STATE OF ETHIOPIA'S ANIMAL GENETIC RESOURCES - COUNTRY REPORT

A CONTRIBUTION TO THE FIRST REPORT ON THE STATE OF THE WORLD'S ANIMAL GENETIC RESOURCES

BY

INSTITUTE OF BIDIVERSITY CONSERVATION (NATIONAL FOCAL POINT)

E-MAIL: bioresearch@telecom.net.et

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ACRONYMS

AAU	Addis Ababa University
ACA	Awassa College of Agriculture
ADB	African Development Bank
AI	Artificial Insemination
AnGR	Animal Genetic Resource
ARARI	Amhara Regional Agricultural Research Institute
ARDU	Arsi Rural Development Unit
ASARECA	Association for Strengthening Agricultural Research in Eastern and Central Africa
ATVET	Agricultural Technical and Vocational Education Training
AUA	Alemaya University of Agriculture (now AU)
AU	Alemaya University
BLPD	Borena Lowland Pastoral Development Program
BSAP	Biodiversity Strategy Action Plan
BTA	Biotechnology Trust for Africa
CBD	Convention on Biological Diversity
CSA	Central Statistics Authority
DAD-IS	Domestic Animals Diversity Information System
DAGR-IS	Domestic Animal Genetic Resources Information System
DPPC	Disaster Prevention and Preparedness Commission
DU	Debub University
EARO	Ethiopian Agricultural Research Organization (x- IAR)
EPA	Environmental Protection Authority
FAO	Food and Agriculture Organization of the United Nations
FDRE	Federal Democratic Republic of Ethiopia
FINIDA	Finland International Development Agency
GDP	Gross Domestic Product
GO	Governmental Organization
GTZ	German Technical Cooperation
ha	hectare
HF	Holstein-Friesian
HLI	Higher Learning Institutions
IAR	Institute of Agricultural Research (now EARO)
IBC	Institute of Biodiversity Conservation
IBCR	Institute of Biodiversity Conservation and Research (now IBC)
IDAD	Institute of Domestic Animals Diversity
ILRI	International Livestock Research Institute
INRA124	y-specific allele microsatellite locus
KARI	Kenya Agricultural Research Institute
masl	meters above sea level
MNRDEP	Ministry of Natural Resources Development and Environmental Protection
MoA	Ministry of Agriculture
MoARD	Ministry of Agriculture and Rural Development
MOET	Multiple Ovulation and Embryo Transfer

MSFD	Ministry of State Farms Development
MU	Mekele University
MW	Megawatt
NA	not available
NAIC	National Artificial Insemination Center
NCC	National Consultative Committee
NCS	National Conservation Strategy
NDC	National Drafting Committee
NEPAD	New Partnership for Africa's Development
NFP	National Focal Point
NGO	Non-Governmental Organization
NLDP	National Livestock Development Program
NVI	National Veterinary Institute
QTL	Quantitative Trait Locus
RDPSI	Rural Development Policies, Strategies and Instruments
RIR	Rhode Island Red
RRC	Relief and Rehabilitation Commission
SIDA	Swedish International Development Agency
SNNP	Southern Nations Nationalities and Peoples
SSA	Sub-Saharan Africa
UN	United Nations
UNCED	United Nations Conference on Environment and Development
UNICEF	United Nations International Children's Emergency Fund
UNRRA	United Nations Relief and Rehabilitation Administration
WFP	World Food Program

EXECUTIVE SUMMARY

In response to FAO's request, the National Drafting Committee prepared this Country Report following FAO's guidelines developed for the process of preparing the first Report on the State of the World's Animal Genetic Resources. The Committee, which comprised of six experts representing relevant government institutions, has prepared a comprehensive Country Report on the state of Ethiopia's farm animal genetic resources.

The report contains six parts: Part 1 describes the country's major animal production systems and related animal genetic resources, their diversity, utilization, relative importance, and provides an overview of the state of the art and tools for the utilization and conservation of animal genetic resources. Part 2 provides an overview of the past and present policies, strategies, programs and management practices; analysis of future demands, trends of animal products, changes in production systems and their impact on animal genetic resources. Part 3 provides an assessment of the current and future national capacity building requirements to undertake activities related to animal genetic resources. Part 4 identifies opportunities, challenges and strategic priorities for action. Parts 5 and 6 discuss future areas of international co-operation for utilizing and conserving the country's farm animal genetic resources.

Ethiopia is endowed with diverse ecosystems inhabited by an abundant diversity of animal, plant and microbial genetic resources. The country's geographical proximity to the historical entry point of many livestock populations from Asia and Europe to Africa and the diverse topographic and climatic conditions as well as the wide ranging production systems have further contributed to the existence of a large diversity of farm animal genetic resources. Indigenous breeds of farm animal genetic resources (that contribute most to food and agriculture in the country), namely cattle, sheep, goats, camels, donkeys, horses, mules and chickens identified so far number 25, 13, 15, 4, 4, 2, 2 and 5, respectively. Moreover, there are 3 dairy cattle, 7 sheep, 7 chickens and 2 goat exotic breeds used for food and agriculture.

Farm animals are an integral part of the Ethiopian agricultural fabric. They are the country's source of food, traction, manure, raw materials, investment, cash, security, and foreign exchange earnings as well as its social and cultural identity. They are one of the input suppliers to the manufacturing sector of the country. The contribution of livestock to the total agricultural GDP and national foreign currency earnings are about 30% and 16%, respectively.

The livestock production systems are characterized as mixed crop-livestock, agro-pastoral, pastoral and peri-urban and urban. The majority of livestock are kept in low input production system in rural areas, while some species are kept in medium input system mainly in peri-urban and urban areas.

The institutional and human resource capacity to properly utilize and conserve the country's animal genetic resources is very limited. Currently, government organizations, primarily MoARD, EARO, and IBC as well as institutions of regional research, higher

learning and ATVET centres are involved in activities related to the utilization and conservation of farm animal genetic resources. International or bilateral agencies provide some financial and technical inputs.

Commercial private farms in and around urban areas use the exotic and crossbred dairy cattle and chickens. Lowland areas produce most of the export cattle and shoats. An improved beef production system would create good opportunity for both domestic and international markets. Ethiopia has a comparative advantage in producing such quality beef for nearby Middle East and other countries. However, there is a need to further develop efficient infrastructure to utilize these opportunities. Breeding programs for sustainable use of AnGR is not available. There is a need to urgently develop appropriate breeding programs for the different livestock breeds adapted to the different agro-ecological zones.

A top priority for the utilization and conservation of AnGR in the country is the characterization of different species of farm animals (including genetic and molecular level), census at breed level and breeds' bio-geographic distribution. There is a need for capacity building in farm animal use, development and conservation-related disciplines so as to implement AnGR programs.

The national policy on biodiversity conservation and development is formulated based on the rationale that the conservation of biodiversity is one of the conditions of overall national economic development. IBC has developed the Biodiversity Strategy and Action Plan. However, a national livestock breeding policy is not yet in place. In this regard, there is a need to develop a sound breeding policy and strategy for conservation and sustainable use of animal genetic resources.

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1.1. Introduction

1.1.1. Physico-geographic and climatic features

Ethiopia is located in the horn of Africa, bordering Eritrea in the north, Djibouti and Somalia in the east, Kenya in the south and Sudan in the west. The country stretches from 3^0N of the equator to latitude 15^0N and from 33^0E to 48^0E longitude. With a land area of 110 million hectares, Ethiopia is the ninth largest country in Africa (MoA, 2004).

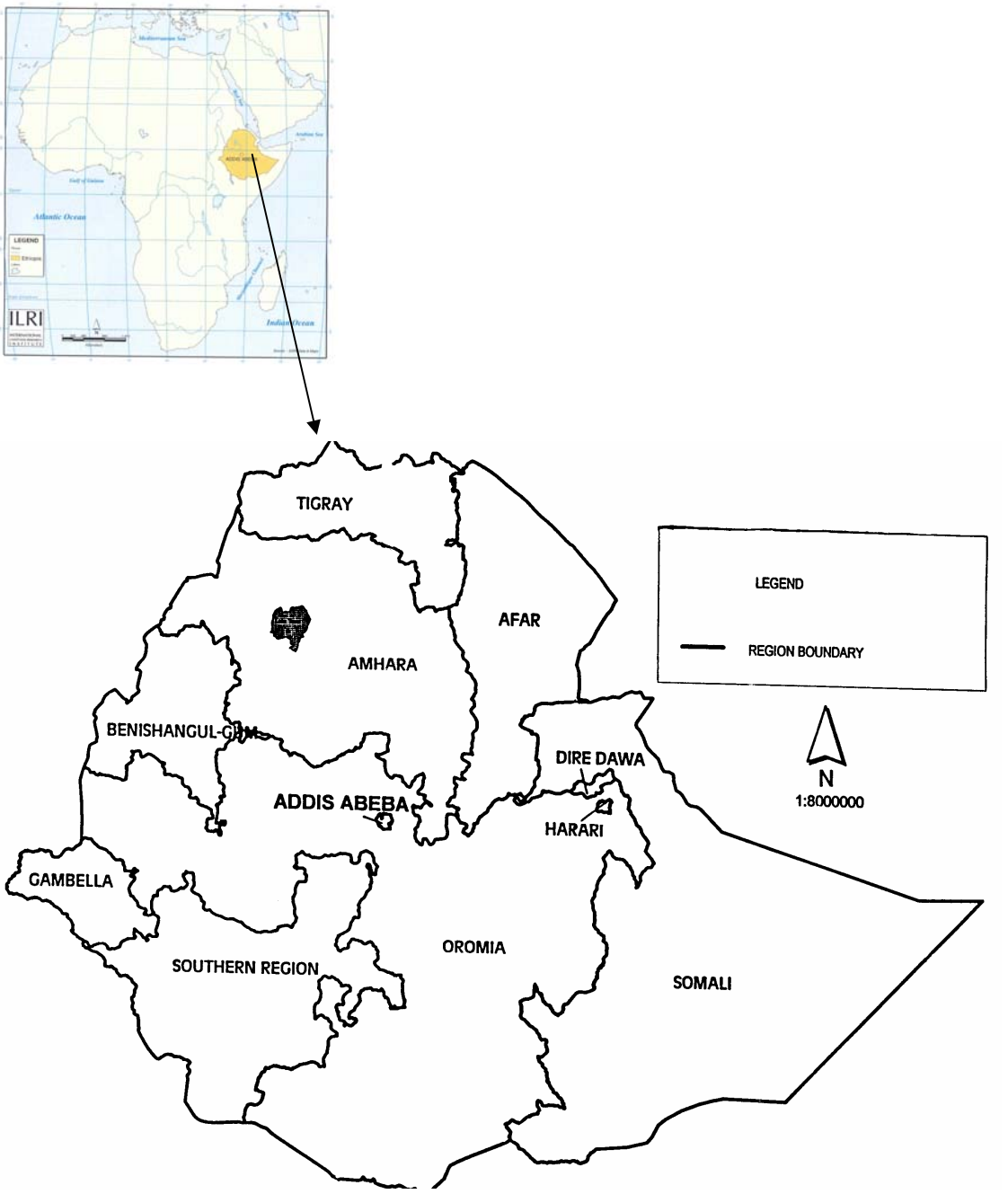
Ethiopia is a country of great geographic diversity. Erosion, volcanic eruptions, tectonic movements and subsidence have occurred for centuries in the country and still continue to occur accentuating the unevenness of the surface. As a result, Ethiopia is subjected to wide latitudinal and physico-geographic variations. The latitudinal variation of the country ranges from 110 meters below sea level in the Danakil depression to the highest peak of 4,620 meters above sea level (masl) on Mount Ras Dashen. The physico-geographic features are composed of high and rugged mountains, flat-topped plateaux, deep gorges, incised river valleys and rolling plains. The western and southeastern highlands are separated by the Great Rift Valley that runs from northeast to southwest of the country. Extensive semi-arid lowlands in the east, south and west are extensions of these highlands.

The Ethiopian highlands cover the central lava highlands, the southwestern plateau and the southeastern highlands. The southeastern highlands have high mountains on their western rims having slopes that run continuously towards the southeastern lowlands.

Macro- and micro-climatic conditions of the country are highly variable. The rainfall distribution is seasonal. The major rainy season lasts from June to September followed by short rainy season that occurs between February and April. The mean annual rainfall ranges from 500 mm to 2800 mm. The southwestern regions receive the heaviest annual rainfall, which, in some areas, goes up to 2800 mm. Rainfall is moderate in the central regions and declines towards northeast and eastern Ethiopia. Annual rainfall in the southeastern and northern regions is about 700 mm and 500 mm, respectively. Similarly, temperature variations are wide. During certain seasons, temperatures go above 30^0C or below 10^0C in one place or another. Regimes of relative humidity, influenced by the rainfall patterns and temperature levels, are also highly variable. Because of the combined effects of the above factors, the country is endowed with diverse ecosystems that are inhabited by amazingly great diversity of animal, plant and microbial genetic resources (FAO, 2001).

Ethiopia is comprised of nine federal states and two city councils (Figure 1). Eighty-three distinct languages having 200 dialects are spoken. Amharic is the working language of the Federal government. As per the provision of the Constitution, official languages used in the regional states are those that are chosen by the respective states. English is widely used in business and academic circles (MoA, 2004).

Figure 1. Regional States of the Federal Democratic Republic of Ethiopia



1.1.2. Population

The Estimated human population of Ethiopia in 1980 and 1990 were 37.7 million and 50.8 million, respectively with an average annual growth rate of about 3%. Today, Ethiopia is the third most populous country in Africa. The estimated current population is 69.1 million with annual rate of growth at 2.7% (Annex Table 1.7). The projected human population is estimated at 84, 106 and 129 million in 2010, 2020 and 2030, respectively. Females constitute 49.8% of the current population. Forty-seven percent of the females, i.e. 24% of the population, are of childbearing age. The population between ages 15 and 59 years constitutes 52.2% of the current total, while the population under 15 years constitutes about 43%. The level of fertility, at about 5.9 during the current year, is among the highest in sub-Saharan Africa. The level of total fertility in rural areas is higher than in the urban areas. According to the population census of 1994, for example, total fertility of the rural areas (6.4) was almost twice as high as in the urban areas (3.3). Crude birth and death rates (number of births and deaths per 1000 population per annum) between 1994 and 2000 were 44.4 and 44.2, and 16.4 and 15.0, respectively. In 1994, life expectancy of females and males was about 52.7 and 50.2 years, respectively (Genet Mengistu, 2004).

The majority of Ethiopians dwell in rural areas. The proportion of urban dwellers until about 1940s was less than 3%. Over the years, this proportion increased reaching 9.7, 11.4, 13.8 and 15.0% in 1970, 1984, 1994 and 2004, respectively (Annex Table 1.7). According to projections made by Genet Mengistu (2004) the proportion of the urban dwellers in 2010 and 2020 will be 17.2% and 19.9%, respectively.

Distribution of the population is highly skewed towards the highlands. This is attributed mainly to different environmental factors. About 80% of the population is settled in 45% (above 1500 masl) of the country's land area. As a result, the highland areas are more densely populated than the lowland areas, which are characterized, by insufficient rainfall, high temperature regimes and vector infestation such as by tsetse flies. The highland areas, therefore, have for long been subjected to severe overgrazing and degradation of its natural resources.

1.1.3. Agriculture

Agriculture is the main stay of the Ethiopian economy employing about 85% of the total population. It contributes about 45% to the GDP, 90% to the total export earnings and 70% of the raw materials to the agro-industrial sector. At present smallholders dominate as they generate more than 95% of the overall national agricultural output. Despite this, due to limited access of the smallholders to agricultural inputs and extension services, farming is still practised in traditional ways (MoA, 2004). According to CSA (2004), for example, the proportion of the total cultivated land where fertilizer, pesticides and improved seeds are applied/used constitutes only 36.8, 8.2 and 2.8%, respectively. Similarly, the proportion of the crop-farming households (totalling about 11 million) who

participate in the extension package is only 5.6%. The level of education of the farming community is very low. Illiterate farming households comprise about 64.6% of the total.

About 66% of the country's land area is suitable for agriculture but only 22% of this area is currently under cultivation. Similarly, only 4.4% (0.16 million ha) of the country's potentially irrigable land is under irrigation (MoA, 2004), and about 90% of total cultivated area is occupied by crops. More than half the country's land mass is suitable for grazing and browsing (Annex Table 1.2). Land tenure for livestock production is under private and communal grazing (Annex Table 1.4).

Farm animals are an integral part of the Ethiopian agricultural fabric. They are sources of food, traction, manure, raw materials, investment, cash, security, foreign exchange earnings, social and cultural identity. The success of Ethiopian agriculture, in addition to other factors, is based on availability and/or contribution of farm animals and no agricultural practices other than mowing are conducted without the involvement of farm animals. Land cultivation is mainly done by oxen, horses, donkeys or their combinations. Farm animals serve to level the ploughed field, shortly before and after sowing. In some areas, farm animals are involved in weeding, especially maize and sorghum fields. Transportation of the harvested crops to and from threshing sites, threshing itself, transportation to and from the market is conducted by the farm animals**.** Similarly, transportation of water, firewood, mobile houses, construction materials and other goods is conducted by farm animals and they are the main means of human transport.

Livestock have several other values that are important for the livelihood of the farming communities. Their primary products such as meat, milk, egg and honey are important sources of animal protein. Live animals, skins and hides are sources of cash income. Moreover, skins, hides and horns are used as raw materials for making a range of household items, agricultural tools and ornaments. Their manure is used to fertilize backyards and crop fields. Farm animals serve as insurance and a source of cash for rural farming communities. Their role in cultural and social ceremonies is significant. Major primary products of the livestock are presented in Annex Table 1.8.

Animal dung is used as a construction material. It is also the major source of fuel, particularly in areas where firewood is scarce. According to NCS Secretariat and MNRDEP (1994), the contribution of manure to the total energy consumed in 1984 was about 7.5%. In 1990/91, about 3.9 million tons of dung was consumed. According to the above source, the increase in the annual demand for traditional energy and proportion of dung that was used as fuel in the early '90s was estimated at 1.5 million tons and 70%, respectively.

Livestock play a significant role, directly or indirectly, in achieving food self-sufficiency in the country. The livestock sub-sector is one of the input suppliers to the manufacturing sector of the country. According to Sileshi Ashine (2003), the contribution of livestock to the total agricultural GDP and national foreign

currency earnings is about 30% and 16%, respectively (Annex Table 1.1). Major export items from the sub sector comprise live animals, hides, skins, frozen meat, dairy products, honey and beeswax (Annex Table 1.10).

Given the country's diverse topographic and climatic conditions, a huge livestock population, different breeds of animals evolved over time and adapted to the ecological conditions of their habitat and to some extent been influenced by production systems, Ethiopia could be considered as a centre of diversity of animal genetic resources (Beyene Kebede and Beruk Yemane, 1992).

Despite, *inter alia*, the uncompromising contributions the livestock sub sector plays in the livelihoods of the majority of Ethiopians and in the overall national economic development, the attention given to develop the sub sector has not been so significant. Needless to say, this is despite their huge diversity and intrinsic capability to adapt to adverse and ever-worsening environmental conditions and the future implications of this potential.

Thus, the fate of production and productivity of the sub sector is still left to depend on the scarce and ever-declining marginal and commonly used lands. Provision of health facilities and services are far below the required minimum. They have been left to undergo untraceable levels of inbreeding and crossbreeding. And yet, depicted as the "low performers", they are expected to gradually give way to other "best performing" genotypes. Consequently, if indiscriminate distribution of the "best performing exotic genotypes" to different parts of the country is to continue at the current pace**,** the gene pool of the locals, particularly of the chicken, would be lost in the near future before they are even fully described and understood.

Major farm animal species of the country are cattle, sheep, goats, horses, mules, chicken and camels (Annex Table 1.6). Honeybees are often considered as farm animals. Diversity and composition of species of livestock are variable from place to place. This is mainly due to differences in agro climatic conditions. At lower altitudes, the proportion of goats and camels rises. The majority of livestock are in the rural areas, but limited numbers of some species are also kept in the peri-urban and urban areas.

1.2. Distribution and Roles of Livestock in Major Production Systems

1.2.1. Mixed crop-livestock system

Mixed farming system is predominantly found in highland agro-ecological zones where the climatic factors are conducive for farming of crops and raising livestock. In this system, livestock and crops are maintained as complementary enterprises. The average land size per household is often less than two hectares. Consequently, farming is mainly subsistence in nature. The relative importance of livestock products and services within species has not been properly quantified. Thus, Annex Tables 4.1 and 4.2 could not be completed.

The major species of farm animals of the country, except camels, are found in this farming system. Although dominated by cereal crops production, the diet of the people is composed of cereals, vegetables, meat and milk.

Compared to other farming systems, this system is more conducive to crossbred dairy cattle production. The system is characterized by land scarcity, severe resources degradation and recurrent drought. Former productive grazing lands are gradually turning into crop fields. Therefore, major feed sources are grazing on marginal lands, crop aftermath and crop residues. Crop residues are the major sources of feed, particularly during periods of feed shortage. In the rural areas, dung is an important source of fuel.

1.2.2. Agro-pastoral system

In the agro-pastoral system, human pressure on natural resources is relatively lighter than that observed in higher altitudes. Household landholding is often greater than in the mixed farming system. Livestock are important components of the farming system. Crops are produced both for subsistence and market. Livestock are kept for draft, sale and generation of other primary products. All of the major species of Ethiopian farm animals are possibly found in this system, but with variable species composition. The lower the altitude the higher will be the proportion of small ruminants, especially goats. Livestock are mainly kept in communal grazing lands and the use of crop residues and aftermath grazing is not uncommon. The diet of the people is composed of cereals, vegetables, meat and milk. The use of dung for fuel is not as intense as in the mixed crop-livestock production system.

1.2.3. Pastoral system

Pastoralism is a way of living in vast arid agro-ecological zones of Afar, Somali and Borena rangelands and in the semi-arid areas of the Southern Nations, Nationalities and Peoples Region. In these areas, land ownership at household level is not a common practice. Land holding in most rangelands, like the Somali rangelands, is mostly clan based. Despite their vast size, pastoral areas are sparsely populated compared to the other farming systems. As a result, they are subject to intrusions from the highlanders and large-scale commercial plantation schemes. Crop production is not a feature of the system and subsistence is almost entirely based on livestock and livestock products. The main source of food is milk. Consequently, pastoralists tend to keep large herds to ensure sufficient milk supply and income. Although most of the farm animal species, excepting horses and mules, are reared in this system, it is dominated by goats, cattle, sheep and camels.

Species of indigenous farm animals found in this farming system, except for insignificant cases in chicken, is not diluted by exotic blood. Distribution of exotic chicken is still being promoted and carried out. Water and feed shortage are the most limiting factors of production and productivity of the system.

Water development activities, if available, are limited mainly to accessible areas. Entire sources of feeds are rangelands. Herdsmen have virtually no control on their productivity. Therefore, pastoralists are forced to move constantly to different areas, sometimes even into the neighbouring countries in search of feed and water for their animals. Cattle are often moved out of their area during such times. Camels are used to transport mobile houses of the herdsmen. Such movements are considered the life-saving strategies adopted for decades. However, they have also some undesired effects such as triggering of conflicts between the occupants of the areas and the newcomers. They also create the opportunity to the mixing up, around potential watering and grazing/browsing areas, of formerly separated herds of different stocks and species that came from various areas often resulting in interbreeding. In addition to several other factors, gradually increasing human and livestock populations are further deteriorating the productivity of rangelands and severe droughts frequently occurring in the area are worsening the situation. Moreover, some of the productive rangelands are being invaded at an alarming rate by exotic weeds such as *Prosopis juliflora*.

1.2.4. Peri-urban and urban system

Practically all species of farm animals available in the country are kept in peri-urban and urban areas. In recent years, peri-urban and urban commercial dairy and chicken (both layers and broilers) production is increasing in and around cities and major towns. The level of management adopted currently in peri-urban and urban livestock production system varies from relatively low to high intensive systems (Azage et al., 2001).

The expansion of peri-urban and urban livestock production system, particularly commercial dairying and chicken rearing, is favoured by multitudes of opportunities. Like any other emerging economic system, however, it is yet to be tested against challenges emerging simultaneously in such areas as management, disease control, reproduction, quality control and public health, waste management and disposal, and its ultimate success will depend on how best the system could overcome these challenges.

1.3. Levels of Inputs in Different Production Systems

Based on the type and quantity of inputs as well as the objective and level of intensity of production, major livestock production systems presented above could be further classified into low, medium and high input level production systems (Annex Table 2.1). The level of intensification of the systems depends on land tenure, social structure, know-how, access to credit and inputs, availability of market and economic return. Similarly, the level of utilisation of inputs depends on climatic conditions, production systems, types of livestock and livestock products demanded, species and breed of animals used, the extent of use of crossbreeds, accessibility to consumer areas, availability of reliable sources of inputs, prices of inputs, the level of know-how, availability of labour, pasture and other feed sources, and the level of extension services rendered.

1.3.1. Low input production system

Low input production system is a production system where one or more rate-limiting inputs impose continuous or variable severe pressure on livestock, resulting in low survival, reproductive rate or output. Output and production risks are exposed to major influences, which may go beyond human management capacity (FAO, 2000).

The majority of the country's current livestock production system lies in the low input category. It accommodates more than 95% of the livestock population. The main features of the low input production system are its full dependence on natural resources and the limited demand for inputs. Low input production system is found in three of the four livestock production systems prevailing in the country, namely: pastoral, agro-pastoral and livestock-crop mixed farming systems. However, it is more pronounced in pastoral livestock production system than in the others (Annex Tables 2.4, 2.5, 2.6, 2.7, 2.8 and 2.10).

Most of the cattle in low input production system are indigenous breeds. Considerable numbers of crossbred dairy cows are also distributed into these areas. Based on agro-ecology and tradition, the uses of cattle in the system are variable.

In the lowland areas, cattle are used mainly for milk production. To ensure a constant supply of milk, therefore, a large number of females and few selected breeding males are maintained. The remaining males are sold while young. These areas provide about 20% of the draft animals used in the highland areas. About 90% of live animals exported are produced from these areas (Sileshi Ashine, 2003). Moreover, the areas supply considerable number of cattle to those who are involved in fattening and crossbreeding practised in smallholder dairy programs. The lowland areas are, thus, important sources of livestock supply to the neighbouring highlanders.

In the mixed crop livestock farming dominated highland areas, cattle are mainly reared for draft purposes. Milk and meat are considered as secondary priorities. Fattening or conditioning of oxen and/or steers is practised in the central highlands. The practice is aimed at selling with relatively good prices of old draft oxen after feeding for a specific period of time. Young replacement oxen and steers are purchased at cheaper prices.

In the low input production system of the highlands, small ruminants are the second most important animals next to cattle. They are prominent sources of meat, skin, milk, wool/hair and cash income. This is true for the lowland areas also, except that they are not used for wool/hair production. Except for a few crossbred animals resulting from the distribution of imported rams, the majority of the small ruminants are indigenous breeds. Most of the sheep population is found in the highland areas while goats are almost equally distributed in the highland and lowland areas (FARM Africa, 1996).

Most of the equine populations of the country are found in the low input production system and are all indigenous species. They are the main means of transportation for humans and goods. In some parts of the country, especially in the highland areas, horses and occasionally donkeys are also used for ploughing, threshing and other agricultural activities.

The entire camel population of the country is maintained in the low input production system of the lowland areas. All camels are indigenous breeds and provide milk, meat, transport and other sources of income as well. Camel milk constitutes the major part or even the entire part of the diets, thus serving as the backbone for the livelihoods of some pastoralsits (Coppock, 1994).

More than 99% of the poultry population is found under the low input production system. Almost all the poultry are local breeds. Very few improved and crossbred poultry are found under this system. In low input production system, poultry is one of the major sources of food and cash income.

1.3.2. Medium input production system

Medium input production system is a production system where management of the available resources has the scope to overcome the negative effects of the environment, although it is common for one or more factors to limit output, survival or reproduction in a serious fashion (FAO, 2000).

Medium-input production system consists of farmers who are using relatively different kinds of inputs. The majority of these farmers are residents of urban and peri-urban areas. About 1% of the cattle and 4% of the chicken population are found in this production system. The smallholders participating in the government livestock extension package programs are heading towards the medium-input production system. Moreover, the expansion and the success of this system are favoured by numerous opportunities.

Species with good market opportunities are involved in the medium input production system. As presented in Annex Tables 2.3 and 2.9, only cattle and poultry are treated under the system.

Data on change in the distribution of production systems over the last 20 years (which was supposed to be filled in Annex Table 2.2) are not available. Thus, further study is required to illustrate the distribution over time.

1.3.3. High input production system

High input production system is a production system where all rate-limiting inputs to animal production can be managed to ensure high levels of animal survival, reproduction and output. Output is constrained by managerial decisions (FAO, 2000).

Although the trend is towards high input production and there are few private poultry, dairy and fattening farms, the system is at the moment not significant.

1.4. The State of Farm Animal Genetic Resources Diversity

In Ethiopia, classification of farm AnGRs into breeds is far from complete. Classification studies have been conducted on most of the cattle and goat breeds that exist in the country. However, research is at its rudimentary stage for the other species, particularly chickens. Therefore, the list of breeds presented below should be viewed from this perspective.

The most common farm animals of the country can be categorized into mammalian, avian and honeybee species. Cattle, sheep, goats, camels, donkeys, horses and mules are the major farm animals that lie under the mammalian category. The number of breeds of cattle, sheep, goat, camel, donkey, horse, mule and chickens breeds identified so far are 25, 13, 15, 4, 4, 2, 2 and 5, respectively (Annex Table 3.1). Under the avian category are chicken (poultry), ostrich and turkey. The latter two avian species are not widely used in the country. Stinging honeybee species are economically the most important species in the country.

1.4.1. The state of diversity of farm AnGR

Cattle breeds

Indigenous breeds: major cattle breeds identified so far are Arsi, Begayit, Ogaden, Borena, Goffa, Arado, Nuer, Gurage, Jidu, Karayu/Afar, Harar, Horro, Smada, Fogera, Mursi, Raya-Azebo, Adwa, Jem-Jem, Sheko, Ambo, Jijiga, Bale, Hammer, Medenece and Abergelle. Medenece and Abergelle are recently reported by the Tigray Regional Bureau of Agriculture and Natural Resources Development (1999) to exist in that part of the country. Since there has not been any exhaustive identification and characterization work, it is possible that new breeds are to be described yet.

Out of 25 indigenous cattle breeds, the Borena, Horro, Fogera, Karayu, Arsi and Nuer are the widely used breeds (Annex Table 4.3).

Exotic breeds: The purpose of importation of exotics was to improve milk production in the country. The breeds so far imported are Holstein-Friesian, Jersey and Simmental. The breeds are being used in medium input production system where Holstein-Friesians and their crosses occupy the lion's share. Crossbreeds used under medium input production system are those produced from crossings between exotic sire breeds and three indigenous dam breeds, namely: Borena, Fogera and Arsi. The above crossbreds and others resulting from crossings between Borena with Simmental, Arsi with Jersey, Horro with Holstein Friesian, Horro with Jersey, Horro with Simmental are being used by research and/or teaching institutions.

Sheep breeds

Indigenous sheep breeds: Major sheep breeds found in Ethiopia are Begayit, Farta, Horro, Abergelle, Menz, Begi-Degu, Arsi, Ille, Tukur, Bonga, Afar, Dangila and Black Head Somali (formerly known as Black Head Ogaden) sheep breeds. Farta sheep breed (found in South Gondar Zone of Amhara Regional State), and Abergelle, Begi-Degu and Ille sheep breeds (found in Tigray Regional State) have been reported recently by the agricultural bureaux of the respective regions.

Exotic sheep breeds: Exotic sheep breeds introduced for their wool and mutton production are Awassi, Hampshire, Blue-de-main, Merino, Romney, Corriedale and Dorper. Crossbreeding of the Menz breed with the five exotic breeds, namely: Awassi, Hampshire, Bleu-de-Main, Romney and Dorper are being used for development and research activities.

Goat breeds

Indigenous goat breeds: Major goat breeds existing in the country are Begayit, Ille, Afar, Hararghe Highland, Arsi-Bale, Short-eared Somali, Woyito-Guji, Long-eared Somali, Central Highland, Abergelle, Western Highland, Widar, Western Lowlands, Maefur and Keffa. Moreover, Felata, Arab, Gumuz, Agew and Oromo sub-types of the western lowlands have been recently reported.

Exotic goat breeds: The aim of introducing exotic goat breeds was to improve milk production of the local goat breeds. Anglo-Nubian and Toggenberg are exotic goat breeds that were introduced by Farm-Africa and higher learning institutions. Thus, crossbreeds between Anglo-Nubian and Hararghe Highland and Anglo-Nubian and Somali are being used for milk production by smallholders in central, eastern, southeastern, and southern parts of the country. Toggenberg and their crosses with Hararghe Highland are used for research purposes at the Alemaya and Debub Universities. Very recently, Boer goat semen has been imported from the United States of America for crossbreeding studies at the two Universities to improve meat production of local goats.

Equine breeds

Donkey breeds that exist in the country are the Jimma, Abyssinian, Ogaden and Sinnar. Major breeds of horses that have so far been well recognized are the Oromo and Dongola. In Ethiopia, crossing of Asses with mares to produce mules dates back to centuries. Except for two well known, namely: Sinnar and Wollo Mule breeds, there are no other well-defined hybrids in the country. In Mekele University,Tigray region, phenotypic characterization of local donkeys has been carried out. However, such activities have to be complemented with proper genetic characterization in order to classify the donkey types found in the region or elsewhere.

Camel breeds

Attempt to classify Ethiopian camels has not been satisfactory so far. Wilson (1984) has classified and described major camel breeds in the country as the Afar, Borena, Anfi and Somali/Ogaden breeds.

Poultry breeds

Indigenous chicken breeds: Indigenous chicken breeds identified so far are Horro, Jarso, Tililli, Tepi and Cheffe breeds that are found in the central highland areas (Tadelle et al., 2003), and the naked-neck breed found in northern, northwestern, western and southern lowland areas of the country.

Exotic chicken breeds: Several layer, broiler and dual-purpose exotic chicken breeds introduced into the country are being used for food and agriculture. Rhode Island Red (RIR), White Leghorn**,** Lawman Brown, Cobb-500, Fayoumi, Bovans Brown, Arob Acre and Bubcocks are reared by small and large-scale commercial producers in urban and peri-urban areas. Besides, RIR and White Leghorns as well as their crosses with indigenous chicken are used by rural smallholders for egg and meat production.

Honeybees

It is estimated that Ethiopia has about 10 million honeybee colonies. Species of honeybees identified so far are Apis melifera adansol, Apis melifera lementica, Apis melifera monticola, Apis melifera litorea and Apis melifera abyssinica.

1.4.2. Population trends

Cattle: Complete information on trends of populations of cattle at breed level is not available. Limited information available in literature and obtained from field surveys indicate, however, that there are indigenous cattle breeds with decreasing trends. These are the Sheko, Fogera, Begayit and Borena.

Sheko breed: Sheko cattle breed is the only remaining representative of the brachyceros type in eastern Africa. The total population of the breed reported by FAO (1999) was 31,000. According to the information obtained from Bench-Maji Zonal Agricultural Development Office in 2001 (the Zone in which the breed exists), however, the total population of the breed was estimated at 18,307 heads. According to the latter source, the majority of the heads so counted as Sheko breed are, unfortunately, those animals that might have been produced by interbreeding with the local zebu found in their surroundings. The major causes of decline in population are trypanosomiasis, inbreeding and interbreeding with other local breeds of cattle. It is generally believed that the breed is at risk of being extinct.

Fogera breed: The Fogera is exhibiting a decreasing trend. According to information from the Amhara Regional Agricultural Development Bureau (2001),

the estimated population of this breed was 800,000 in 1981 and 636,000 in 1998. The major causes contributing to the declining trend are inbreeding, uncontrolled inter- and crossbreeding, diseases and drought.

Begayit breed: Compared to several others, Begayit cattle breed has small population size and is confined in a smaller area in the northern part of the country. Even though exact information on the population trend of the breed is lacking, it is believed that the population of Begayit cattle has suffered greatly due to high off-take rate during the Ethio-Eritrean war that occurred between 1998 and 2000.

Borena, Afar and Ogaden breeds: Complete information on the population trend is lacking for these breeds, too. Because of prevailing feed shortage resulting from bush encroachment, recurrent drought, and interbreeding and diseases; these areas are experiencing vivid change in species composition from cattle to camels and small ruminants. Therefore, cumulative effects of the above factors are believed to have negatively affected the population trend of these breeds.

In Ethiopia, artificial insemination of indigenous cattle using the semen from exotic cattle breeds has been implemented over the last three to four decades. While artificial insemination has, in most cases, been and is still being executed on indigenous breeds that have not been evaluated and/or not characterized, simultaneous efforts to conserve the gene pool of the indigenous breeds are non-existent. Due to the ease of artificial insemination, therefore, indiscriminate crossbreeding is resulting in unforeseen levels of dilution of the indigenous gene pool.

Chickens: Complete information on the current status of indigenous chicken breeds is not available. As a matter of fact, introduction of exotic breeds of chicken into different parts of the country have been conducted over the last five decades and the trend is increasing in almost all parts of the country. Such massive introduction of exotic blood into different corners of the country is conducted via distribution of fertile eggs, day-old chickens, crossbred pullets and exotic cockerels. A number of governmental and non-governmental organizations are involved in this operation. To this end, about seven poultry breeds multiplication centres are involved in the production and distribution of exotic and crossbred chickens for pure and crossbreeding purposes aimed at improving the genetic potential of the local breeds for egg and meat production. As a result, distribution of "best performing genotypes" is being implemented at an alarming rate and if this trend continues at the current pace, the gene pool of the local breeds could be lost in the near future before they are even described.

Other farm AnGR:

Information on the trends of other farm AnGR is lacking. However, the Afar sheep and Sinnar donkey breeds are reported as decreasing.

The only species of farm AnGR reported as increasing is the camel. This is mainly attributed to bush encroachment that particularly resulted in cattle populations decreasing**.**

Farm animal breeds whose population is reported as stable are the Horro cattle and sheep breeds, all indigenous goat breeds and the Black Headed Somali sheep breed.

1.5. The State of Development and Use of AnGR

1.5.1. Farm animal development

This part presents the number of breeds that are actively used for food and agriculture. Where available, information on development efforts as well as information on policy and strategic issues on development and use of farm AnGR on species basis is presented.

Cattle

Although Ethiopia has no standing breeding policy, crossbreeding activities are nonetheless being conducted on four widely used cattle breeds, namely: Borena, Horro, Arsi, and Fogera (Annex Table 4.3). Borena, Arsi and Fogera are crossbred with Holstein-Friesian while Horro is crossbred with Jersey. To some extent, selection on Borena, Fogera and Horro breeds is being undertaken in different ranches (Annex Table 4.4).

Recognizing the contribution of the livestock sub sector to the national economic development and improvement of nutritional status of the people, quite a number of programs and projects have been designed and implemented. The pioneer project that started extension work on improving cattle under smallholder production system was implemented by the Chilalo Agricultural Development Unit from 1967 up to 1975 and the Arsi Rural Development Unit from 1975 up to 1984. Following these, a number of programs and projects that mainly focused on smallholders were implemented. These include:

- The Joint Program for Eradication of Rinderpest and CBPP Campaign (1969-1975),
- The Wolayita Agricultural Development Project (1974),
- The Minimum Package Program (1972-1980),
- The Second Livestock Development Project (1973-1980),
- The Third Livestock Development Project (1977-1993),
- The Fourth Livestock Development Project (1987-1991),

- Addis Ababa Dairy Development Project (1972-1981),
- Dairy Rehabilitation and Development Project (1986-1990),
- Pan Africa Rinderpest Campaign (1993-1998),
- Hides and Skin Improvement Project (1991-1997),
- Selale Peasants Dairy Development Pilot Project (1981-1994),
- Support to National Artificial Insemination Centre (1987-1980),
- Smallholder Dairy Development Pilot Project (1981-1994),
- Smallholder Dairy Development Project (1995-2000).

On-going projects that are currently contributing to AnGR are the National Livestock Development Programme (MoA, 1997), Integrated Livestock Development Project (1998), Pan African Control of Epizootics (2000), Farming in Tsetse Controlled Areas (2001) and Livestock Development Master Plan Study (starting from 2004).

Along these projects and programs, the regular livestock extension program, with special emphasis on dairy extension service has been implemented at all levels of the former MoA structure over the last three to four decades. The extension service was delivered through various methods, such as training of experts and farmers, distribution of in-calf crossbred heifers, distribution of breeding bulls and improved forage seeds as well as delivery of artificial insemination (AI) and animal health services.

In Ethiopia, work on the development of animal genetic resources, particularly in the dairy sector, goes back to post-World War II years. Ethiopia got the first batch of dairy cattle through United Nations Relief and Rehabilitation Administration (UNRRA), under the Marshal Plan set to rehabilitate the war affected allied force countries (Solomon Haile Mariam, 1981). Since then, agricultural training institutions were established such as the Alemaya College of Agriculture and Holetta Research Station which contributed to manpower development in the field and the initiation of research in the livestock sector, particularly in dairy and extension services.

All dairy development endeavours require inputs such as improved dairy cattle, AI and improved forage seeds. Accordingly, the government established five cattle improvement and multiplication ranches from which crossbred in-calf heifers and crossbred breeding bulls are distributed to smallholder farmers. Nevertheless, there is still a serious shortage of improved dairy cattle in the country. The country used to import pure and crossbred dairy cattle for breeding and research purposes mainly from Kenya.

The efforts made so far by different projects and extension programs have helped gear smallholder farmers towards management of improved dairy cattle, improved nutrition and increased income at the household level. The dairy sector has also contributed to crop production through provision of additional power for farming, manure, and generating income for purchasing inputs needed for crop production.

Similar to the dairy sector, various governmental and non-governmental organizations have undertaken a number of livestock development and related projects. In this respect, the MoA is the principal organization followed by the Ministry of State Farms Development and the Ministry of Trade. Research activities on beef have been carried out by the Institute of Agricultural Research, Alemaya University of Agriculture, the junior agricultural colleges and other development organizations.

Cattle fattening on a small-scale is emerging as a profitable, low-risk and low-input livestock enterprise for smallholders (EARO, 2002). Studies conducted on beef fattening at Jirma State Farm and on economics of feeding old oxen for beef production at Adami Tullu indicated that beef production is a profitable enterprise. However, the livestock marketing system is not well organized in all aspects to benefit smallholders. Poor market information system, low level of organization or institutional set-up and lack of proper transportation facilities required for local and foreign markets have influenced the sector. Lack of proper understanding of the production system, inadequate nutrition, fragile environment, prevalence of diseases as well as problems associated with processing, marketing and land use, and thermal stress are other important constraints to beef production.

Major constraints and challenges to the development of the dairy sector:

- Lack of co-ordinated activities engaged in the development, research, training, extension and delivery of inputs.
- Development efforts have not been institutionalised and have rather been short-term project-oriented undertakings. They were often fragmented and were based on piecemeal approaches with no inter-linkages.
- An accountable and responsible body for the coordination and development of the dairy industry has not been identified and set in place. As a result, improved performance in husbandry and management has been hampered.

Sheep

Sheep have social and economic importance to the producers who keep indigenous breeds for meat, hair production and income generation. The sheep have coarse fleece and a coat of short or long hair. To improve their productivity,

the former MoA has drafted two development strategies (1) to improve and select a program for indigenous sheep with higher potential, and (2) to crossbreed small- to medium-sized local breeds with the exotics where there is no other choice for improvement.

In 1981, ARDU started a breeding program on indigenous breeds which involved (1) crossbreeding exotic with indigenous sheep to study the performance of different levels of crossing and (2) producing crossbred rams to be distributed to farmers. The indigenous breeds involved in this program were Arsi, Bonga, Horro, Black Head Somali and Afar. Rams of exotic breeds involved in the program were Bleu-de-Main, Corriedale, Romney and Hampshire (Annex Table 4.3).

The then MoA also established three sheep breeding and multiplication ranches in different parts of the country. The main objectives of these ranches were to improve meat and wool production of the indigenous sheep through selection and crossbreeding. The indigenous breeds that were involved under these programs were Black Head Somali, Menz and Horro.

The former Institute of Agricultural Research (IAR), higher teaching institutions like Alemaya University (AU), the Ambo and Jimma Junior Agricultural Colleges and ARDU carried out research activities on sheep. Most of the research activities focused on performance testing of crossbred sheep at different blood levels and to some extent breed evaluation of the indigenous Arsi, Horro, Black Head Somali and Afar sheep breeds.

Goats

Despite their economic importance, particularly to the most vulnerable groups of the community, little attention has been paid to the development of goats. In 1988, FARM Africa initiated a dairy goat development program in collaboration with the former MoA, AU, Awassa College of Agriculture (ACA) and several international and local NGOs. The objectives were to identify and characterize the indigenous goats, to describe the traditional goat husbandry practices in different production systems to develop and test methods for the rapid survey of livestock.

Poultry

Chickens are widely kept in Ethiopia and make up the largest population of farm AnGRs of the country. According to Teketel Forssido (1986), the distribution of chicken varies with altitude. The local chickens (non-descriptive types) vary widely in body size, conformation, plumage and other characteristics. In depth studies to determine variations that exist in egg and meat production and the productivity among different poultry breeds have never been commissioned in Ethiopia (Million Tadesse et al., 2003). Both crossbreds and pure exotic breeds are widely used to increase meat and egg production. A number of governmental and non-governmental organizations have been involved in distributing pure

exotic breed pullets, cockerels and fertile eggs to farmers from abroad and poultry breeding and multiplication centres existing in the country. Exotic breeds used as pure and for crossbreeding with the locals are the White Leghorn, Rhode Island Red, Bovans Brown and Bubcocks (Annex Table 4.3).

Equines

Equines have been playing an important role in the country by supplying vital power for traction, transport and field operations. Animal power is the backbone of food production and rural economy of smallholders in the highlands of the country. Over 90% of farmers in these areas, use animal traction for food crop production. The density of equine population in the country is estimated to be 6.1/km^2. There is one equine for every five persons of the total population and for every four persons that are engaged in agriculture. Donkeys, horses and mules together represent 13.7% of the total live weight of domestic herbivores of the country. An estimated 75% of the farms are more than a day and half walk from all weather roads. Equines play a vital role in providing means of transport for agricultural produce to market. Equines are, thus, important animals in Ethiopian agriculture and in the overall national economy (Asamenew et al. 1993).

Until 2003, interventions made in livestock development had overlooked the equine resources. However, the government has now paid due attention to theses resources by establishing a Draft and Pack Animals Resources Development Team under the Animal and Fisheries Resources Development Department of MoARD. In addition to these activities, the Donkey Health and Welfare Trust, based at the Faculty of Veterinary Medicine in Debere Zeit, is undertaking surveys and studies related to the utilization and health care of equines in general and of donkey in particular. These activities are currently being undertaken in Amhara, Oromia and Tigray regions.

Camels

In Ethiopia, only the one-humped camel (*Camelus dromedaries*) exists. Breeds of camels identified so far are Afar, Borena, Anfi and Somali/Ogaden breeds. There exists, however, no conceptual classification of camel breeds or strains that helps to categorize according to their potential for milk, meat and draught. Postgraduate students of Alemaya University have undertaken nutritional, meat production, parasites, physiological and economic studies on camels. Although the Faculty of Veterinary Medicine of Addis Ababa University has made several studies on diseases of camels (Bekele et al., 1998) only recently has research on camel husbandry been initiated at Alemaya University, now followed by Mekele University.

1.5.2. Farm animal policy and strategy

Although farm animal breeding policy is not yet in place, its preparation is underway. The Rural Development Policy gives due emphasis to the agricultural

sector. The policy envisages building the capacity of farmers in various ways and encourages formation of cooperatives. This has positive effect on livestock development since the majority of Ethiopian farmers are involved in livestock production. In addition, there are other sectoral policies, such as the Investment Policy, that have created favourable environment for investments in the livestock sub sector. This is mainly aimed at promoting labour-based strategy and broad based internal and external market opportunities.

To support the development of the livestock sub sector, the then MoA has drafted a Ruminant Livestock Development Strategy in 1995. The general objective of the draft strategy is to develop and utilize the available resources and to increase its contribution to the social and economic development of the country. The other strategy, having a sectoral nature, is the Industrial Development Strategy, which is based on Agricultural Development Led Industralization. It is strongly believed that this strategy supports the agricultural sector through creating markets.

1.6. The State of Conservation of Farm AnGRs

In developing countries, animal genetic resources are being eroded through rapid transformation of agricultural systems. One of the major causes to the loss of indigenous breeds of farm AnGR is indiscriminate use of exotic genetic resources. According to FAO **(**1999), about 30% of the world's farm animal breeds are subjected to the risk of extinction. In Ethiopia, local communities still remain custodian of the diversified farm AnGR and the indigenous knowledge associated with it.

Conservation of local breeds of farm AnGR is part of animal husbandry and should, ideally, be based on complete information on distribution, structures, trends, productive and adaptive performances of populations of the existing breeds. As stated in preceding sections, although much information is lacking, conservation of farm AnGR in the Ethiopian perspective should be viewed from the rational utilization and protection of existing genotypes from genetic erosion. Unfortunately, no conservation activities of farm AnGR have so far been practised in the country, except for limited activities that are meant to maintain pure stocks of three cattle and one sheep breeds (Annex Table 5.1). Breeds of farm AnGR so maintained are Borena cattle breed at Did Tuyura Ranch, Horro cattle breed at Horro Ranch, Fogera cattle breed at Metekel Ranch and Adet Agricultural Research Centre, and Menz sheep breed at Amed Guya Research Centre.

1.7. The State of the Art in AnGR Management

In Ethiopia, information for sustainable utilization and conservation of the farm AnGR are very limited and, if available, are full of gaps.

1.7.1. Phenotypic characterization

In this document, phenotypic characterization refers to the morphological descriptions of farm AnGR only. Attempts by the former MoA in 1975 were one of the few pioneering efforts made to classify the indigenous sheep, goat and cattle breeds into specific groups. Based on the tail form and quality of the hair,

sheep were classified into four broad categories as Hairy Thin Tailed, Wooled Thin Tailed, Fat Tailed and Fat Rumped. Goats were classified into five major groups as Nubian, Highland, Afar, Somali and Long Tailed Gishe. Similarly, Alberro (1982a, 1982b) has classified cattle into four broad categories, namely: the Humpless Hametic Longhorn and Shorthorn, the Zebu, the Senga and the Intermediate Senga.

The other nationwide baseline survey was conducted on goats by FARM Africa in collaboration with the former MoA and the then AUA (Alemayehu Reda, 1993; Workneh Ayalew, 1994; Nigatu Alemayehu, 1994).

A survey to initiate community-based conservation practices has also been conducted on the status of Borena cattle breed by BLPD/GTZ in collaboration with Oromia Regional Bureau of Agricultural Development (Alemayehu Reda, 2001). Oromia Agricultural Research Institute (Bako and Adami Tulu) is undertaking phenotypic characterization on sheep and goats. Amhara Region Agricultural Research Institute (ARARI) has undertaken phenotypic characterization on sheep breeds of the region in 2001. Similarly, Tigray Regional Agricultural and Natural Resources Development Bureau conducted a survey on livestock breeds of the region in 1997. More recently, the Oromia Agricultural Development Bureau in collaboration with ILRI (ILRI, 2004) conducted a comprehensive survey on livestock breeds of the region.

1.7.2. Evaluation of breeds and crosses

A number of organizations attempted to evaluate performances of some farm AnGR at different times.

- The former MoA and the IAR/EARO have been intensively involved in performance evaluation activities of farm AnGR. These are cattle breeds such as the Borena, Fogera, Arsi and their crosses with different exotic breeds within its ranches.

- IAR/EARO and AUA have also been evaluating performances of such cattle breeds as Horro, Begayit, Fogera and Borena and their crosses with different exotic breeds. IAR/EARO (Debre Zeit and Holetta) has evaluated performances of different chicken breeds, Horro, Borena and Begayit cattle breeds and their crosses.

- Oromia Agricultural Research Institute (Bako and Adami Tulu) has conducted performance evaluation on Borena and Horro cattle breeds and their crosses as well as Horro sheep breeds and Rift Valley Family goats.

- AUA has also evaluated performances of Somali and Afar camel breeds, Somali goat breeds, and Borena and Begayit cattle breeds and their crosses.

- Debub University has undertaken performance studies on Somali goat breeds and their crosses.

- Debre Zeit, Holetta and Adami Tulu research centres have evaluated performances of donkeys found in the central highlands. Major emphasis was placed on assessing productive and reproductive performances of the breeds and their crosses under improved feeding and management conditions.

- Growth and carcass yield performance of Horro and Menz sheep has also been undertaken in a comparative breed evaluation study (Kassahun Awgichew, 2000). This was part of ILRI's performance and breed evaluation studies on Menz, Horro and Wollo sheep breeds at its former Debre Birhan Research Station.

Mekonnen Haile-Mariam and Hailu Kassa (1995) have estimated genetic parameters for growth traits of Borena cattle breed. Similarly, Million Tadesse and Alemayehu Reda (2000) evaluated reproductive and productive performances of Borena cattle and their crosses with HF. Million Tadesse (2001) estimated crossbreeding parameters for milk production traits of Borena, Begayit and their crosses with HF. Million Tadesse and Tadelle Dessie (2003) have also evaluated performances of local, HF, and their crosses.

The Debre Zeit Agricultural Research Centre (Alemu Yami et al., 1998) has evaluated egg production and growth performances of indigenous chickens. Workneh Ayalew (2000) has evaluated performances of some well-known sheep and goat breeds.

1.7.3. Genetic characterization

In Ethiopia, only limited activities on genetic characterization have been conducted on some breeds of cattle, goats and chicken.

In the study conducted by Hanotte et al. (2000) on indigenous African ruminant livestock; specifically on cattle, sheep and goats, molecular characterization meant to quantify between-and within-population genetic diversity at microsatellite INRA124 was conducted on 10 cattle breeds namely: Bale, Borena, Ogaden, Sheko, Nuer, Raya-Azebo, Danakil, Horro, Arado and Fogera cattle breeds. Characterization of nine goat breeds, namely: Afar, Western Highland, Hararghe Highland, Western Lowland, Anglo-Nubian, Toggenberg breeds, crosses of Anglo-Nubian with Somali, Hararghe Highland and Toggenberg with Hararghe Highland have been conducted by Addis Ababa University (Addisu Simachew, 2002) using blood protein polymorphism. Genetic characterization of indigenous Tililli, Jarso, Cheffe, Tepi and Horro chicken breeds using Fayoumi (exotic) as reference has been conducted by Tadelle et al. (2003). Oromia Agricultural Research Institute has estimated genetic parameters of Horro sheep. Similarly, ARARI has estimated genetic parameters of Menz sheep breed and their crosses with Awassi.

2. CHANGING DEMANDS ON LIVESTOCK PRODUCTION AND THEIR IMPLICATIONS FOR FUTURE POLICIES, STRATEGIES AND PROGRAMMES

2.1. Impacts of Past and Present Policies, Strategies and Programs on AnGR Management

2.1.1. Government policies

Planned national economic development programs have been undertaken in Ethiopia since the early 1960's. Over the past five decades, the country has undergone through three distinct political changes along with corresponding food and agricultural policies that have influenced the development of the livestock sub-sector.

During the imperial regime (up to 1974), livestock development interventions focused on creation of public institutions that support and promote improved livestock production, marketing, processing and distribution. Favourable government policies such as subsidized milk collection, secured land tenure, and free markets for feed and other inputs as well as economics of scale in production and marketing had encouraged large private commercial farming. The emergence of modern dairy and poultry operations using exotic and high-grade genotypes was evident in peri-urban areas. In addition, provision of government services was launched to support smallholders who had little land, capital and poor access to improved breeding animals.

During the socialist-oriented regime (between 1974 and 1991), the economic policy was characterized by government intervention and monopoly in all economic sectors. Activities traditionally belonging to the private sector such as meat and by-products processing plants, dairy and poultry farms, cattle and sheep breeding and multiplication ranches, and livestock export were run by the government. Government support for smallholders was largely nominal and with the intention of promoting medium- and large-scale operations, support was available only for peasant members of producer or service cooperatives that were based exclusively in rural areas. Actual government support was for unprofitable state farms, the production that had little impact on the development of the livestock sub-sector.

From 1991 to the present, Ethiopia has been undergoing through structural adjustment programs and market liberalization. Major policy reforms are being taken in the macro-economic framework and in the sectoral and cross-sectoral policies and strategies. The food and agricultural policy is elaborated in a comprehensive document: "Rural Development Policies, Strategies and Instruments (RDPSI)" issued by the Government in November 2001. According

to RDPSI, agriculture is given the priority to lead the overall economic development and measures are being taken to create a supportive and favourable policy environment to promote the private sector and to transform agriculture from subsistence to market oriented smallholder farming. Regional land use and land administration authorities are established and land title certificate is being given. Several Government strategies and programs, poverty reduction strategy have been formulated to ensure rapid economic development. The role of livestock in poverty reduction, attaining food security and sustainable economic development cannot be overemphasised. Like for other economic sectors, decision-making power on animal resources planning and management, and livestock support services are devolved to regional states and local level stakeholders. Favourable Government policy support, the prospective market opportunity for the smallholder livestock producers looks more promising than ever before.

2.1.2. Interventions in the livestock sector

A series of programs and projects aimed at increasing food and animal production which may affect management of farm animal genetic resources have been undertaken both at institutional and producers level. The overall objective was achieving increased livestock production and productivity, and thereby enhancing its contribution to food security and the national economy. Major efforts have been directed toward removing the constraints facing livestock development and transferring new technologies to transform the traditional sector into a modern livestock production. Genetic improvement of the indigenous animal resources was an integral component of most of the interventions.

Efforts to improve genetic potentials of local animals mainly concentrated on crossbreeding with "improved" exotic breeds. The first introduction of exotic cattle breeds took place in 1947 when the United Nations Relief and Rehabilitation Administration (UNRRA) donated 300 Friesian and Brown Swiss dairy cattle under the post Second World War Relief Program, which were used as nucleus herd at state owned dairy farms. From mid-1970s onwards when involvement of the public sector dominated, state owned parastatal dairy and poultry farms, and cattle and sheep improvement and multiplication ranches served as central sources of breeding stocks for distribution to smallholders.

Several government organizations were responsible in the implementation of these interventions with some financial and technical assistance from international, bi- or multi-lateral agencies. The former MoA and the Ministry of State Farms Development (MSFD) have been the major government institutions engaged in importing, multiplying and distributing exotic, high grade and/or F_1 crossbred animals to smallholders. To a limited extent, the former Relief and Rehabilitation Commission (RRC), now Disaster Prevention and Preparedness Commission (DPPC) and NGOs have also been involved in the distribution of crossbred or local cattle, sheep, goats and chickens for restocking in areas affected by drought and displacement.

Artificial insemination of cattle, introduced in late 1930's and further expanded with the establishment of the National Artificial Insemination Centre (NAIC) in 1981, has facilitated widespread crossbreeding of the local cattle with European breeds. Liquid Nitrogen production capacities are also being built in five Regional Centres to strengthen the AI services.

Ethiopia had declared provisional freedom from Rinderpest in 1999 and has since then been undertaking surveillance activities to declare that it is permanently free from the disease. In line with this an intervention, which aims at promoting the export earning of the country from its livestock resources is underway. This is FAO supported TCP project which is launched to undertake a feasibility study to establish a disease free zone for livestock production.

2.1.3. Impact on animal production and AnGR diversity

Despite substantial public investment for development of the livestock sub-sector, the resulting impact on the contribution of the sub-sector to the overall economic growth was unsatisfactory. The significant share of Ethiopia in East Africa's total output is attributable mainly to the size of the livestock population rather than increased productivity.

However, results of farm-level studies have shown that adopting crossbred cows and the associated package of improved feeding and management strategies could increase milk production and household income of resource-poor smallholder mixed crop-livestock farmers (ILRI, 1997). Furthermore, adoption of crossbred cows brought about improved human health and nutritional status of all members of the household (Jemal Haider et. al., 2000; Shapiro et. al., 2000).

Given suitable government policy support, access to market and services, there is great potential for development of smallholder dairy scheme in peri-urban and urban areas (Staal and Shapiro, 1996). However, it could still be argued whether the gains attained were commendable when compared to the substantial investment involved in the genotype improvement undertakings, and recent hypothesis suggested that the economic benefits of crossbreeding may have been overestimated as non-market effects and environmental values have not been included in breed comparison studies (Workneh Ayalew, 2002).

There is little quantified information as to the impact of livestock interventions on the diversity of indigenous farm AnGR. The extent to which the exotic genotypes have diffused into the indigenous populations and the level of dilution is not objectively assessed. But, available estimates indicated that crossbred cattle make only 1% of the total cattle population of Ethiopia. There is a general understanding among professionals that indiscriminate distribution of exotic chicken might have caused rapid genetic dilution and erosion of local chicken types.

At farm level, the genotype of crossbred animals kept by producers is likely to include any percentage of foreign genetic material due to unsystematic breeding practices, unplanned mating schemes uncontrolled AI services and bull distribution. There is no controlled breeding in communal grazing areas where exotic bulls are introduced and allowed to indiscriminately mate with local cows. Such schemes have resulted in a complex mixture of genotypes and possibly threats to indigenous AnGR gene pool. In the absence of a clearly defined breeding policy, crossbreeding is bound to cause genetic erosion resulting in loss of adaptation and loss of probably unique genetic identities of indigenous AnGR. The completion and implementation of the policy preparation, which is underway, is expected to address the issues mentioned above.

Past research and development efforts ignored the importance of adapted indigenous farm AnGR due to a general belief that they are not productive and incapable of contributing to increased agricultural production.

2.1.4. Shortcomings of previous efforts

Political instability and/or inconsistency of development policies: There always has been weakness in institutionalising and setting commitments for the continuation of programmed undertakings. Experiences reflect that lasting acceptances, stability and further enriching and carrying on of an on-going programs are missing. Moreover, various livestock improvement programs and projects have not often taken the specific conditions of different production environments, market and agro-ecological conditions of the country into account. The need for favourably modified production environment such as improvements in the physical, management and institutional environments have been neglected and as a result these schemes have not been sustained after completion of the projects.

Limited stakeholder participation: Participation of stakeholders in the identification of problems, formulation of solutions, implementation and monitoring of interventions related to AnGR has been very low.

Limitation of interventions in scope and scale: past activities often focused only on a couple of species (usually cattle and poultry), while other species of major significance to the poor were totally ignored.

2.1.5. Lessons learnt

a. F_1 crossbred cattle are adaptable and produce more than locals under improved management environments in the highlands

b. The importance of indigenous resources and knowledge as a basis for development

c. The need for improved production environment to complement genetic improvement

d. The need for comprehensive and integrated national livestock development plan and breeding strategies based on agro-ecological zones, production systems and breed types

e. the need for demand-driven research

2.2. Future Demands and Trends

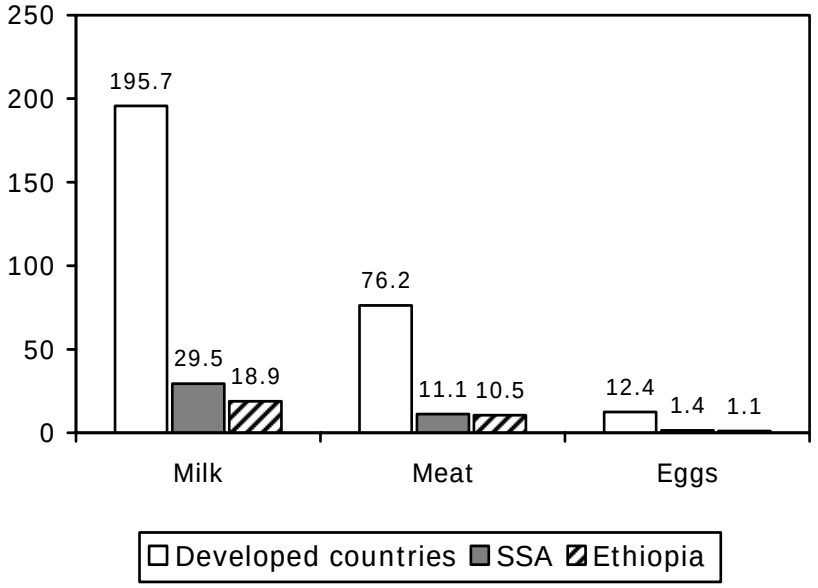
2.2.1. Demand for animal products

Demand for animal products in developing countries is projected to rise significantly and faster than in developed countries as a result of population growth, urbanisation and rising incomes. Greater consumption diversification or changes in food patterns are likely to occur in the developed countries, as a larger proportion of consumers require a more varied menu of a higher quality (Delgado et. al., 1999).

Output of meat and milk in Ethiopia is low and growth in productivity has been lagging behind population growth rates. As a consequence, the trend in per caput output of livestock products has been negative. Between 1995 and 2000, total milk and meat production increased by 2.6% and 1.4% per year, respectively. According to Genet Mengistu (2004) with an estimated annual growth rate of 2.7%, the population of Ethiopia is projected to increase from 63.5 million in 2000 to 84.0 million in 2010 and 106.0 million in 2020. Figure 2.1 illustrates the wide gap in per capita consumption of animal products between Ethiopia, Sub-Saharan Africa (SSA) and developed countries and signifies the link between population growth and declining per capita animal food availability. The picture for milk appears much worse than for meat. Proportion of per caput intake of calories (5.8%) and proteins (13.7%) as compared to 6.3% and 19.5% in SSA and 26.5% and 56.1% in developed countries is also relatively smaller (FAO, 2001).

Additionally, demand for livestock products is expected to increase as a result of urbanization. The proportion of urban population in Ethiopia has increased from about 13.8 % in 1994 to 15.0% in 2004 and is expected to reach 19.9% in 2020. Accordingly, the rural agricultural sector is expected to feed 21.2 million urban population in 2020 compared to about 9.0 million in 2000. While the overall population increase suggests that overall food supply has to increase greatly, higher urbanisation would mean a shift in dietary preferences towards higher quality food items such as meat, milk and eggs.

Figure 2.1. Average per capita milk and meat consumption in Ethiopia, Sub-Saharan Africa and developed countries, 1997-1999 (Source: FAO, 2001).



Market-oriented and demand driven opportunities for growth exist where population concentration is increasing. A study on urban demand for live sheep showed that sheep prices and household income, as well as socio-demographic factors, including household size and composition, significantly affect the likelihood of buying and expenditures on live sheep. Projections of live sheep demand and supply in Addis Ababa in 2010 and 2020 showed that sheep producers in Addis Ababa alone will be able to meet up to only 27% of the demand (Ehui et. al., 2000). Thus, the impact of population growth plus urbanisation will provide impetus for livestock development

2.2.2. Change in livestock production systems

A low growth rate of livestock output vis-à-vis high human population growth rate becomes one of the major causes of concern in Ethiopia. Comparison of livestock population with the small share of total livestock output and very low output per animal shows that the nature of the livestock production systems is the least developed and indicates that an all out efforts have to be made to increase production and productivity.

Increased demand for livestock products may provide an engine for sustainable intensification of smallholder food and feed production systems. Changing factor combination of land, labour and capital and rising prices for livestock products are the starting point for livestock producers to invest in technologies that help

achieve higher yields of livestock products and generate higher incomes. Crossbred animals can be seen as such a technology, provided that adequate infrastructure, extension and technical support services are established. Availability of sources of dairy genotypes was cited by Walshe et al. (1991), as an important factor in establishing market oriented dairying.

Traditionally livestock production has been an important source of income for the rural poor. It is anticipated that expansion of livestock and livestock products will offer one of the best opportunities for increased trade and economic integration between pastoralists and farmers. Several African countries can also be considered as potential export markets given the gap that exist in these countries between demand and local supply of animals and animal products.

Improved livestock marketing is viewed as an important national development strategy to increase both rural incomes and foreign exchange earning. The share of foreign trade in livestock and livestock products to the overall export value of Ethiopia between 1999 and 2002 is shown in Table 2.1. Skins and hides in the form of pickled, wet-blue, and finished leather and leather products are the major exports. Ethiopian hides and skins have relatively high demands in Western industrialized nations and South East Asian countries. Next to skins and hides, goat meat and chilled mutton as well as canned meat products are the second important export commodities. Live sheep, goats and camels and to a limited extent beef cattle are exported mainly to Middle East and African countries.

The Government of Ethiopia has decided to integrate its economy into the Multilateral Trading System. Recently, Ethiopia has applied for World Trade Organization membership. The agreement on agriculture was designed to bring the agricultural sector under new set of multilateral trade rules and disciplines, which cover the three components of agricultural liberalization; market access, export subsidies and domestic support.

Table 2.1. Export values of livestock and livestock products (millions US$), 1999-2002

Item	USD (000) in year			
	1999	2000	2001	2002
Live cattle	130	73	503	336
Live sheep and goat	866	1,256	NA	35
Other animals	111	3	4	182
Hides	1,271	3,953	16,795	3,948
Skins	25,430	38,200	56,895	53,956
Leather products	3,080	5,310	164	23
Bees wax	895	893	555	554
Dairy products	46	4	10	20
Meat and meat products	3,799	2,360	1,515	1,710
Value of total products exported	431,659	481,040	427,451	413,226
Share of livestock to total export value (%)	8.33	10.85	17.94	14.75

Source: National Bank of Ethiopia and Ethiopian Customs Authority
NA = Not Available

Sanitary problems and products quality have always constrained the export trade of Ethiopian products. With increased liberalisation of both foreign and domestic markets of most developing countries, import and export of meat and dairy products may be expected to increase at a rate faster than is currently observed. Product properties such as quality and safety, and increasingly the production methods, will influence the choice of products. Sanitary requirements of the international market and increased competition are expected to encourage the production of diversified high quality products.

The presence of problems such as unavailability of inputs, inadequate research application and extension support, poor infrastructure, and inadequate technologies, leading to insufficient animal productivity will limit the rate of adoption of technology toward intensification and commercialisation of specialised livestock farming systems.

Urban and peri-urban areas offer most favourable opportunity for the adoption of technology for the development of intensified and specialized dairy and poultry production systems. Smallholder farmers in the highlands who carry out dairy activities within a traditional mixed farming system prefer to maintain crossbred cattle and some cattle of local breeds and, provided that they have better access to inputs, market outlet and research and extension support, they are likely to adopt medium level input dairy production. Utilization of crop residues, increased production of manure ensuring soil fertility and minimizing the need to purchase feed will remain important in ensuring sustainable integration of crop and livestock production.

The majority of rural farmers and pastoralists cannot follow this path of intensification because of increasing transaction costs and poor marketing infrastructures, although adoption of crossbred cattle appears attractive. The different opportunities in low-input systems include diversification of livestock products through promotion of post-harvest technologies and small-scale processing units, providing incentives for organic products, and improving quality aspects of traditional products.

For pastoralists and agro-pastoralists systems, the main thrust will be to devise and implement disease monitoring and approved certification schemes for export of live animals and animal products. Animal identification associated with sanitary control will be very important.

In Ethiopia, crossbreeding has been going on, mainly in areas where mixed agriculture is practiced, to improve animal productivity. Animal performance recordings will have best chances to be adopted in medium to large private livestock farms that have considerable scope for increasing productivity, but will require more inputs supply and advisory services. Research and development institutions that are mandated to undertake various aspects of breed improvement need to coordinate their tasks, establish common livestock recording systems, and ensure the common use of information generated.

2.3. Alternative Strategies in the Utilization and Conservation of AnGR

Widespread poverty, hunger, malnutrition and deteriorating environmental conditions are the problems the country is faced with. Therefore, the major concern for the agriculture sector is to address these national issues, while ensuring sustainable management of the natural resources. Local genetic resources are crucial for sustainable production in such environmental and economic circumstances. In this regard, valuation of local breeds should consider their major contribution to risk management under the prevailing harsh and fluctuating environmental conditions. The future emphasis will have to concentrate on increased livestock productivity per animal and per unit of input, mainly land. This calls for the improvement of livestock management techniques and exploitation of new possibilities to increase efficiency.

Breeding policy for sustainable use of farm animal diversity is not yet in place. On the other hand, there is a strong tradition of livestock keeping in pastoral and mixed farming systems. Traditional selection methods improve productivity only very slowly. Biotechnology offers tools that achieve rapid increases in productivity. Breeding strategies to improve efficiency of livestock production comprise selection schemes amongst populations, crossbreeding and use of biotechnological techniques to enhance the productive and reproductive performance. Therefore, improved AnGR management envisages sustained and balanced resource utilization and conservation by strengthening networking among the concerned national and international institutions. However, the cooperation and Networking with international institutions should be in line with the international agreements the country has signed regarding access to and benefit sharing from genetic resources. Thus, the overall objective of developing strategies for AnGR should ensure better use, development and conservation of farm AnGR diversity.

2.4. Future National Policy for Utilization and Conservation of AnGR

The future breeding policy on development and conservation of AnGR should include, among other things, strategies and guidelines for farmers, researchers, extension workers and animal breeds that are suitable for the various agro-ecological zones. It should also include alternative breeding programs, regulations of import and export of genetic materials, characterization, conservation and sustainable use of indigenous genetic resources and use of modern breeding technologies. Priority areas for research, development and the legal and institutional framework required for implementation should be identified. There is also urgent need to build more constructive approaches to breeding, ensuring that valuable local types are conserved. At the same time, a guided approach is required for specialised breed substitution and crossbreeding programs. Addressing the issues mentioned above will assist in laying the groundwork required for a genetic improvement work.

3. THE STATE OF NATIONAL CAPACITIES AND FUTURE CAPACITY BUILDING REQUIREMENTS

3.1. State of Capacity on Farm AnGRs

3.1.1. Current institutional capacity

The limited knowledge on Ethiopia's animal diversity indicates that no substantive measures have been taken to prevent the growing genetic erosion. The scope and depth of animal genetic resources utilization and conservation are still underdeveloped. Inadequate organizational structure, coordination facilities, scientific capacity, decision-making mechanisms are further compounded by the lack of a comprehensive policy and legislation. Thus, there is an urgent need for the formulation of a coordinated institutional capacity for animal genetic resources use, development and conservation programs.

The Federal Government of Ethiopia has devolved greater responsibility of conservation, development and sustainable utilization of natural resources to the regional governments limiting itself to public functions such as issuing policy, legal directives and playing regulatory role. It is, therefore necessary to create community awareness and build up their capacity for sustainable use of farm AnGR. Building capacity at the federal and regional levels through bilateral agreements, exchanging experience through workshops, training, and creating other linkages would be beneficial. At the moment, attempt is being undertaken to synchronize efforts between the various higher learning, research, development and conservation institutions, on the one hand and policy makers of the country at all levels on the other hand.

Table 3.1. Institutions involved in the livestock sector

	Extension	Research	Breeding	Education	Domestic Animal Diversity
International		ILRI	ILRI		ILRI, FAO, GTZ, IDAD, WAAP
Regional		ASARECA			
National	MoARD	EARO (MoARD)	NAIC (MoARD)	Universities	EPA, IBC & EARO (MoARD)
Regional	Regional Agricultural and Pastoral Dev. Bureaus	Regional Agricultural Research Iinstitutes	Breeding Ranches / Multiplication Ranches	Asgric. College & Training Centres	Regional Agricultural Research Institutes
Local	Wereda Agricultural Development Offices	Farmers	Peasant Associations		Farmers

3.1.2. Policies and strategies on AnGR

Ethiopia has made several global and regional agreements regarding the conservation and utilization of biological diversity. By ratifying the UN Convention on Biological Diversity (CBD, 1992), Ethiopia has committed itself to develop sustainable management of genetic resources. The convention necessitates initiation of measures at a national level designed for identifying and monitoring biodiversity, maintaining and sharing the resulting benefit arising out of the utilization of genetic resources, and integrating the conservation and sustainable use of biological resources into national decision making (FAO, 1998). The general understanding, therefore, is that the development of animal agriculture in Ethiopia should be based on sustainable utilization and conservation of farm animal genetic resources the country has.

In line with this perspective, the Government of Ethiopia recognized the need to promote environmentally sustainable social and economic development of the country through protecting and preserving environmental values including biodiversity. Accordingly, Ethiopia has adopted policies and strategies that directly address biodiversity conservation. These are the Federal environmental policy (1997), the National biodiversity conservation and research policy (1998), and the Conservation strategy of Ethiopia (1997) and Regional conservation strategies specific to each regional state.

The draft policy and strategy for livestock utilization and conservation prepared by the former MoA has not been finalised. Currently the country's animal breeding policy is being prepared with the participation of relevant institutions.

The contribution of AnGR to the national economy is very well recognised. At present, the Federal and Regional States finance most of the livestock research activities. There are also some limited financial and technical supports from international and non-governmental organizations.

3.1.3. Policies and strategies favoring AnGR

- Constitution of FDRE
- Rural development policy and strategy
- Industrial development strategy
- Education policy
- Federal environment policy
- Biodiversity conservation and research policy, strategies and programs
- Conservation strategy of Ethiopia
- Conservation strategies of regional states
- Inclusion of AnGR issues as an integral part of several governmental organizations (MoARD, EARO, HLI)

3.2. Current Research and Development Status and Facilities

In spite of the vast potential resources in farm animal diversity, the current capacity of the country in animal genetic resources research is very limited both institutionally and in terms of qualified manpower. Therefore, building up a research capacity and capability is essential and a prerequisite to the utilization and conservation of genetic resources.

Limited capacities of basic research facilities are available at both Federal and Regional Research Institutions. Molecular biology laboratory at IBC, Animal health laboratory at NVI and Faculty of Veterinary Science at Addis Ababa University, Bedelle and Sebetta Animal Health Laboratories are some of the research facilities available in the country. In the area of Biotechnology, there is MOET laboratory at ILRI Debre Zeit Research Station. However, these facilities are not sufficiently utilised to undertake experiments needed in animal genetic resources due to lack of adequate trained human-power and limited accessibility. In addition to these, a draft national biotechnology strategy and action plan has been developed recently

The NAIC is responsible for production, preservation and distribution of semen as well as for importing bulls and semen that are used mainly for the dairy development. It also selects bulls for semen production both from exotic and local cattle and small ruminants.

There are a number of Regional ranches/breeding centres, which provide crossbred animals to smallholder farmers through the local extension program.

International or bilateral agencies (UNICEF, WFP, SIDA, FINIDA, FAO, ADB, GTZ, World Bank..etc) provide technical advice and financial input to the development of livestock production. ILRI is also involved in some areas of livestock research activities.

3.3. Training Institutions

Higher Learning Institutions, notably Alemaya University and Jimma Agricultural College are pioneers in starting research on farm animals. Currently, the above mentioned institutions, Debub and Mekele Universities, and ATVET centres are involved in undertaking training on farm animals. The ATVET program, which provides all-round training to extension agents in almost all the regions of the country, is vital in transferring knowledge acquired through research to the farming communities.

3.4. Natural Resources Conservation and Management

The Federal Government of Ethiopia has taken an action with regard to the conservation of the country's biological resources by establishing institutions like the IBC and the Environmental Protection Authority, which are vested with responsibilities of conserving biodiversity, and enforcing related policies and regulations respectively. The emphasis given to biodiversity and environmental protection could be also evidenced by the endeavour that is being made with regard to awareness raising by introducing biodiversity and environmental science into the school curricula.

In June 1998, the then IBCR, was established by decree and published the National Policy on Biodiversity Conservation and Research in the same year. Besides, Ethiopia has not only participated in the United Nation's Conference on Environment and Development (UNCED) held in Rio de Janeiro in 1992, but also endorsed and signed the Convention on Biological Diversity (CBD).

The Animal Genetic Resources Program of the IBC will undertake studies on livestock breed identification, characterization, develop conservation and breed evaluation guidelines and carry out studies on the diversity and distribution of breeds in the country.

3.5. Future Capacity Requirements

Performance recording schemes are not in place, but are planned. Private large-commercial, smallholders and rural farmers shall be responsible for recording. Utilization of improved technologies and methodologies in breed evaluation will have a great impact on the use and development of AnGR. As the country is yet to establish genetic improvement programs, the opportunity exists to start at the state of the art level of technology. Development of reproductive biotechnological tools and genomic have been effectively developed over the last twenty years and is now routinely used on farm animals to quickly multiply desirable animals and to enhance genetic selection and there is a need to build capacity in this area.

4. STRATEGIC PRIORITIES FOR ACTION

4.1. State of Development of Farm AnGR

In the low input system, cattle, small ruminants, equines, camels and chicken are important farm AnGR. The entire equine populations as well as the majority of other farm AnGR that are maintained within the system are composed of indigenous breeds. In the medium input production system, pure exotic and crossbreds are kept in addition to the indigenous farm animals.

The majority of the livestock production of the country is traditionally run under natural resources based low input production system. Despite this, four species of the farm AnGR of the country, namely: cattle, sheep, chicken and goats are addressed in different development programs. Four of the seven widely used cattle breeds (Borena, Horro, Arsi, and Fogera) are used for pure and cross breeding programs. Similarly, such programs consider the use of pure and crossbred chickens with the exotic broilers and layers. Two sheep breeds (Menz and Horro) and two goat breeds (Short and Long-eared Somalis) are considered in the program. There is no genetic improvement program with regard to equines and camels (Annex Table 4.4).

4.2. Opportunities, Challenges and Priorities for Utilization and Conservation of Farm AnGR

4.2.1. Opportunities

Opportunities for better use and development of AnGR exist in mixed crop-livestock production system. The broad genetic variability, the ability of the indigenous breeds of cattle, sheep, goats, chicken and honeybees to survive under stressful environmental conditions including high disease incidence and poor nutrition are some of the important genetic traits which provide opportunities for research and development of farm AnGR.

Studies undertaken so far show that indigenous sheep and goat breeds have good growth and reproduction performances in low input production systems. The large framed Fogera and Horro cattle breeds have reasonably satisfactory levels of milk yield. A recent study on scavenging Fayoumi chicken breed indicated the existence of great potential for rural poverty reduction and protein supply.

In the pastoral and agro-pastoral areas, there are also opportunities for better use and development of AnGR. Based on limited findings at research stations and government breeding ranches, the Borena cattle are typified as potential beef and dairy breed**.** Ogaden cattle breed has good potential for beef production. Black Head Somali and Horro sheep and Somali goat breeds have good potential for meat production. Sheko and Nuer breeds are considered to be trypanotolerant. The Afar/Danakil cattle are very tolerant and well adapted to extremely harsh environmental conditions. Beef ranching will create good opportunity for supply

of domestic and international markets. Ethiopia has a comparative advantage in producing beef for Middle East and some other countries.

Opportunity for better use and development of AnGR exits in the urban and peri-urban areas also. Dairy cattle, chicken and small ruminants are the most important species in the system. Commercial farms use pure exotic and crossbred dairy cattle and chicken. The system is characterized by the presence of agro-industrial by-products. It also has good market opportunities for livestock and livestock products than the other production systems. The existence of various research, teaching and development institutions as well as other facilities in and around these areas makes the system more favourable for livestock production.

The indigenous knowledge involved in the traditional livestock production could be considered as an opportunity for the use and development of AnGR. Women and children play important roles in management and utilization of AnGR, particularly small ruminant and chickens. Women are also involved in feeding, watering and health management of large ruminants. Moreover, they play important roles in processing and marketing of livestock products. Children participate actively in milking and herding activities.

Opportunity also exists in beekeeping. Ethiopia is endowed with immense potential of diverse plant genetic resources. There is over 7,000 species of flowering plants, most of which are utilized by the honeybees. Besides, the country's variable climate, ample water resources and other conducive ecological factors have enabled the country to sustain a large number of honeybee colonies.

Government policy with regard to investment in agriculture provides various incentives such as duty exemption, tax relief,..etc is another opportunity to enhance sustainable utilization and conservation of farm AnGR.

4.2.2. Challenges

Use, development and conservation of AnGR have been constrained by different challenges. Poverty is the most serious challenge to the conservation and sustainable use of farm AnGR. We cannot talk of conservation of genetic resources without having a sound poverty alleviation program in place.

One of the major challenges is weak institutional set up & capacity which resulted in lack of coordination between stakeholders, absence of responsible body at national level, inadequate institutions engaged in AnGR, low involvement of professional associations, civil societies, private sector and absence of breeders associations.

Inadequate human resources capacity, limitations in know-how and expertise, is the other major challenge for better use of AnGR. There are very few animal breeders, experts in modern reproductive technology and molecular genetics. The Ethiopian government is sensitised and committed to provide necessary support. However, the country is faced with the scarcity of financial resources. Therefore,

additional financial support is required from national, regional and global initiatives, and the international community.

Unimproved management of natural and human resources have also contributed a lot to the under-development of AnGR.

Poor inputs and services delivery systems are the other challenges for sustainable use, development and conservation of AnGR. Inputs and services delivery systems are often fragmented, piece meal approach with no inter-links among development projects. Dairy development projects, for example, often focussed on high inputs delivery approach, such as distribution of crossbred in-calf heifers, which requires intensive delivery of AI and animal health services.

The performance of breed improvement and multiplication centres in supplying improved stock to the farmers has been low. The current dissemination scheme of crossbred, high grade and exotic animals, assisted by subsidized AI service, is unable to satisfy the ever-increasing demand by smallholders. In addition, there are a number of other technical, technological and socio-economic constraints that hinder improvements in productivity and efficiency of smallholders.

The other challenge in the use and development of AnGR is lack of coordination in development, research, training, extension and delivery of inputs. Efforts have not been institutionalised and tended to be shot-term oriented.

Some of the major challenges of beef production are lack of proper understanding of the production systems, improper use of natural resources, inadequate nutrition, fragile environment, prevalence of diseases, poor processing and marketing infrastructures.

Free and unregulated movement of livestock in the country has also contributed to uncontrolled breeding and dissemination of diseases.

Other challenges for better utilization and conservation of farm AnGR are poverty, recurrent drought and financial constraints.

Information and database management systems necessary for AnGR use, development and conservation are not available. There exist no comprehensive data on farm AnGR of the country. The limited available information on some cattle breeds is documented in the FAO (DAD-IS) and ILRI (DAGR-IS) databases.

The absence of livestock breeding policy, strategies and action plans has led to the uncontrolled interbreeding and crossbreeding of a number of species of animals, thus affecting the use, development and conservation of AnGR. This has also an impact on potential cooperation with other countries and international organizations.

4.2.3. Priorities

Developing appropriate animal breeding policy is crucial to undertake sustainable utilization and conservation of the country's farm AnGR.

Developing institutional set up such as strengthening of coordination between stakeholders, capacitating of institutions engaged in AnGR, promoting of the roles of professional associations, civil societies and private sector, and formation of breeders associations is one of the major priorities.

To implement AnGR utilization and conservation programs, there is a need for capacity building in animal breeding, reproduction, nutrition, health and other related disciplines. Therefore, development of human resource in areas of characterization, utilization and conservation are the other priority areas.

Effective research and development programs geared towards better utilization and conservation of AnGR require strong collaboration and networking with various national, regional and international institutions. Similarly, formation of breed societies and breeders associations will have an important role in AnGR use, development and conservation.

There is a need to develop database management system, information network and early warning system at a national level to capture national, regional and global information on use, development and conservation of farm AnGR. In addition, establishment of a national recording system is one of the priorities. There is a need to establish systems to monitor the status and trends of breeds.

Classification, description, and identification of breeds of farm animals, including genetic and molecular level characterization, breed level census and breeds bio-geographic distribution, is one of the top priority areas for better utilization and conservation of AnGR. As a matter of urgency, there is a need to conserve the already endangered breeds such as the Sheko cattle breed.

5. THE WAY AHEAD: MAINSTREAMING ANIMAL GENETIC RESOURCES

5.1. Capacity Building

5.1.1. Communication between regions and countries

Establishment of a strong communication system and linkages between regions, regional institutions and countries that are engaged in utilization and conservation of AnGR is one of the options to build national capacity in AnGR utilization, development and conservation. For example, networking with the Biotechnology Trust for Africa (BTA), the Kenyan Agricultural Research Institute (KARI) and ASARECA can be considered.

5.1.2. Capacity building

Capacity building requirements are:

- Establishment of a critical mass of a core team of national experts to form the basis for better use, development and conservation of AnGR, especially in the areas of genetics, breeding, genomics, biotechnology, research and development;
- Provision of various levels of training to all stakeholders such as ATVET centres and farmers, that are directly or indirectly involved in the use, development and conservation of AnGR;
- Setting up a well-equipped modern laboratory for development and conservation of AnGR;
- Encourage and support the formation of breed societies and breeder associations. They will have an important role to play in the use, development and conservation of AnGR;
- Strengthen institutional arrangements, to effectively mobilise all stakeholders including NGO's involved in activities related to AnGR.

5.1.3. Support to the continuity of regional workshops on AnGRs

Networking with regional and international institutions involved in AnGR development, use and conservation is important to share experiences and identify gaps and challenges among countries. Therefore, strong interaction between the National Focal Points (NFP) and support from FAO and other relevant institutions is required to implement such activities.

5.1.4. Develop regional markets for products from AnGR

Strong and sustainable national, regional and international markets should be developed to ensure sustainable use, development and conservation of AnGR. To this end, due attention should be given to the development of necessary infrastructure and institutions. In order to be competent in marketing of animals and animal products, establishment of disease free zones and quality control systems that are required to meet regional and international standards.

5.1.5. Raising awareness

Awareness of farmers, general public and decision-makers on the strategic relevance of AnGR should be raised. To do so, establishment of a strong national database on AnGR and use of mass media are required. To increase awareness on the importance of AnGR, FAO and professional associations should lobby governments and policy makers.

Dissemination of indigenous knowledge in animal production and management of AnGR is highly important. To appreciate and develop the knowledge, strong extension service, commitment of stakeholders and finance are required.

5.1.6. Set up of gene banks

The government will strengthen the capacity of IBC and other relevant institutions that are dealing with use, development and conservation of AnGR. In so doing, the assistance of FAO and other regional and international institutions will be indispensable.

5.2. Institutional Arrangements

For better utilization and conservation of AnGR, a well-coordinated institutional arrangement is a key issue. The arrangement should include dissemination of information and networking at regional and international levels. To implement this, concerned national, regional and international institutions and NFP should take up the lead responsibility. FAO is expected to play a catalytic role in this regard.

5.3. Possible Sources of Finance

The government, the private sector, communities, NGOs, FAO, bi-lateral and multi-lateral donors, World Association of Animal Production and other donors are potential sources of finance to activities geared towards better utilization and conservation of AnGR.

5.4. Policy Development

Policies favouring the promotion of use, development and conservation of farm AnGR should be developed in the earliest time possible where such policies are lacking.

5.5. Partnership

It is important to create and develop partnerships with national, regional and international institutions that are directly or indirectly involved in the utilization and conservation of AnGR.

5.6. Potential Modalities for Facilitating Interaction Among Donors and Recipients

Projects/proposals should be developed in the area of utilization and conservation of AnGR by stakeholders for funding. NCC should play an advisory role in the development, implementation and coordination of such activities.

5.7. Process Forward: Post-State of the World Process

The NCC should further be strengthened and work closely with the concerned national, regional and international institutions. The NCC should play active role in lobbying government bodies to raise awareness on the importance of AnGR. FAO should participate in influencing governments.

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7. ANNEXES

Table 1.1 Importance of livestock to the gross domestic product in agriculture (millions of $US).

Activity	$US (millions)	Data from Year
Livestock production (official statistics)	$284	2004
Other agricultural production (official statistics)	$853	
Best estimate of additional value of livestock		

Source: MoA (2004)

Table 1.2 Land use and current trends (1000 ha).

	Area (1000 ha)	Area (1000 ha)	Current trend
Category	**1993**	**1999**	
Arable land	11000	10000	
Permanent crops	650	728	
Permanent pastures	20000	20000	
Agricultural area	31650	30728	
Land area	100000	100000	
Total Area	110430	110430	

Source: FAO (2001). FAOSTAT

Table 1.3 Land use for livestock and current trends.

	Area (1000 ha)	Area (1000 ha)	Current trend
Category	**1990**	**1999**	
Cropping for food	8217	10000	
Cropping for feed		110	
Cropping for food and feed			
Natural pasture	20000	20000	
Improved pasture			
Fallow			
Forest			
Non-agricultural			
Total	28217	30110	

Source: CSA (1999), IBCR (2002)

Table 1.4 Land tenure for livestock production.

Category	Area (1000 ha)	%
Private	94000	0
Government and communal	687000	0
Total	781000	

Source: Sileshi Ashinie (2003)

Table 1.5 Farm structure and distribution.

Category	Number of farms / households	%	Number of farms / house-holds with livestock	%
Landless	NA	#VALUE!	NA	#######
> 0 to 2 ha	NA	#VALUE!	NA	#######
> 2 to 10 ha	NA	#VALUE!	NA	#######
> 10 to 50 ha	NA	#VALUE!	NA	#######
> 50 to 100 ha	NA	#VALUE!	NA	#######
> 100 to 500 ha	NA	#VALUE!	NA	#######
> 500 ha	NA	#VALUE!	NA	#######
Unknown	NA	#VALUE!	NA	#######
Total	0	#VALUE!	0	#######

Table 1.6 Livestock population, number of owners/house-holders and employment by species.

	Livestock population (1000)	Number of owners / householders	Number of persons additionally employed	
Species			**Fully**	**Partially**
Cattle	44319	NA	NA	NA
Buffalo				
Sheep	23620	NA	NA	NA
Goats	23325	NA	NA	NA
Camels	2314	NA	NA	NA
Lamas and Alpaca				
Horses	1505	NA	NA	NA
Donkeys	4195	NA	NA	NA
Pigs				
Chicken	42000	NA	NA	NA
Turkey				
Ducks				
Geese				
Rabbits				
Mule	358	NA	NA	NA

Source: The 2001/02 Ethiopian Agricultural Sample Enumeration (EASE), Excutive Summary- CSA (2004)

Table 1.7 Human populations in the country.

Year	Total (millions)	Rural or Farming (%)	Urban or Non Farming (%)	Total
1994	53	86	14	100
2004	69	85	15	100
Average annual growth rate	3			

Source: Genet Mengistu (2004)

Table 1.8 Major livestock primary production (1000 tonnes/numbers).

	Meat (t)		Milk (t)		Eggs (t)		Fiber (t)		Skin (No.)	
Species	1993	2000	1993	2000	1993	2000	1993	2000	1993	2000
Cattle	230	285	750	930						
Buffalo										
Sheep	77	78	54	53						
Goats	63	63	93	94						
Camels	10	11	73	76						
Lamas and Alpaca										
Horses										
Donkeys										
Pigs										
Chicken	72	74			73	75				
Turkey										
Ducks										
Geese										
Rabbits										

Source: FAO (2001). FAOSTAT

Livestock primary product imports

Table 1.9 Major livestock primary product imports (1000 tonnes/numbers).

	Meat (t)		Milk (t)		Eggs (t)		Fiber (t)		Skin (No.)		Animals (No.)	
Species	**1993**	**1999**	**1993**	**1999**	**1993**	**1999**	**1993**	**1999**	**1993**	**1999**	**1993**	**1999**
Cattle	5		256	626								
Buffalo												
Sheep												
Goats												
Camels												
Lamas and Alpaca												
Horses												
Donkeys												
Pigs	2	2										
Chicken	100				2	10						
Turkey												
Ducks												
Geese												
Rabbits												

Source: FAO (2001). FAOSTAT

Livestock primary product Exports

Table 1.10 Major livestock primary product exports (1000 tonnes/numbers).

	Meat (t)		Milk (t)		Eggs (t)		Fiber (t)		Skin (No.)		Animals (No.)	
Species	**1993**	**1999**	**1993**	**1999**	**1993**	**1999**	**1993**	**1999**	**1993**	**1999**	**1993**	**1999**
Cattle	40	73							23	24		
Buffalo												
Sheep	33	259							28	30		
Goats		243							23	22		
Camels												
Lamas and Alpaca												
Horses												
Donkeys												
Pigs												
Chicken												
Turkey												
Ducks												
Geese												
Rabbits												

Source: FAO (2001). FAOSTAT

Table 2.1 Distribution of livestock by production system (%).

	Production systems			
Species	**Low input**	**Medium input**	**High input**	**Total**
Cattle	98	2	0	100
Buffalo	0	0	0	0
Sheep	100	0	0	100
Goats	100	0	0	100
Camels	100	0	0	100
Lamas and Alpaca	0	0	0	0
Horses	100	0	0	100
Donkeys	100	0	0	100
Pigs	0	0	0	0
Chicken	96	4	0	100
Turkey	0	0	0	0
Ducks	0	0	0	0
Geese	0	0	0	0
Rabbits	0	0	0	0
Mule	100	0	0	100

Comment: There exists no official information on the distribution of livestock by production systems. Thus, based on available information and the existing situation the above figures are set by the NDC, and later approved by the NCC and stakeholders at the national workshop.

Table 2.2 Changes in the distribution of production systems during the last 20 years

	Production systems			
Species	**Low input**	**Medium input**	**High input**	**Total**
Cattle	NA	NA	NA	0
Buffalo				0
Sheep	NA	NA	NA	0
Goats	NA	NA	NA	0
Camels	NA	NA	NA	0
Lamas and Alpaca				0
Horses	NA	NA	NA	0
Donkeys	NA	NA	NA	0
Pigs	NA	NA	NA	0
Chicken	NA	NA	NA	0
Turkey				0
Ducks				0
Geese				0
Rabbits				0
				0

Table 2.3 Type of livestock farm by production system for cattle (%).

	Production systems			
Type of operation	**Low input**	**Medium input**	**High input**	**Total**
Subsistence	100	0	0	100
Smallholder	99	1	0	100
Small-scale-commercial	0	100	0	100
Large-scale-commercial	0	0	0	0

Comment: There exists no official information on the type of operation within production systems. Thus, based on available information and the existing situation the above figures are set by the NDC, and later approved by the NCC and stakeholders at the national workshop (This comment holds true for Tales 2.3 through 2.10)

Definitions (as given in the FAO Country Report preparation guideline):

1. **subsistence**: - less than 50% of production is marketed
2. **smallholder**: - small family farms with more than 50% production marketed
3. **small scale commercial**: - medium family farms with more than 50% production marketed
4. **large scale commercial:** - large farms or companies with all production marketed

Table 2.4 Type of livestock farm by production system for sheep (%).

	Production systems			
Type of operation	**Low input**	**Medium input**	**High input**	**Total**
Subsistence	100	0	0	100
Smallholder	100	0	0	100
Small-scale-commercial	0	0	0	0
Large-scale-commercial	0	0	0	0

Table 2.5 Type of livestock farm by production system for goats (%).

	Production systems			
Type of operation	**Low input**	**Medium input**	**High input**	**Total**
Subsistence	100	0	0	100
Smallholder	100	0	0	100
Small-scale-commercial	0	0	0	0
Large-scale-commercial	0	0	0	0

Table 2.6 Type of livestock farm by production system for camels (%)

	Production systems			
Type of operation	**Low input**	**Medium input**	**High input**	**Total**
Subsistence	100	0	0	100
Smallholder	0	0	0	0
Small-scale-commercial	0	0	0	0
Large-scale-commercial	0	0	0	0

Table 2.7 Type of livestock farm by production system for horses (%).

	Production systems			
Type of operation	**Low input**	**Medium input**	**High input**	**Total**
Subsistence	100	0	0	100
Smallholder	0	0	0	0
Small-scale-commercial	0	0	0	0
Large-scale-commercial	0	0	0	0

Table 2.8 Type of livestock farm by production system for donkey (%)

	Production systems			
Type of operation	**Low input**	**Medium input**	**High input**	**Total**
Subsistence	100	0	0	100
Smallholder	0	0	0	0
Small-scale-commercial	0	0	0	0
Large-scale-commercial	0	0	0	0

Table 2.9 Type of livestock farm by production system for chicken (%)

	Production systems			
Type of operation	**Low input**	**Medium input**	**High input**	**Total**
Subsistence	100	0	0	100
Smallholder	99	1	0	100
Small-scale-commercial	0	100	0	100
Large-scale-commercial	0	0	0	0

Table 2.10 Type of livestock farm by production system for mule (%)

	Production systems			
Type of operation	**Low input**	**Medium input**	**High input**	**Total**
Subsistence	100	0	0	100
Smallholder	0	0	0	0
Small-scale-commercial	0	0	0	0
Large-scale-commercial	0	0	0	0

Table 3.1 Breed Diversity (Number of Breeds)

	Number of breeds									
	Current Total		At risk		Widely used		Others		Lost (last 50 yr)	
Species	**L**	**E**	**L**	**E**	**L**	**E**	**L**	**E**	**L**	**E**
Cattle	25	3	1	0	6	1	18	2	0	0
Buffalo	0	0	0	0	0	0	0	0	0	0
Sheep	13	7	0	0	8	0	5	7	0	0
Goats	15	2	0	0	10	0	5	2	0	0
Camels	4	0	0	0	3	0	1	0	0	0
Lamas and Alpaca										
Horses	2	0	0	0	2	0	0	0	0	0
Donkeys	4	0	1	0	3	0	0	0	0	0
Pigs										
Chicken	5	7	0	0	4	2	1	5	0	0
Turkey										
Ducks										
Geese										
Rabbits										
Mule	2	0	0	0	2	0	0	0	0	0

Comments: **L - locals**
E - Exotics

Table 3.2 Number of breeds for which characterization has been carried out (Number of breeds)

	At population level				At individual level		
Species	**Baseline survey**	**Genetic distance**	**Breeds and crosses evaluation**	**Valuation**	**Performance recording**	**Genetic evaluation**	**Molecular evaluation**
Cattle	21	10	5	0	5	1	10
Buffalo							
Sheep	13	0	2	0	2	2	0
Goats	15	9	2	1	0	0	9
Camels	2	0	2	0	0	0	0
Lamas and Alpaca							
Horses	2	0	0	0	0	0	0
Donkeys	4	0	0	0	0	0	0
Pigs							
Chicken	5	5	5	5	0	0	5
Turkey	0	0	0	0	0	0	0
Ducks	0	0	0	0	0	0	0
Geese	0	0	0	0	0	0	0
Rabbits	0	0	0	0	0	0	0

Table 4.1. Relative importance of livestock products and services within species (%)

Species	Milk	Meat	Eggs	Fiber	Skin	Risk management	Fertiliser manure	Draught	Culture	Recreation	Fuel	Feather	Environmental management	Total
Cattle	NA	NA			NA	NA	NA		NA	NA	NA		NA	#VALUE!
Buffalo														0
Sheep	NA	NA		NA	NA	NA	NA		NA	NA	NA		NA	#VALUE!
Goats	NA	NA		NA	NA	NA	NA		NA	NA	NA		NA	#VALUE!
Camels	NA	NA		NA	NA	NA	NA		NA	NA	NA		NA	#VALUE!
Lamas and Alpaca														0
Horses	NA	NA		NA	NA	NA	NA		NA	NA	NA		NA	0
Donkeys	NA	NA		NA	NA	NA	NA		NA	NA	NA		NA	#VALUE!
Pigs														0
Chicken		NA	NA			NA	NA		NA	NA		NA	NA	#VALUE!
Turkey														0
Ducks														0
Geese														0
Rabbits														0

Table 4.2. Relative importance of species within livestock products and services (%)

Species	Milk	Meat	Eggs	Fiber	Skin	Risk management	Fertiliser manure	Draught	Culture	Recreation	Fuel	Feather	Environmental management
Cattle	81	54			66								
Buffalo	0	0			0								
Sheep	5	18			17								
Goats	8	14			17								
Camels	6	2											
Lamas and Alpaca	0	0											
Horses	0	0											
Donkeys	0	0											
Pigs		0											
Chicken		13											
Turkey		0											
Ducks		0											
Geese		0											

Sources: Getachew Feleke, (2003); FAOSTAT (2001), MOA (1993, 1997)

Table 4.3 Number of widely used breeds with breeding strategies (No. of breeds).

		Breeding strategies		
Species	Total number of breeds	Purebred selection	Cross-breeding	Both
Cattle	4	4	4	4
Buffalo				
Sheep	2	1	1	1
Goats	0	0	0	0
Camels	0	0	0	0
Lamas and Alpaca				
Horses	0	0	0	0
Donkeys	0	0	0	0
Pigs				
Chicken	0	0	0	0
Turkey				
Ducks				
Geese				
Rabbits				
Mule	0	0	0	0

Comments: although there exists no breeding strategy, activities of selection of pure breeds of indigenous and crossbreeding with exotic sire are conducted

Table 4.4 Number of breeds with current breeding strategies and tools being used (No. of breeds).

		Breeding strategies		Tools				
Species	Breeding goals	Designed	Designed and implemented	Individual identification	Recording	AI*	ET	Genetic evaluation **
Cattle	4	4	4	4	4	4	0	1
Buffalo								
Sheep	2	2	2	2	0	0	0	2
Goats	0	0	0	0	0	0	0	0
Camels	0	0	0	0	0	0	0	0
Lamas and Alpaca								
Horses	0	0	0	0	0	0	0	0
Donkeys	0	0	0	0	0	0	0	0
Pigs								
Chicken	0	0	0	0	0	0	0	0
Turkey								
Ducks								
Geese								
Rabbits								

Comments: same as comments under Table 4.3
* - semen of exotic breeds only
** - refers to breeding values

Table 4.5 State of the art of technologies / methodologies used in breeding strategies.

	Used for:	
Technology or Methodology	**Research**	**Breeders**
Multi-trait selection index construction	0	0
Optimization tools for breeding plans	0	0
Electronic database related to recording schemes	0	0
Genetic evaluation Software for: phenotypic selection breeding values	0	0
Reproductive technologies (AI, ET, etc)	0	0
Microsatellite linkage maps for QTL identification for Marker Assisted	0	0
Conventional selection method	*	*

Comments: * - refers to phenotypic selection conducted at research centers and ranches on some cattle and sheep breeds

Table 4.6 Role of stakeholders in the implementation of tools for the development of AnGR

Stakeholders	Breeding goals	Individual identification	Recording	Artificial insemination	Genetic evaluation
Federal Government	5	1	1	5	3
State Government	5	1	1	4	4
Local Government	5	1	1	4	4
Breeder's	2	5	5	4	2
Private companies	2	5	5	4	2
Research	4	5	5	1	5
NGO's	2	1	2	2	2

Comments: Assign scores (1 = none, 2 = little, 3 = regular, 4 = more, 5 = high) based on thorough analyses of data available, to indicate the degree of involvement of each stakeholder on activities that support the development of AnGR

Table 4.7 Involvement of stakeholders in activities related to the development of AnGR.

Stakeholders	Legislation	Breeding	Infrastructure	Human	Farmer's
Federal Government	3	3	3	3	3
State Government	3	3	3	3	3
Local Government	3	3	3	3	3
Breeder's associations	1	2	1	1	1
Private companies	1	2	1	1	1
Research	2	2	2	3	2
NGO's	2	2	1	2	2

Comments: Assign scores (1 = none, 2 = little, 3 = regular, 4 = more, 5 = high) based on thorough analyses of data available, to indicate the degree of involvement of each stakeholder on activities that support the development of AnGR.

Table 4.8 Stakeholders preference for animal genetic resources

Stakeholders	Locally adapted breeds	Imported within region	Imported exotic breeds
Federal Government	2	2	4
State Government	2	1	4
Local Government	2	1	1
Breeder's associations	1	1	1
Private companies	1	2	4
Research	2	2	4
NGO's	1	2	2

Comments: Assign scores (1 = none, 2 = little, 3 = regular, 4 = more, 5 = high) based on a tHorrough analyses of data available, to indicate the degree of preference of the various types of AnGR by stakeholders.

Table 4.9 Priority of needs for utilization of technologies for the development of AnGR

Technology	Knowledge	Training	Financial resources	Breeder's organization
Recording	4	4	5	5
Genetic evaluation	4	4	5	4
AI / ET	5	5	5	5
Molecular techniques	5	5	5	5
Breed organisation techniques	4	4	2	5

Comments: AI= Artificial Insemination; ET= Embryo Transfer. Assign scores (1 = none, 2 = little, 3 = regular, 4 = more, 5 = high) to indicate the priority of solving specific needs in order to use technologies to support the development of AnGR.

Table 5.1 Current number of breeds in managed conservation programmes.

	Number of locally adapted breeds at risk			
Species	**Total**	**Managed *in situ***	**Managed *ex situ***	**Both (*in* and *ex situ*)**
Cattle	0	0	0	0
Buffalo				
Sheep	0	0	0	0
Goats	0	0	0	0
Camels	0	0	0	0
Lamas and Alpaca				
Horses	0	0	0	0
Donkeys	0	0	0	0
Pigs				
Chicken	0	0	0	0
Turkey				
Ducks				
Geese				
Rabbits				
Mules	0	0	0	0

Table 5.2 Current number of breeds receiving incentives and for which various tools for management of *ex situ* conservation programmes are used.

Species	Gov.	NGO	Market	Semen storage	Embryos storage	DNA/Tissue storage	*In vivo*	Monitoring system
Cattle	0	0	0	0	0	0	0	0
Buffalo								
Sheep	0	0	0	0	0	0	0	0
Goats	0	0	0	0	0	0	0	0
Camels	0	0	0	0	0	0	0	0
Lamas and Alpaca								
Horses	0	0	0	0	0	0	0	0
Donkeys	0	0	0	0	0	0	0	0
Pigs								
Chicken	0	0	0	0	0	0	0	0
Turkey								
Ducks								
Geese								
Rabbits								
Mule	0	0	0	0	0	0	0	0

Table 5.3. Current number of breeds receiving incentives and for which tools for *in situ* conservation programmes are used.

	Incentives				Technical tools			
Species	**Gov.**	**NGO**	**Market**	**Private**	**Recording**	**AI**	**ET**	**Others**
Cattle	0	0	0	0	0	0	0	0
Buffalo								
Sheep	0	0	0	0	0	0	0	0
Goats	0	0	0	0	0	0	0	0
Camels	0	0	0	0	0	0	0	0
Lamas and Alpaca								
Horses	0	0	0	0	0	0	0	0
Donkeys	0	0	0	0	0	0	0	0
Pigs								
Chicken	0	0	0	0	0	0	0	0
Turkey								
Ducks								
Geese								
Rabbits								
Mule	0	0	0	0	0	0	0	0

Table 5.4 Stakeholders involvement in the management of conservation programmes.

Stakeholders	*In situ* Conservation	*Ex situ* Conservation
Government	0	0
Breeder's associations	0	0
Private companies	0	0
Research institutions/universities	0	0
NGO's	0	0

Comments: Assign scores (1=none, 2=little, 3=regular, 4=more, 5=high) based on through analyses of data available, to indicate the degree of involvement of each stakeholder on conservation programmes.

Table 5.5 Priority of needs for utilization of technologies for *in situ* conservation programmes.

Technology	Knowledge	Training	Financial resources	Technology
Recording	2	4	5	
Genetic evaluation	4	4	5	
AI / ET	4	4	5	
Molecular techniques	5	5	5	
Breeder improvement techniques	5	5	5	

Comments: AI=Artificial Insemination; ET=Embryo Transfer; Assign scores (1=none, 2=little, 3=regular, 4=more, 5=high) to indicate the priority of solving specific needs in order to use technologies to support conservation programmes.

Table 6.1 Effects of existing policies and legal instruments on the utilization (use and development) of AnGR

	Urban & peri-urban systems		Rural production	
	Industrial systems	Smallholder systems	Industrial systems	Smallholder systems
Cattle	**3**	**3**	**2**	**5**
Buffalo				
Sheep	**2**	**2**	**4**	**5**
Goats	**2**	**2**	**4**	**5**
Camels	**1**	**1**	**2**	**5**
Lames & Alpaca				
Horses	**1**	**2**	**1**	**2**
Donkeys	**1**	**3**	**1**	**4**
Pigs				
Chicken	**5**	**5**	**2**	**5**
Turkey				
Ducks				
Geese				
Rabbits				
Mules	**1**	**2**	**1**	**2**

Comments: **Assign scores (1 = none, 2 = little, 3 = regular, 4 = more, 5 = high) to indicate the extent that current policies support activities related to the utilization of AnGR**

Table 6.2 The focus of current policies on activities related to the utilization (use and development) of AnGR

	Actuivities			
	Use of exotic breeds	Use of locally adopted breeds	Training, Research & Extension	Organisation of breeders/farmers
Cattle	**5**	**5**	**4**	**1**
Buffalo				
Sheep	**1**	**5**	**3**	**1**
Goats	**2**	**5**	**2**	**1**
Camels	**1**	**5**	**2**	**1**
Lames & Alpaca				
Horses	**1**	**2**	**1**	**1**
Donkeys	**1**	**2**	**2**	**1**
Pigs	**1**	**1**	**1**	**1**
Chicken	**5**	**4**	**4**	**1**
Turkey				
Ducks				
Geese				
Rabbits				
Mules	**1**	**2**	**1**	**1**

Comments: Assign scores (1 = none, 2 = little, 3 = regular, 4 = more, 5 = high) to indicate the extent that current policies support activities related to the utilization of AnGR.

Table 6.3 Prioritising the needs to enable the development of AnGR policies.

	Required		
Needs	Immediately	Medium term	Long term
Financial resources	*		
Human resources	*		
Infrastructure		*	
Organizational structures	*		
Technology	*		

Comments: identify the main needs for policy development and specify if it is critical (immediately required) or important in the medium or long term.

Table 6.4 The priority of future needs in policy development for AnGR conservation programmes

Species	Policy development related to:				
	Technology	Infrastructure	Human resources	Financial resources	Organizational structures
Cattle	5	5	5	5	5
Buffalo					
Sheep	4	4	4	4	4
Goats	4	4	4	4	4
Camels	4	4	4	4	4
Lamas and Alpaca					
Horses	3	3	3	3	3
Donkeys	3	3	3	3	3
Pigs					
Chicken	5	5	5	5	5
Turkey					
Ducks					
Geese					
Rabbits					
Mule	3	3	3	3	3

Comments: Assign scores (1 = none, 2 = little, 3 = regular, 4 = more, 5 = high) to indicate the priority for the development of policies to support AnGR conservation programmes.

Table 6.5 The priority of future needs in policy development for the utilization (use and development) of AnGR

Species	Policy development related to:				
	Technology	Infrastructure	Human resources	Financial resources	Organizational structures
Cattle	5	5	5	5	5
Buffalo					
Sheep	4	4	4	4	5
Goats	4	4	4	4	5
Camels	4	4	4	4	5
Lamas and Alpaca					
Horses	3	3	3	3	3
Donkeys	3	3	3	3	3
Pigs					
Chicken	5	5	5	5	5
Turkey					
Ducks					
Geese					
Rabbits					
Mule	3	3	3	3	3

Comments: Assign scores (1 = none, 2 = little, 3 = regular, 4 = more, 5 = high) to indicate the priority for the development of policies to support the utilization of AnGR.

8. ACKNOWLEGEMENTS

The support of various institutions, stakeholders and individuals was instrumental in the preparation of this Country Report on the State of Farm Animal Genetic Resources of Ethiopia.

My sincere thanks go to State Minister, His Excellency Mr. Belay Ejigu and State Minister, His Excellency Dr. Tekalign Mamo, Ministry of Agriculture and Rural Development, for taking their precious time to review the draft Country Report and for their invaluable comments, which have helped us to refine and finalize the CR.

I would like to thank the Management of the Institute of Biodiversity Conservation (IBC) for the financial and logistical support. The General Manager of the Institute of Biodiversity Conservation, Dr. Girma Balcha was a driving force behind the preparation of this Country Report and I am very grateful for his contributions. Thanks also go to the former General Manager, Dr Abebe Demisie, of the then IBCR now IBC for his contribution in many ways in the CR preparation particularly at the initial stage.

Thanks also go to W/o Mebrat Alem, Head Department of Livestock and Fisheries Resources Development, Ministry of Agriculture and Rural Development, for her constructive comments on the draft Country Report and her participation in the reviewing process.

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I thank the then Ministry of Agriculture, the Ethiopian Agricultural Research Organization, the Oromia Regional State Bureau of Agricultural Development and the Sheno Agricultural Research Center (Amhara Region Agricultural Research Institute) for allowing their staff members to work intensively on the preparation of this Country Report.

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Kassahun Awgichew (Ph.D)
Head, Animal Genetic Resources and
National Coordinator, SoW-AnGR Country Report Preparation
Institute of Biodiversity Conservation

9. HOW THE COUNTRY REPORT WAS PREPARED

Following the request in 1999 of the FAO Commission on Genetic Resources for Food and Agriculture, the FAO Secretariat has been coordinating the preparatory work on the First Report on the State of the World's Animal Genetic Resources (SoW-AnGR). In September 2000, the FAO member states Inter-governmental Technical Working Group on Animal Genetic Resources has agreed on the main technical areas to be included in the report. Following this, in March 2001, the FAO has invited governments to participate in the preparation of the First Report on the State of the World's Animal Genetic Resources (SoW-AnGR) through an assessment of national animal genetic resources in the form of Country Reports. It was also stated in the FAO communication that Country Reports should constitute an official government document, which will clearly identify national priorities and set out plan of action for the sustainable utilization and conservation of farm animal genetic resources.

The FAO guideline set for the preparation of SoW-AnGR Country Report calls for the establishment of a National Consultative Committee (NCC) to identify the primary areas and issues that need to be addressed in preparing the Country Report. It is also stated in the guideline that the NCC should have as diverse representation as possible and develop a broader network to insure opportunities for the full range of stakeholders to develop the Country Report.

The FAO has organized two regional workshops and has trained trainers so that the country reports could be prepared and submitted to the FAO as has been envisaged. Unfortunately however, in our case there had been a communication gap among the concerned institutions and the FAO and the report preparation didn't start on time to meet the deadline set by the FAO.

Seeing the importance and urgency of the matter, a discussion between the then Ministry of Agriculture, the Ethiopian Agricultural Research Organization (EARO) and the then Institute of Biodiversity Conservation and Research (IBCR) was held to decide as to which institute should coordinate the CR preparation and to identify the key stakeholders to be represented in the National Consultative Committee. It was then decided that the then Institute of Biodiversity Conservation and Research (IBCR) now Institute of Biodiversity Conservation (IBC) be the National Focal Point for the preparation of the CR as per the guidelines set by the FAO. All the parties have agreed that it is very important and essential that Ethiopia, being a country with a huge farm animal genetic resource, participate in this exercise. Since the Institute of Biodiversity Conservation (IBC) has the responsibility to lead the national effort to conserve, develop, manage and sustainably utilize the country's plant, animal and microbial genetic resources, it accepted to spearhead the preparation of the Country Report and agreed to assign the National Coordinator for the process.

The Institute of Biodiversity Conservation (IBC) and the then Ministry of Agriculture jointly prepared the list of possible key stakeholders to form the National Consultative Committee (NCC). The list of NCC members and institutions represented are shown in the Annex part of the CR.

The IBC then requested all concerned stakeholders to nominate professionals for the membership of the National Consultative Committee (NCC), which will oversee the preparation of the Country Report as set in the FAO's guideline. At the NCC inaugural workshop, held in early November 2003, the National Drafting Committee (NDC) was elected. The NDC is composed of institutions that play a very significant role in the conservation and sustainable utilization of Farm Animal Genetic Resources at a national level. Please see the persons and institutions represented in the NDC in the Annex part of the CR.

The Draft CR prepared by the NDC was Technically reviewed by two senior professionals and presented to the NCC workshop for further reviewing. After incorporating the comments and suggestions forwarded at the NCC workshop, the NCC adopted the CR. Following the adoption of the CR by the NCC it was then presented to a National Workshop convened to discuss the draft CR. The NCC then held a short workshop to see if there is any major change to be made following the deliberations of the National Workshop. The comments and suggestions forwarded at the workshops were subsequently used to finalize the CR. The NCC then adopted the CR and gave directives to the National Coordinator to arrange for language editing. The draft Country Report was submitted to the Ministry of Agriculture and Rural Development through the General Manager of the Institute of Biodiversity Conservation (IBC). After further reviewing the Country Report following the comments by concerned high officials and professionals, the final report was then re-submitted to the Ministry of Agriculture and Rural Development for endorsement and to be sent to the FAO officially.

The Country Report does not include an action and communication plan; the National Focal Point, in close collaboration with the key stakeholders, Regional Focal Point and the FAO should develop a follow-up mechanism

10. NATIONAL CONSULTATIVE COMMITTEE (NCC) MEMBERS AND AFFILIATED INSTITUTIONS

No.	Name	Ministry/Institute/Organization/ Commission/Authority/Bureau
FEDERAL LEVEL		
1	Dr. Kassahun Awgichew	National Coordinator, Institute of Biodiversity Conservation (IBC)- National Focal Point
2	Dr. Misikire Tesema	Institute of Biodiversity Conservation (IBC)- National Focal Point
3	Mr. Hizkias Ketema	Livestock and Fisheries Resources Development Department, Agricultural Development Sector, Ministry of Agriculture and Rural Development
4	Dr. Ashenafi Worku	Livestock and Fisheries Resources Development Department, Agricultural Development Sector, Ministry of Agriculture and Rural Development
5	Mr. Million Tadesse	Debre Zeit Research Center, Ethiopian Agricultural Research Organization (EARO)
6	Mr. Yohannes Gojam	Holetta Research Center, Ethiopian Agricultural Research Organization (EARO)
7	Mr. Moges Abreha	Ministry of Federal Affairs
8	Mr. Yonas Kassaye	Ethiopian Science & Technology Commission
9	Mr. Tsegaye Abegaz	Agricultural Input and Marketing Development Sector, Ministry of Agriculture and Rural Development
10	Mr. Birhanu Ayalew	Environmental Protection Authority
REGIONAL AGRICULTURAL RESEARCH INSTITUTES/CENTERS, COMMISSIONS, AGRICULTURAL & PASTORAL DEVELOPMENT BUREAUS		
11	Mr. Sisay Lemma	Debrebirhan Research Center, Amhara Region Agricultural Research Institute (ARARI)
12	Dr. Lemma Gizachew	Animal Research Directorate, Oromia Agricultural Research Institute
13	Dr. Mohamed Ali Farah	Somali Region Pastoral and Agro-Pastoral Research Institute
14	Dr. Gebeyehu Ganga	Southern Agricultural Research Institute, Southern Nations Nationalities and Peoples Regional State
15	Mr. Moges Alene	Tigray Agricultural Research Institute, Tigray Regional State
16	Mr. Tefera Abreha	Bureau of Agriculture, Addis Ababa Administration
17	Mr. Seyoum Mezgebe	Bureau of Agriculture, Amhara National Regional State
18	Mr. Biru Eshete	Bureau of Livestock, Agriculture and Natural Resources Development, Afar National Regional State
19	Dr. Tesfaye Tenagne	Bureau of Agriculture, Benishangul - Gumuz National Regional State
20	Dr. Girma Bekana	Bureau of Agriculture, Gambela Peoples' Regional State
21	Mr. Fasika Fantahun	Bureau of Agriculture, Hareri National Regional State
22	Mr. Asfaw Tolessa	Oromia Agriculture Development Bureau
23	Mr.Feysel Abdulahi	Livestock, Crop and Natural Resource Development Bureau, Somali Regional State

24	Mr. Haile Mariam Zara	Bureau of Agriculture, S. N. N. P. Regional State
25	Mr. Tsigabu Araya	Bureau of Agricultural Development and Natural Resources, Tigray Regional State
26	Mr. Adane Ketaba	Pastoral Development Commission, Oromia Regional State
HIGHER LEARNING INSTITUTES		
27	Mr.. Fassil Bekele	Debub University
28	Mr. Girma Fikre Selassie	Ambo College of Agriculture
No.	**Name**	**Ministry/Institute/Organization/ Commission/Authority/Bureau**
PROFESIONAL SOCIETIES		
29	Dr. Tesfaye Kumsa	Ethiopian Society of Animal Production (ESAP)
INTERNATIONAL/REGIONAL/NON-GOVERNMENTAL ORGANIZATIONS		
30	Dr. Workineh Ayalew	International Livestock Research Institute (ILRI)
31	Mr. Biruk Yemane	OXFAM Great Britain (GB)

11. COUNTRY REPORT DRAFTING COMMITTEE MEMBERS

	Name	Ministry/Institute/Organization/ Commission/ Bureau
1	Kassahun Awgichew, Chairman, NCC and NDC	National Coordinator and NDC Chairperson, Institute of Biodiversity Conservation (IBC)- National Focal Point
2	Dr. Misikire Tesema, Member	Member NCC and NDC, Institute of Biodiversity Conservation (IBC)- National Focal Point
3	Mr. Hizkias Ketema, Member	Member NCC and NDC, Ministry of Agriculture and Rural Development
4	Mr. Million Tadesse, NDC Secretary	Secretary, NCC and NDC, Debre Zeit Research Center, Ethiopian Agricultural Research Organization (EARO)
5	Mr. Sisay Lemma, Member	Member NCC and NDC, Debre Birhan Research Center, Amhara Region Agricultural Research Institute (ARARI)
6	Mr. Asfaw Tolessa, Member	Member NCC and NDC, Oromia Agriculture Development Bureau

12. NATIONAL WORKSHOP PARTICIPANTS FOR THE REVIEW OF THE DRAFT CR AND REPRESENTED INSTITUTIONS (MAY 10-11, 2004)

No.	Name	Ministry/Institute/Organization/ Commission/Authority/Bureau
FEDERAL LEVEL		
1	H.E. Dr. Tekalign Mamo	State Minister, Ministry of Agriculture and Rural Development
2	Dr. Girma Balcha	General Manager, Institute of Biodiversity Conservation (IBC)- National Focal Point
3	Dr. Kassahun Embaye	Deputy General Manager, Institute of Biodiversity Conservation (IBC)- National Focal Point
4	Honourable Mulatu Neguma	Natural Resources Protection Affairs Standing Committee, House of Representatives
5	Dr. Kassahun Awgichew	National Coordinator, Institute of Biodiversity Conservation (IBC)- National Focal Point
6	Dr. Misikire Tesema	Institute of Biodiversity Conservation (IBC)- National Focal Point
7	Ms Mebrat Alem	Head, Livestock and Fisheries Resources Development Department, Agricultural Development Sector, Ministry of Agriculture and Rural Development
8	Mr. Hizkias Ketema	Livestock and Fisheries Resources Development, Agricultural Development Sector, Ministry of Agriculture and Rural Development
9	Dr. Ashenafi Worku	Livestock and Fisheries Resources Development, Agricultural Development Sector, Ministry of Agriculture and Rural Development
10	Mr. Tesfaye Cherinet	Artificial Insemination Center, Agricultural Development Sector, Ministry of Agriculture and Rural Development
11	Ms Alemtsehay Assefa	Ministry of Finance and Economic Development
12	Dr. Zinash Sileshi	Animal Research Directorate, Ethiopian Agricultural Research Organization (EARO)
13	Mr. Million Tadesse	Debre Zeit Research Center, Ethiopian Agricultural Research Organization (EARO)
14	Mr. Yohannes Gojam	Holetta Research Center, Ethiopian Agricultural Research Organization (EARO)
15	Dr. Alemu Gebre Wold	Holetta Research Center, Ethiopian Agricultural Research Organization (EARO)
16	Mr. Yonas Kassaye	Ethiopian Science & Technology Commission
17	Mr. Birhanu Ayalew	Environmental Protection Authority
18	Ms Debritu Beyene	Institute of Biodiversity Conservation (IBC)
19	Mr. Getahun Mulat	Institute of Biodiversity Conservation (IBC)
20	Mr. Engidawork Tadesse	Institute of Biodiversity Conservation (IBC)
21	Mr. Wonwosen Mekonen	Institute of Biodiversity Conservation (IBC)
22	Mr. Kebu Balemie	Institute of Biodiversity Conservation (IBC)
23	Mr. Yeshitila Mekibib	Institute of Biodiversity Conservation (IBC)
24	Dr. Medhin Zewdu	Institute of Biodiversity Conservation (IBC)/ CSMPP
25	Dr. Tesfaye Mesele	Institute of Biodiversity Conservation (IBC)

26	Mr. Taye Bekele	Institute of Biodiversity Conservation (IBC)
27	Mr. Berihun Gebre Medhin	Institute of Biodiversity Conservation (IBC)
REGIONAL AGRICULTURAL RESEARCH INSTITUTES/CENTERS, COMMISSIONS, AGRICULTURAL & PASTORAL DEVELOPMENT BUREAUS		
28	Dr. Alemayehu Assefa	Center Manager, Debre Birhan Research Center, Amhara Region Agricultural Research Institute (ARARI)
29	Mr. Solomon Gizaw	Debre Birhan Research Center, Amhara Regional Agricultural Research Institute (ARARI)
30	Mr. Sisay Lemma	Debre Birhan Research Center, Amhara Region Agricultural Research Institute (ARARI)
31	Dr. Lemma Gizachew	Animal Research Directorate, Oromia Agricultural Research Institute
32	Mr. Sokat Yiech	Manager, Gambela Agricultural Research Centre
33	Dr. Mohammed Ali Farah	Somali Region Pastoral and Agro-Pastoral Research Institute
34	Dr. Gebeyehu Ganga	S.N.N.P. Agricultural Research Institute
35	Mr. Tefera Abreha	Bureau of Agriculture, Addis Ababa Administration
36	Mr. Biru Eshete	Bureau of Livestock, Agriculture and Natural Resources Development, Afar National Regional State
37	Dr. Mekonnen Golessa	Bureau Head, Bureau of Agriculture, Benishangul - Gumuz National Regional State
38	Dr. Tesfaye Tenagne	Bureau of Agriculture, Benishangul - Gumuz National Regional State
39	Dr. Girma Bekana	Bureau of Agriculture, Gambela Peoples' Regional State
40	Mr. Goaner Yier	Gambela Agricultural Development Bureau, Gambela Peoples' Regional State
41	Mr. Fasika Fantahun	Bureau of Agriculture, Hareri National Regional State
42	Mr. Asfaw Tolessa	Oromia Agriculture Development Bureau
43	Mr.Feysel Abdulahi	Livestock, Crop and Natural Resource Development Bureau, Somali Regional State
44	Mr. Haile Mariam Zara	Bureau of Agriculture, S. N. N. P. Regional State
45	Mr. Adane Ketaba	Pastoral Development Commission, Oromia Regional State
HIGHER LEARNING INSTITUTES		
46	Mr. Girma F/ Selassie	Ambo College of Agriculture
FARMERS REPRESENTATIVES		
47	Mr. Mohamed Balila	Farmer, Benishangul-Gumz Regional State
48	Mr. Sime Wolde Tensai	Adaa Libel Dairy Cooperative, Oromia Regional State
PROFESIONAL SOCIETIES		
49	Dr. Tesfaye Kumsa	Ethiopian Society of Animal Production (ESAP)
INTERNATIONAL/REGIONAL/NON-GOVERNMENTAL ORGANIZATIONS		
50	Mr. Sintayehu Gebre Mariam	FAO Country Office, Addis Ababa
51	Dr. Workineh Ayalew	International Livestock Research Institute (ILRI)
52	Dr. Azage Tegegne	International Livestock Research Institute (ILRI)
53	Dr. Tadelle Dessie	International Livestock Research Institute (ILRI)
54	Mr. Birhanu Damte	ELFORA- Poultry
PRIVATE		
55	Mr. Tefera Gebere Meskel	Senior Livestock Expert
56	Mr. Nigatu Alemayehu	Livestock Expert
57	Ms Jennie Stein	PhD Student, ILRI