Rodonit	White
Japanese Game Bantam		Sebright	
Jersey Giant	**Emu**		**Turkey commercial strains**
La Fléche	Emu	**Goose (domestic)**	BUT
Lakenvelder		African Goose	Hybrid
Langshan	**Guinea fowl**	Bourbonnaise	Nicholas
Light Sussex	Purple Guineafowl	Chinese	
Malay Game	White Guineafowl	Embden	
Minorca		Pilgrim	
Modern Game	**Nandu**	Pomeranian	
Nankin	Ñandú	Rhein	
New Hampshire		Roman	
New Hampshire Red	**Ostrich**	Sebastopol	
Old English Game	Australian	Swan	
Onagadori		Toulouse	
Orloff		White Emden	
Orpington		White Hungarian	

Annex B3 Regional transboundary mammalian breeds in Europe and the Caucasus

Mammalian breeds		
Ass	**Goat**	**Horse**
Cyprus	Azerbaijan	Altai
Poitou	Bonte Geit	Anglo-Kabarda
	Brown Shorthair Goat	Bavarian Warmblood
Buffalo	Carpathian Goat	Bosnian Pony
Caucasian	Dutch Pied	Boulonnais
	Grisons Striped	Budyonny
Cattle	Karachai	Buša Pony
Angeln	Maltese	Camargue
Armorican	Mingrelian	Comtois
Azerbaijan Zebu	Poitou	Czech Warmblood
Breton Black Pied	Valais Blackneck	Dagestan Pony
Buša	Weiße Deutsche Edelziege	Estonian Draft
Cachena	White Shorthaired Goat	Fell Pony
Caucasian		Finnhorse
Caucasian Brown	**Pig**	Freiberger
Caucasian Red	Black Slavonian	French Saddlebred
Danish Red	British Landrace	Furioso-Northstar
Estonian Red	Finnish Landrace	Gidran
Fighting Bull	French Landrace	Gotland Pony
Grauvieh	Kahyb	Hutsul
Greater Caucasus	Mangalitsa	Karachai
Groningen White-Headed	Mangalitsa Blond	Kladruby
Hinterwald	Mangalitsa Red	Knabstrupper
Hungarian Steppe	Mangalitsa Swalow Belly	Maremmano
Kostroma	North Caucasus	Merens Pony
Lebedin	Norwegian Landrace	Mur Island
Mölltaler	Norwegian Yorkshire	Nonius
Parthenais	Polish Large White	Noric
Podolian	Šiška	Norman Cob
Polish Red	Swedish Landrace	Pinkafö
Ramo Grande	Swedish Large White	Polish Konik
Russian Brown	Turopolje	Posavina
Slovenian White	Ukrainian	Pottok
Svensk Fjällras		Silesian Norik
Tuxer (ger.)		Tarpan
White Galloway		Tersk
Whitebacked Cattle		Tinker
		Trakehner
Deer		Tuigpaard
Roe deer		Westphalian Warmblood

Annex B3 *CONT.* Regional transboundary mammalian breeds in Europe and the Caucasus

Mammalian breeds		
Rabbit	**Sheep**	**Sheep cont.**
Alaska	Askanian	Portland
Belgian Giant	Balbas	Precoce
Belgian Giant Albino	Beltex	Prekos
Blaugraue Wiener	Blue Texel	Racka
Burgundy	Bozakh	Romanian Zackel
Chinchilla giant	Brigasca	Rouge De L'ouest
Chinchilla small	British Milksheep	Rouge Du Roussillon
Deilenaar	Brown Mountain	Roussin De La Hague
English Spot	Cambridge	Russian Mountain Merino
English Wether	Carinthian	Rygja
Fox	Castlemilk Moorit	Salsk
Graue Wiener	Caucasian Merino	Schwarzbraunes Bergschaf
Hare	Chushka	Skudde
Havanna	Cikta	Solcava
Hermelin	Coburger Fuchs	Solognot
Lynx	Cotentin	Soviet Mutton-Wool
Marburger Feh	Dala	spælsau
Mecklenburger Schecke	Devon and Cornwall Longwool	Stavropol
Pearl	Est à laine Mérino	Steigar
Rex Small	French Alpine	Steinschaf
Rhön	Galway	Steppe Voloshian
Russian	Gedek	Swifter
Satin	German Blackheaded Mutton	Tiroler Steinschaf
Schwarze Wiener	German Mountain	Valachian
Siamese	Hebridean	Valais Blacknose
Silver	Herdwick	Vlaams Schaap
Tan	Herik	Waldschaf
Three Colour Spotted	Hungarian Zackel	Weißes Alpenschaf
Thüringer	Icelandic	Wensleydale
Weisse Wiener	Karabakh	Yugoslav Zackel
White Hotot	Kempen Heath	Zwartbles
Wiener	Kerry Hill	
	Krainer Steinschaf	
	Kuibyshev	
	Latvian Darkheaded	
	Leine	
	Lezgian	
	Lleyn	
	Manx Loghtan	
	Mazekh	
	Mergelland Schaap	
	Merinolandschaf	
	Norfolk Horn	
	North Caucasus Merino	
	North Caucasus Semi-Fine Wool	
	North Ossetian Semi-Fine Wool	
	North Ronaldsay	
	Olkusz	
	Ouessant	

Annex B4 Regional transboundary avian breeds in Europe and the Caucasus

Avian breeds		
Chicken	**Chicken commercial strains**	**Turkey**
Altsteirer	broiler, Euribrid Hybro N	Cröllwitzer
Amrock	broiler, Shaver Minibro	Red
Appenzeller Barthuhn	layer, Euribrid Hisex White	Ronquieres
Augsburger		
Barbu d'Anvers	**Duck (domestic)**	**Turkey commercial strains**
Barbu d'Uccle	Abacot Ranger	BUT 8
Barnevelder Bantam	Appleyard	BUT 9
Belarus 9	Black East Indian	BUT BIG 6
Belgian Game	Call	Hybrid Euro FP
Braekel	Duclair	
Bresse	Emerald	
Cochin Bantam	Hook Bill	
Dresdener	Huttegem	
Friesland	Overberg	
Gournay	Pommern	
Houdan Bantam	Rouen Clair	
Italian	Swedish Blue	
Kraienkoppe		
Kraienkoppe Bantam	**Goose (domestic)**	
La Fléche Bantam	Czech White	
Lakenvelder Bantam	Diepholzer	
Legbar	Landaise	
Lincolnshire Buff	Large Grey	
Marans	Oies D'alsace	
Marans Bantam	Slovak	
Marans White	Steinbacher	
Norfolk Grey		
North Holland Blue		
Old English Game Bantam		
Oravka		
Progress		
Rhinlander		
Rhode Island Red Bantam		
Rhodebar		
Rumpless Game		
Scots Dumpy		
Sicilian Buttercup		
Sulmtaler		
Thüringer Barthühner		
Transylvanian Naked Neck Bantam		
Vorwerk		
Welsummer Bantam		

Annex C

Definition of risk status categories

Breed populations are categorized as endangered, endangered-maintained, critical or critical-maintained. The categorization is based on the overall population size, the number of breeding females, the number of breeding males, the percentage of females bred to males of the same breed and the trend in population size.

A breed is categorized as CRITICAL if: the total number of breeding females is less than or equal to 100 or the total number of breeding males is less than or equal to five; or if the overall population size is less than or equal to 120 and decreasing and the percentage of females being bred to males of the same breed is below 80 percent.

A breed is categorized as ENDANGERED if: the total number of breeding females is greater than 100 and less than or equal to 1 000 or the total number of breeding males is less than or equal to 20 and greater than five; or if the overall population size is greater than 80 and less than 100 and increasing and the percentage of females being bred to males of the same breed is above 80 percent; or if the overall population size is greater than 1 000 and less than or equal to 1 200 and decreasing and the percentage of females being bred to males of the same breed is below 80 percent.

Breeds may be further categorized as CRITICAL-MAINTAINED or ENDANGERED-MAINTAINED. These categories identify critical or endangered populations for which active conservation programmes are in place or those that are maintained by commercial companies or research institutes.

Strategic priorities: **Europe and the Caucasus**

The priorities presented here represent a summary of the views of European countries on Strategic Priorities for Action for the Europe and the Caucasus region, which are based on:

- discussions among National Coordinators for the Management of Animal Genetic Resources within the European Regional Focal Point; and
- input of the members of the FAO Intergovernmental Technical Working Group on Animal Genetic Resources (ITWG-AnGR) representing the European region, during the Fourth Session of the ITWG-AnGR, Rome, 13–15 December 2006.

1 Priority areas

Five priority areas are suggested:

- inventory, monitoring and characterization;
- sustainable use and development;
- conservation;
- capacity building; and
- public and stakeholder awareness.

1.1 Inventory, monitoring and characterization

There is a need for better monitoring of status and trends of animal genetic resources (AnGR) in Europe and the Caucasus. It is important to continuously monitor "genetic risks", including maintenance of within-breed genetic variation. Good and useful in indicators need to be developed for monitoring and early warning purposes, to be used at national level.

An integrated approach to characterization, inventory and monitoring of AnGR should be promoted. Clear and separate steps are needed, starting with inventory. Characterization is not the first priority for breeds under threat. When inventories and monitoring have to be established or developed, use should be made of existing herd books as well as of livestock registration and identification systems.

The term "breed" is a central element in inventories and monitoring of animal diversity. No widely accepted definition is available for the term, and no such a definition is likely to emerge in the foreseeable future. However, it may help to note that the term breed reflects a mix of biological and social factors; so for instance it refers to the case of closed and homogeneous populations as well as to landraces with open and heterogeneous structure. Also breeds may have been established only decades ago, while others have undergone an evolution of centuries.

It should be stressed that the national responsibility to decide on whether breeds are endangered must not be touched by international standards or protocols. FAO's Domestic Animal Diversity Information System (DAD-IS) should be strengthened to gain information from the national databases and monitoring systems, and to evaluate, condense and distribute this information for the purposes of highlighting threats and needs.

For the monitoring of "local" and "transboundary" breeds at regional level and to harmonize policy development (e.g. to calibrate support for genetic resources in rural development programmes within the EU), there is also a need to further develop and use the European Farm Animal Biodiversity Information System (EFABIS).

Assessment of the value and importance of local production systems is needed, including assessment of trends and drivers of change that may affect the genetic base and the resilience and sustainability of production systems.

1.2 Sustainable use and development

Sustainable breeding programmes, enhancement and continued use of a variety of breeds are the most important strategies to maintain farm animal genetic diversity in Europe. A key target in AnGR-related work is to have long-term plans for enhancing the profitability and quality of animal production for human consumption and livelihoods in the light of growing human population. This would require sound and cohesive selection programmes for local and mainstream breeds with the objective of meeting present and foreseeable breed functions and needs of markets and consumers. Regarding local, native breeds there are opportunities for niche markets and other functions.

The potential of AnGR lies in the large amount of variation that exists within livestock populations. This variation should be maintained. The domestication process, and to a greater extent recent intensive selection schemes, have shown that very substantial and continued progress can be made with no signs of slow down in the rate of change. However, there are risks. It should be emphasized that there is a need to improve understanding of genetic resources, to provide guidelines for sustainable selection practices, and to encourage development work for local populations. This would cover both pure and cross-breeding strategies. It is very important to carefully balance conservation and genetic improvement programmes. Breed development strategies should recognize the importance of sustainability traits such as disease resistance, hardiness and selective grazing to manage biodiversity, as well as the wider socio-economic and environmental context.

1.3 Conservation of animal genetic resources

Conservation objectives should cover both mainstream and local breeds. Mainstream poultry, pig and cattle breeds provide the majority of animal products and play an important international role in industrial production systems. These breeds require sustainable selection policies. It is widely accepted, that a broad genetic variability between and within breeds is essential for the present and future needs of livestock production. Therefore, adequate means to ensure that this broad variability is maintained need to be in place. The strategy should be to maintain variation within and between breeds to meet future needs.

The most realistic approach to maintain diversity in a long-term perspective should be to keep a broad diversity of breeds in economical production. This should be the key approach with respect to the use of AnGR. Enhanced utilization should be seen as a way to support conservation, in such a way that the long-term goal of conservation schemes should be profitable use of the breeds involved. Limited financial resources mean that it is not possible to maintain all existing breeds. Therefore, we need procedures to prioritize breeds and conservation strategies. Absolute priority should be given to all means which lead to the sustainable use of a broad diversity of breeds *in situ* without need for support from public funds or extra funding. *In situ* conservation measures allow for the maintenance and adaptive management of AnGR in productive landscapes. *In situ* measures facilitate continued co-evolution in diverse environments, and avoid stagnation of the genetic stock. *In situ* conservation measures are best based on agro-ecosystem approaches and, ideally, should be established through economically and socially profitable sustainable use. However, in some instances this can only be achieved after initial investments in creating markets and in product development. In cases where this is not possible, direct support, including direct payment for the *in situ* conservation of AnGR, may be necessary, and are comparable to payment for agri-environmental services. Specific elements of conservation programmes include the enhancement of efforts to improve underutilized breeds, especially within low to medium external input production systems. Furthermore, assessments of the impact of exotic animal breeds and the development of measures to prevent negative impacts could be very relevant.

As public funding will always be restricted, conservation disconnected from human use should only be a last resort. However, genetic erosion of AnGR has complex drivers and cannot be halted by one simple solution. Therefore, a combination of linked *in situ* and *ex situ* measures is necessary. The main focus of *ex situ* backup systems should be to protect against the risk of emergency or disaster scenarios. Breeding programmes should include elements for the maintenance of genetic variation within breeds. Regular breeding schemes should always include back-up storage of genetic variation in the form of frozen semen or embryos as an insurance policy. Cryopreservation methods and strategies to serve as a safety net for in vivo conservation should be further developed. There is a need to exchange knowledge and protocols as a contribution to further professionalization of *ex situ in vitro* strategies.

Conservations decisions need to be increasingly based on genetic indicators in addition to phenotypic aspects. Another important issue is to review sanitary standards with regard to their impact on the accessibility of the conserved genetic resources.

1.4 Capacity building

There are significant differences within and between regions in terms of national human, institutional, technological and research capacities for the sustainable use and development of AnGR. Developing countries and countries with economies in transition will greatly benefit from exchange and collaboration with countries with comparative advantages in this area, as well as from multilateral and bilateral technical support.

Regional collaboration in the use and development of transboundary breeds, which now often depend on a narrow genetic base, could be established and strengthened. Technical cooperation for technology transfer and enhanced educational and other training opportunities should be strengthened, to assist developing countries and countries with economies in transition to better conserve AnGR.

Capacity building is fundamental to efficient implementation of measures to promote sustainable AnGR breeding programmes, utilization of national breeds and import of exotic genetic resources. Capacity building must be understood in a broad and dynamic context, including regulatory frameworks. Both bilateral and multilateral initiatives could be effective to support capacity building. It is important to develop organizations, which keep herd books, implement and perform breeding and conservation programmes. A legal framework for the functioning of breeding programmes is important. Strong coordination at national level, involving National Focal Points, the breeding industry, administration, science and NGOs should also be developed.

The European region would like to emphasise the importance of supporting the further development of a country-driven Regional Focal Point under a more secure financial footing.

1.5 Public and stakeholder awareness

Lack of public awareness about the important roles and values of AnGR is one of the main bottlenecks for implementation of policies and strategies. Besides public awareness, it is crucial to involve a broad range of stakeholders in the conservation and sustainable use of AnGR. Furthermore, it is crucial increasingly to mainstream sustainable use and conservation objectives into livestock policies.

2 National versus international level policies

In realizing the priority objectives the emphasis should clearly be at the national level. The main responsibility lies at country level, and implementation is a country-driven process. Comprehensive national policies should be developed for sustainable use. This should include setting strategic objectives for breeding and sustainable use, ideally built into a national action plan endorsed by the national government.

There are considerable numbers of regional and international transboundary breeds. Collaboration for *in situ* conservation is desirable for regional transboundary breeds and for transhumant livestock populations held by pastoralist communities that cross national boundaries.

To maximize efficiency and cost saving in the implementation of *ex situ* conservation measures, regional and global strategies and facilities may be preferred over the duplication of national efforts, providing that modalities are developed for sharing facilities among countries and that conservation policies remains under national sovereignty. In the medium and long term, and taking into account likely environmental and socio-economic change such as that which will be precipitated by climate change over the next few decades, as well as other more immediate disasters and emergencies, it is likely that international interdependence with regard to AnGR will increase. This provides further reason for the international community to collaborate in conservation measures, for local, regional and international transboundary breeds, under fair and equitable arrangements for storage, access and use of AnGR. Regional or global cooperation should be based on national efforts, but not substitute for them. Countries could be helped to develop and implement conservation plans combining *in situ* and *ex situ* measures. Integrated support arrangements to protect breeds and populations at risk from emergency or other disaster scenarios, and to enable restocking after emergencies in line with national policies should be established. A global network of gene banks for AnGR should be established. Research is needed to develop or standardize where necessary *in situ* and *ex situ* methods and technologies, including for conservation breeding. Knowledge, technologies and best practices need further dissemination.