

**Republic of Yemen
Ministry of Agriculture and Irrigation
General Directorate of Animal Wealth**

**Country Report on the State of Animal Genetic Resources in
the
Republic of Yemen**

English version from the original in Arabic

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PART 1

Introduction

Yemen Republic lies in the South West of the Arabian Peninsula between latitudes 12N and 17N and longitudes 43E and 56E with an area of 555 thousand km². The country may be subdivided into five physiognomic regions, mountain, plateau, cost, the Empty Quarter and the islands, with a great diversity in climate and topography. There is a great variation in topography, geology and altitudes within short distances which resulted in great ecological variation, biodiversity and unique animals and plants especially in the Island Soqatra. This made Yemen a special country in biodiversity worldwide and especially in Asia. Agro-ecologically the country may be divided into three zones, the highlands, the lowlands and the desert.

The population of Yemen was estimated in 2002 at 18.261 million with an average annual population growth rate of 3.5%. There are 19 governorates beside the Capital Sanaa. Rural population is about 73% of the total population according to 2000 statistics.

1.1 Climate

The country is characterized by extreme variation in topography, geological formations, altitudes (up to 3700 m above sea level, the highest in the Peninsula), proximity or otherwise from ocean/sea coasts and soil. These variations created great climatic and bio diversity and had demographic and style-of-life influences, particularly agricultural practices. Annex 1 shows the main five zones in the country.

Generally the weather is sub-tropical, hot humid in lowland deserts and western plains, moderate to cold in central and northern mountains and hot and dry in eastern desert.

1.1.1 Rainfall

Rains come in two main seasons, February through May and July through October. Rainfall ranges from less than 50 mm annually in the coastal plains to more than 1000 mm annually in the Southern mountains.

Rainfall increases in higher altitudes ranging from 300 mm to 400 mm, decreasing gradually from the central highland towards the Capital Sanaa to nearly 250 mm and increases again towards Sada and Hagga with a rate of 400 mm to 600 mm annually.

Rains are usually erratic and evaporation rate is quite high in most of the regions.

1.1.2 Temperature

Temperature ranges from 12°C in the highland to more than 33°C in coastal plains where it reaches 40°C and higher than that in the desert. Temperature is lower in winter and it reaches below freezing in the highland. The three main factors affecting climatic elements (i.e. humidity, wind and temperature) are the Indian Ocean including the Arabian Sea and Gulf of Eden, Red Sea and Mediterranean Sea. Relative humidity ranges from 30% in dry eastern regions to more than 80% in the Coastal plains.

1.2 Water Resources

Rain and underground water are the main sources beside springs and shallow wells. Rain is the most important where 51% of the agricultural land depends on it. In

nearly half of the rainfed area rainfall goes sometime below 350 mm annually which is less than the average. Water resources are currently witnessing acute shortage due to the indiscriminate use of ground and shallow water without due control and the abandon of wise traditional irrigation practices. This has led to the use of low quality water resulting in increased salinity in soil already poor in phosphorus, nitrogen and organic matter (Plant Resources Report, 1996).

1.3 Agricultural Sector

The agricultural sector contributes 19% to the total national GDP while agricultural labor represents a significant amount of 60% of the total national labor force and 80% to women and junior labor (Livestock Development Project, 1993).

1.3.1 Livestock in the agricultural sector

Livestock was estimated to contribute approximately 12% to the national agricultural production and 3% of the total national GDP (Central Statistics Organization, 2001) (Table 1.1)

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

Livestock production (official statistics)	\$277.133	2001
Other agricultural production (official statistics)	\$8.733.746	2001
Best estimate of additional value of livestock	\$45.100	2001

Total tillable land 1.66 million ha but only 1.19 (72%) are actually cultivated of which 51% are rainfed where main crops are grown, sorghum, wheat, barley, sesame and forage plus some legumes. Land dependent on artesian wells represents 34%, on floods 15% (Yearly Statistics, 2001). In this irrigated land forage crops (mainly sorghum), legumes, grasses and fruits are grown. There are estimated 2,378,167 ha of forests and natural pastures and about 400,000 ha of individual trees.

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

Category	Area (1000 ha)		Current trend
	1992	1999	
Arable land	1398	1564	0
Permanent crops	103	123	increase
Permanent pastures	17546	17733	increase
Agricultural area			
Land area			0
Total Area	52797	52797	

However, livestock farms, either specialized or mixed with crops, represent about 80% of total farms in the agricultural sector (Ward, 1999), Fig 1. Livestock comes second to crops in their contribution to agricultural GDP.

Table 1.3 shows livestock population of different species. Other species that are not usually included in the census are horses, asses, native poultry, rabbits and pigeons. As far commercial intensive poultry (chickens) production is concerned, there are 1200 farms of broilers, 300 farms layers, 700 farms for the production of broiler mother hens and 30 farms layer mother hens (Animal Wealth Directorate

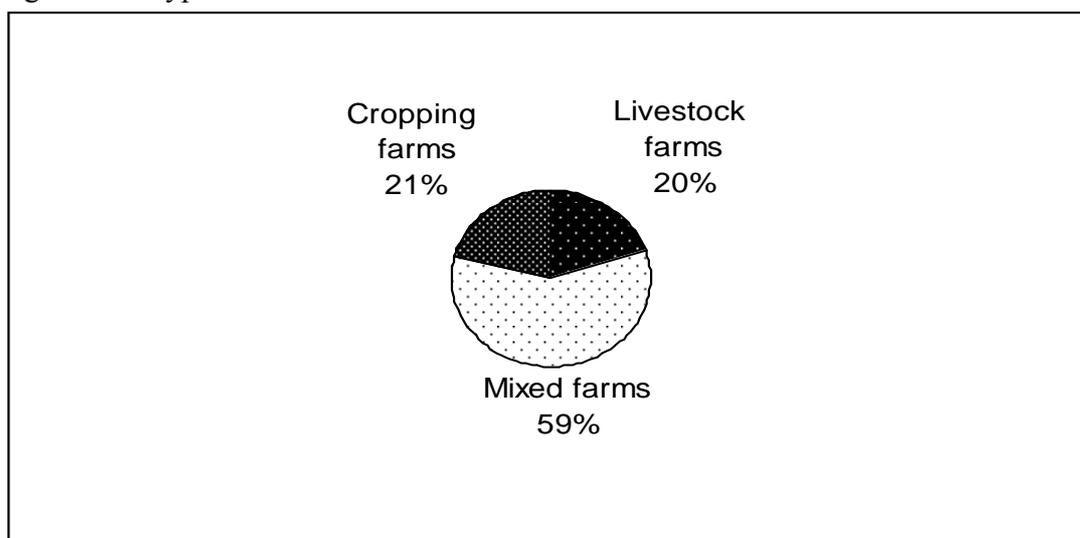
data). Thus, the role played by animal genetic resources in the national and house income is evident which necessitates the need to develop a strategy to utilize their potential.

Table 1.3. Livestock population, number of owners/house-holders and employment by species

Species	Livestock population (1000)	Number of owners / householders	Number of persons additionally employed	
			Fully	Partially
Cattle	1400593	na	na	na
Buffalo	0			
Sheep	5028968	na	na	na
Goats	4452540	na	na	na
Camels	198434	na	na	na
Lamas and Alpaca	0			
Horses	na			
Donkeys				
Chicken	na			
Turkey	na			
Ducks	na			
Geese	na			
Rabbits	na			

Table 1.6 in training pack

Fig 1. Farm types in Yemen



1.4 Population and Population Trends

In general Yemen is considered a rural country where two thirds of the population live in rural areas depending mainly on what the rural economy provides. Table 1.3 shows rural population was 70% of the total population in 1999 (FAOSTAT Database 2001) increasing to 73% in 2000. This means that the rural economy must grow to cope with this increase in the rural population. It is expected that the total population of Yemen will reach 25.366 million in 2010.

Table 1.3. Human population in the country

Year	Total (millions)	Rural or Farming (%)	Urban or Non Farming (%)	Total
1991	12185	8558	3627	12185
2000	18261	13459	4802	18261
Average annual growth rate	0			

Table 1.7 in training pack

1.5 National Food Security

Yemen was self sufficient in food until early seventies of the last century, but the situation has changed drastically due to population growth, change in consumption patterns and other economic and social changes aggravated by recurrent drought, which all led to decreased food self sufficiency . As a result self sufficiency in grain decreased to only 40% in late eighties of the last century (Livestock Development Project, 1993). Urban population has increased due to the immigration from the rural areas to the cities which had a negative impact on economic development especially in the agricultural sector. The annual growth rate of 2.2% in the agricultural sector at the beginning of nineties of the last generation did not cope with the annual population growth of 3.5% in the same period (Beleidy, 1996). Statistics show that the contribution of the agricultural sector to national income decreased from about 30% in the mid-eighties to about 19% 19% in the mid-nineties of the last century and to 12% in 2001. Land devoted to food and forage crops is also shrinking in view of the increased area for growing Qat (a tree whose leaves are chewed green as narcotic).

However, exceptions in the agricultural sector that are growing are the commercial poultry and fruit sub-sectors. Other sectors whose contribution to the nation economy is growing are oil and industry but they could not help in closing the food gap.

Table 1.5 (Statistical Year Book, 2000 & FAO Database, 2001) shows that the average annual share of per capita meat consumption in the country is 2.7 kg as compared to 17 kg stated by WHO for healthy diet (AOAD, 1997). Tables 1.6 and 1.7 show the import-export of animals and animal product during 1991 to 2000. The figures in these tables indicate the compelling need to establish policies and strategies to produce food crops and securing feed resources. In the meantime livestock should be looked at as an important element for feed security and rural development and animal genetic resources should be developed for more efficient production under harsh production environment (e.g. scarcity of feed and water and prevalence of diseases).

Table 1.4. Major livestock primary production (1000 tonnes/numbers)

Species	Meat (t)		Milk (t)		Eggs (t)		Fiber (t)		Skin (No.)	
	1991	2000	1991	2000	1991	2000	1991	2000	1991	2000
Cattle	36815	47110	149162	176850					6876	8798
Sheep	23530	23600	12000	158000			na	na	4660	4668
Goats	16660	22200	15000	19768			na	na	4440	3332
Camels	2480	2690	8000	8800			na	na	na	na
Chicken	35102	57115			18402	31356				

Table 1.8 in training pack

Table 1.5. Major livestock primary product imports (1000 tonnes/numbers)

Species	Meat (t)		Milk (t)		Eggs (t)		Fiber (t)		Skin (No.)		Animals (No.)	
	1991	2000	1991	2000	1991	2000	1991	2000	1991	2000	1991	2000
Cattle	na	4193	na	770								84436
Sheep	na	371	na	0					na	0		
Goats	na	na	na	0					na	0	na	80377
Chicken	na	60196			na	1484					na	16796

Table 1.9 training pack

Table 1.6 Major livestock primary product exports (1000 tonnes/numbers)

Species	Meat (t)		Milk (t)		Eggs (t)		Skin (No.)		Animals (No.)	
	1991	2000	1991	2000	1991	2000	1991	2000	1991	2000
Cattle	3035	8	na	0	na	na	na	0	na	992
Sheep	18	0	na	0			na	0	na	211745
Goats	na	0	na	0			na	0	na	198613
Chicken	na	0			0	0	na	0	na	0

Table 1.10 in training pack

2. SYSTEM OF PRODUCTION

2.1 Description of Animal Production Systems

Animal production systems differ in Yemen according to production environment and social circumstances but the great majority of these systems are traditional in nature. The following are the many factors on the basis of which animal breeders and producers are classified.

2.1.1 Inputs

- low inputs
- medium inputs
- high inputs

The following tables show different production systems in different species and intensity of inputs.

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

Species	Production systems%			Total
	Low input	Medium input	High input	
Cattle	70	28	2	100
Sheep	79	20	1	100
Goats	79	20	1	100
Camels	100	0	0	100
Horses	10	60	30	100
Donkeys	100	0	0	100
Chicken	10	10	80	100
Rabbits	100	0	0	100

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

Species	Production systems			Total
	Low input	Medium input	High input	
Cattle	0	0	0	0
Sheep	0	0	0	0
Goats	0	0	0	0
Camels	very negative			0
Horses	very ngative	very negative	very negative	0
Donkeys	very negative			0
Chicken	very negative	positive	very positive	0
Rabbits				0
				0

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

Type of operation	Production systems %			Total
	Low input	Medium input	High input	
Subsistence	95	4	1	100
Smallholder	94	4	2	100
Small-scale-commercial	0	95	5	100
Large-scale-commercial	0	0	100	100

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

Type of operation	Low input	Medium input	High input	Total
Subsistence	95	4	1	100
Smallholder	94	6	0	100
Small-scale-commercial	0	95	5	100
Large-scale-commercial	80	13	7	100

Table 2.5 Type of livestock farm by production system for camels, donkeys and rabbits (%)

Type of operation	Production systems			Total
	Low input	Medium input	High input	
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 2.6. Type of livestock farm by production system for horses (%)

Type of operation	Production systems			Total
	Low input	Medium input	High input	
Subsistence	10	80	10	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 chicken (%)

Type of operation	Production systems			Total
	Low input	Medium input	High input	
Subsistence	95	5	0	100
Smallholder	80	20	0	100
Small-scale-commercial	20	80		100
Large-scale-commercial	0	0	100	100

Comment:

Previous table indicate that many species are decreasing in numbers especially horses which could be considered at risk and needy urgent programs to averse that danger of extinction. Number of camels, donkeys and rabbits has sharply decreased during the past few years. Cattle, sheep and goats numbers are stable but need efforts to improve their production environments.

2.1.2 Classification of animal producers according to production environment

The great biodiversity that Yemen enjoys and the variation in topography and climate contributed significantly to the types of production systems. Among factors that helped the small producers to adapt to the production system are:

- Prevailing traditions
- Different seasons in different places promoted transhumance
- Availability of water for animals and humans
- Proximity of pasture or cultivated land
- Access family needs
- Availability of means for animal-waste disposal
- Proximity of animal market
- Access to public services, e.g. health, school
- Job availability for income increasing
- Access to veterinary care
- Availability of technologies

Most of these factors are related to bio and agricultural diversity. Each system has its characteristics (Livestock Development Project, 1993) (Annex 2). The most important animal production systems are the following.

- a) Nomadic. It is widespread. Bedouins, especially women, roam the Eastern and Coastal regions looking for feed and water for their animals. It is estimated that 15000 families are engaged in that system who own 25% of the goats and camels in the country. Average ownership in this system is 60 goat and four camels per family.
- b) Transhumance. This is also a widespread system among the landless families. Grazers move between plains and valleys and in the hills and nearby mountains. Number of families engaged in that system is estimated at 20,000 owning 14% of total sheep and goats with an average 50 sheep/goat per family. Goats represent 75% of the total number of animals.
- c) Stationary. This is the most common system involving 600,000 families of farmers and livestock owners. The system is closely related to the cropping pattern. An estimate of 90% of cattle and 50% of goats are under this system. The stationary system can be further subdivided into two subsystems. The *First*, the traditional highland system covering more than 300,000 families renting, owning or co-owning land in the Northern, Central and Southern highlands. Holding is usually small. This sub-system harbors about 50% of the national cattle herd, 45% of sheep, 25% of goats and 50% of village poultry. The *Second*, the traditional lowland system which covers about 300,000 families living in the plains and the Eastern regions where agriculture mostly depends on irrigation from floods or wells but also low rainfall. It is estimated that 45% of the national cattle herd live in this sub-system, 45% of sheep and 25% of goats, all representing about 35% of the national total livestock numbers.
- d) Commercial production system. This is a limited system represented by 7 Friesian dairy farms with an estimated total of 3000 cows distributed in the governorates of Dhamar, Amran, Sada, Taz and Alhudaieda and comes under private sector, cooperatives and state and managed with intensive inputs. There are also about 7 sheep and goat farms with a capacity of 4000 head. These farms are managed semi-traditionally on grazing and feed supplement. There is also smaller scale commercial dairy farming in some 60 farms in Alhudaieda each with 50-100 cows also managed semi-traditionally. There are also two fattening farms with a capacity of 1600 animals that are managed intensively.

Comment

- a) All production systems described contribute significantly to food and agriculture and to the welfare of the rural communities. Most of the systems are sustainable except the commercial system which largely depends on imported inputs, e.g. feedstuffs, equipment, veterinary medicines...etc.
- b) Risk factors for each species depend on the production system and production environment. In the nomadic systems for instance, the risk factors are mainly

drought, disease and social strife while for the commercial systems the risk factors could be availability of imported inputs.

- c) Most framers raise more than species of animals but very few are those who raise only one species.

3. STATE OF ANIMAL GENETIC DIVERSITY

3.1 State of the Information on Animal Genetic Resources (AnGR)

There are some 35 local breeds/types for all species which are well adapted to local environment. Two surveys have been conducted with 10-15 years apart. These surveys reported 2 breeds of cattle, 9 of sheep (Hasnein, 1986) plus one in Soqotra, 8 of goats, 4 of camels, 6 of horses, 3 of donkeys, 1 of chickens, 1 of rabbits and one of pigeons (although there many morphotypes).

There is one introduced cattle breed (Friesian) , 2 of rabbits and 6 of commercial chickens.

3.1.1 Local breeds

Cattle

1. *Zebu*. Also called Yemeni cattle. The breed is widespread all over the country with an estimated population of 1.4 million. It is used for meat and milk production, hides and farm labor.
2. *Soqotry*. Present in the island of Soqotra. with an estimated population of 4-5 thousand
- 3.

Sheep are subdivided to meat , wool and hair types.

1. *Ansi*. Present in south of Dhafar governorate and is used for meat, wool and hair production.
2. *Grey Amrani*. Present in Amran governorate and is used for meat and wool production. It is medium to large in size and wool is moderate.
3. *Black Amrani*. Totally black, small in size and short wool.
4. *Dhamari*. In Dhamar governorates and is used for meat production.
5. *White Ma'reb*. In governorate of Ma'reb and mainly used for meat.
6. *White Sanaa*. Present in North West of the capital and is used for meat and wool.
7. *Red Taz*. Also known as Aljindy. Present in Taz and used for meat.
8. *Tihami*. Present in plains of Tihama and used for meat and wool (Hasnein, 1986).
9. *Yemeni White*. In the coastal region of Tihama. Used for meat.
10. *Soqotri*. In Soqotra island.

Table 3.1. Breed Diversity (Number of Breeds)

	Number of breeds									
	Current Total		At risk		Widely used		Others		Lost	
	L	E	L	E	L	E	L	E	(last 50 yr)	
Species	L	E	L	E	L	E	L	E	L	E
Cattle	2	1	0	0	1	0	0	0	na	na
Sheep	10	0	0	0	na	na	na	na	na	na
Goats	8	0	0	0	na	na	na	na	na	na
Camels	4	0	0	0	na	0	na	0	na	na
Horses	6	na	na	na	na	na	na	na	na	na
Donkeys	3	na	3	na	na	na	na	na	na	na
Chicken	2	6		2	0	7	0	na	na	na
Rabbits	1	2	na	na	na	na	na	na	na	na

Goats

1. *Mori*. In Mor valley north of Tihama with types, Thamoud and Ataq in the southern regions.
2. *Sardoudi*. Present in Sardoud area east of Alhudaiada city.
3. *Black Taez*. Present in Qotoba until mountain chain in the south and highland areas. Used for meat and milk often used in making the famous Taez cheese.
4. *Red Taez*. Present in southern highland regions, Qotoba and Shaia' in Taez.
5. *Jabali*. In the highlands of Ebb, Albida and Ma'areb.

Other locally adapted introduced goat breeds are:

6. *Ogaden*. Originating from Somali goat.
7. *Somali*. Other local names are: Jalal, Monma. Used for meat and milk.
8. *Beetal*. From India and was imported in 1970's for crossing with local breeds in the southern governorates with promising results.

Camels

1. *Arak*. Present in coastal plaes and desert areas in the foot of the mountains. The namnes derives from a tree which is a main source of feed. Used for transport, meat and milk.
2. *Horra*. No information available.
3. *Hojun*. No information available.
4. *Areda*. No information available.

Horses

1. *Omarqoub*
2. *Saqallwiya*
3. *Shweimaa*
4. *Dahmaa*
5. *Abeia*
6. *Jofi*

Camels are mostly found in Sanaa and surrounding regions (50%) and the rest is in different parts of the country. Little information is available.

Donkeys

Very little information is available on donkeys. They are used for agricultural work and, transport and riding.

1. *Qirmani*. Grey. Small size. White and light black colors.
2. *Somali*. Looks like Sudanese donkeys. Grey color.
3. *Sibiani*. Thought to have its origin in Sudan. (Hasanein, 1995). No further information.

Local Chickens

There are many local types of different size and colors in different regions. Usually called Baladi (meaning local in Arabic). Productivity is low but local demand on its product is increasing.

Local rabbit breeds

No information

Local pigeon breeds

No information

3.1.2 More widespread breeds

Most wide-spread sheep breed is the Yemeni White and least is Juhrani.

Most wide-spread goat breed is the Jabali and least is Sardoudi.

Most wide-spread cattle are the Yemeni (Zebu).

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

Species	At population level				At individual level		
	Baseline survey	Genetic distance	Breeds and crosses evaluation	Valuation	Performance recording	Genetic evaluation	Molecular evaluation
Cattle	none	none	none	high	none	none	none
Sheep	none	none	none	high	none	none	none
Goats	none	none	none	high	none	none	none
Camels	none	none	none	low	none	none	none
Horses	none	none	none	high	none	none	none
Donkeys	none	none	none	moderate	none	none	none
Chicken	none	none	none	high	none	none	none
Rabbits	none	none	none	low	none	none	none

Comment.

Valuation of AnGR was estimated as low, moderate or high. The rest of the information in the table does not exist except some performance recording in some commercial farms

3.1.3 Breeds at risk

Horse population is approximately 1337, which means that all breeds could be at risk of extinction. Also, local chicken breeds, donkey breeds, camel breeds and rabbit breeds could be very shortly at risk, unless programs are put in place to conserve them.

3.2 Assessment of Genetic Biodiversity

Yemeni breeders in different parts of the country have long recognized the wide AnGR available and accordingly they tend to prefer the most appropriate breeds that adapt to the local conditions. Consumers also prefer products from some particular breeds, as for instance mutton from Dhamari sheep and cheese from Taez Red goats. Although the National Research Authority and farmers made some efforts to improve Dhamari and Sardoudi sheep breeds not much results have been obtained.

The impact of the introduction of some exotic breeds is rather insignificant, where most of animals from these breeds are either slaughtered or used only for milk production, albeit leakage of genes from animals that are not slaughtered. There are little or no wild relatives of the domesticated animals that are used for human consumption.

3.3 Priorities for Capacity Building in AnGR

Institutions like the General Directorate of Animal Wealth, National Research Authority and General Authority for Environment Protection have some articles in their bylaws and regulations that refer to and emphasize the maintenance of AnGR but they lack on-ground implementation. Priorities in this respect are:

1. Increasing awareness about the utilization, development and conservation of AnGR among farmers through extension service and including such concepts in the curricula of the educational institutions.
2. Agricultural research institutions in coordination with other national bodies should carry out activities in surveying and characterizing breeds of different species and assess their productive and reproductive performance.
3. Training nationals on different aspects of AnGR in coordination with international organizations and providing the technologies and equipment needed.
4. Establishing a specialized unit in the General Directorate of Animal Wealth in coordination with National Research Authority to prepare a practical program to increase awareness among local communities and users of AnGR.
5. Encouraging the private sector to invest in the utilization and development of AnGR through appropriate technologies, especially in view of the increasing demand on animal products.

4. STATE OF AnGR UTILIZATION

4.1. Legislations and Regulations Affecting AnGR

The general national agricultural policies should provide the framework for the utilization of available resources in both animal and plant production sectors. It is also considered as the entry point for the preparation of a strategy for the development of AnGR. However, the present national policy does not provide for clear picture of AnGR. This has resulted in the lack of concern to issue laws and regulations that deal with protection of animal wealth and proper use of natural pastures. Also lacking is the appropriate research to maximize the benefit from the livestock sector and harmonizing the curricula of animal production and veterinary medicine in learning institutions with the national priorities (Workshop on Policies and Strategies for the Livestock Sector, 2000). Additionally, this lack of policies has led to the stagnation in

the development of livestock production systems, inefficient marketing channels and the absence of marketing networks (AOAD, 1998).

Nevertheless, some positive developments in the support of the livestock sector are: establishing the National Research and Extension Authority, establishing the Agricultural Cooperation Union and its associations, establishing the General Authority for Environment Protection, encouraging the private sector in investing in dairy production, encouraging initiatives for policies in AnGR, increased concern about natural pastures, spread of dairy coops, issuing the environment legislation which helps the protection of natural pastures necessary for livestock and the growth of the commercial sector in dairy and poultry production.

4.2 The State of Utilization of AnGR by Species

Cattle, sheep, goats, camels and chickens are the main species of livestock in the country beside donkeys, horses, rabbits and pigeons. These animals (and birds) play an important role in the welfare of local communities in contributing to food, agriculture, transport and fuel in addition to their cultural, social and leisure roles. Cattle and sheep contribute primarily to domestic consumption of meat, milk and skins and hides (as well as export) while goats and camels contribute to domestic consumption of meat and milk to some degree (Table 4.1)

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	40	40			5		5				2		3		95
Sheep	5	60		3	15		15							2	100
Goats	30	40		1	15		10							4	100
Camels	10	10			10		10	30	20					10	100
Horses							5		80	15					100
Donkeys							5	95							100
Chicken		45	50									5			100

The increase in the demand on animals and animal products in local and export markets has resulted in:

- Increased demand on local calves and hides for export. Production of small ruminant has increase as well as dairy farms and bee hives.
- Relative improvement in feeding regimes and veterinary care, resulting in higher production.
- Support of poor rural families in dry and rainfed areas and considering local AnGR, especially goats, as the main sources of income.

Negative aspects, however, are:

- The increase in the rate of slaughter of young calves is considered as a loss of potential of 30,000 tons of meat if grown to mature weight.
- Increase in stocking rate of small ruminants caused pasture deterioration.

- Abandoning the age-tested traditional grazing systems (e.g. *hema*) that helped maintain the pasture.
- Transferring pastures to farmland has caused the shrinkage of available pasture for ruminants and put more pressure on irrigation resources.
- Fewer flocks of local breeds of chickens are maintained while the trend is towards commercial synthetics and hybrids.

4.3 Breeding Organizations and structures and Institutions Utilizing AnGR

Animal breeding in Yemen is without structure except in most herds of exotic breeds where animals are bred from within the herd to secure replacement. Some intentional crossbreeding took place in small ruminants and chickens only in experimental stations. This structureless breeding is a direct result of the lack of genetic improvement strategy and scientific knowledge thereof. The experimental crossbreeding work with Awassi sheep and Beetal goat did not continue for the same reason: lack of a strategy.

4.4 Capacity to Utilize AnGR

The institutions that utilize AnGR are:

1. State Sector and it includes:
 - Ministry of Agriculture and Irrigation. It has modern production farms under the supervision of General Directorate of Animal Wealth and research farms supervised by Agricultural Research Authority.
 - Other state farms belonging to different governmental bodies, e.g. Economic Org. and Ministry of Supplies.
 - Colleges of Agriculture of different universities.
2. Mixed Sector (State + Private):
 - Modern farms
 - Poultry companies
4. Private sector
 - Commercial sub sector
 - Breeders Associations (Coops, Ag. Coop. Union)
 - Other breeders not belonging to any association. These represent the great majority of breeders in the country.

These institutions make some attempts to genetically improve their sheep and goat flocks/herds through selection and are sometimes sought by breeders who want genetically "improved stocks".

The lack of efficient animal production and the increasing cost of production limiting the full utilization of AnGR are caused mainly by: limited feed stuffs, diseases leading to high mortality rate, production systems not responding to the forces of change especially as regards local breeds, poor extension and veterinary services, lack of training for staff and breeders and lack of meaningful research.

4.5 Trends in the Utilization of AnGR

The only detected trends are those of importing high producing dairy breeds and commercial chickens for meat and egg production. This was more or less dictated by market forces of increased demand on dairy and poultry products and the inability of local breeds to satisfy this demand. This change in consumptions pattern accompanied the changes in income, cultural and prices.

Utilization of AnGR could be improved by the introduction of technology and methodology to increase the efficiency of these AnGR, e.g. proper feeding, production of high yield fodder crops, genetic improvement.

The current global trends could impact AnGR in Yemen, e.g. free movement of goods and capital and competition. They could force the country to enact legislations and issue regulations to create conducive production and investment environment for the common benefit of all concerned. Local AnGR, known for their quality products that are already drawing higher prices than their counterparts from exotic stocks, could gain attention and be subject of greater investment.

4.6 Development of AnGR

In spite of the poorly integrated agricultural and rural development, there exist some limited programs and activities to develop AnGR. Currently, the Directorate of Animal Wealth, Ag. Res. Authority and the Coop Commercial sectors have programs in animal health and animal extension. These programs centers around offering better extension services and providing veterinary services in animal markets and veterinary units and centers. Research is conducted to improve productive traits and making use of breeds with distinct characteristics like fertility in Dhamar sheep and meat and milk in Sardoud goats. Selection is going on in Friesian cattle and efforts are being made to produce an improved chicken breed by crossing local breeds with the Egyptian Fayoumi.

Table 4.3 Number of breeds with current breeding strategies and tools being used (No. of breeds)

Species	Breeding goals	Breeding strategies		Tools				
		Designed	Designed and implemented	Individual identification	Recording	AI	ET	Genetic evaluation
Cattle		not yet	not yet	not yet	not yet			not yet
Sheep	meat	not yet	not yet	not yet	not yet			not yet
Goats		not yet	not yet	not yet	not yet			not yet
Chicken	eggs	not yet	not yet					

Table 4.4 in training pack

4.7 Breeding Programs and Capacity to Develop AnGR for the Future

The increase in demand on animal products led to the concentration on some breeds in the species, e.g. Dhamari sheep and Sardoud goats, and to increase in the size and better feeding of dairy cattle herds for higher efficiency.

In traditional breeding, sires are selected according to their phenotype: strong well positioned hind legs and general appearance strong, while females: large and healthy. However, selection programs in experiment station are based on birth weight, weight gain in the first three months of age and linear dimensions.

Farmers are responsible for their breeding programs, i.e. there is no organizational breeding except in the rare cases where Ag. Res. Authority organizes programs for breeding of small ruminants, poultry and camels. Private and coop sector are mainly in breeding of exotic cattle breeds and some selected local small ruminant and chicken breeds. The government role is mainly providing veterinary and

extension services, rural development projects, funds for supporting the coops and research activities.

Ag Research Authority is the closet to AnGR development-related research. Its main activities are currently in modest projects in small ruminants, camels and poultry. Commercial private outfits keep salient performance recording.

Otherwise, the great majority of farmers follow their own instinct and tradition in breeding and managing their animals.

Many layers of the Yemeni society depend on livestock for their income. . These layers range from the communities living in arid and semi arid areas who depend almost totally on animals for their domestic economy (especially women) to those concerned with the delivery of the animal commodity to the consumer.

Table 4.4 Stakeholders preference for animal genetic resources

Government	3	2	3
Private companies	2	2	4
Research	3	3	2
NGO's/Coops	2	3	3

1= lowest preference, 5=highest preference

Table 4.8 in training pack

4.8 Constraints and Opportunities for the Utilization and Development of AnGR

4.8.1 Constraints and difficulties.

These are:

- Lack of modern techniques for the management of AnGR decreases efficiency
- Inadequate feeding
- Epidemic and infectious diseases, e.g. small ruminant pest (PPR), FMD, sheeppox and goatpox
- Lack of due consideration for local breeds
- Insufficient inputs and low quality output
- Inadequate management of grazing land
- Poor marketing channels networks
- Lack of training and qualified manpower to develop AnGR

Opportunities are:

- Good management of AnGR and housing for livestock throughout the year
- Disease surveillance and making available the technologies needed
- Making available high yielding forage crops
- Making available appropriate technologies and equipment

Opportunities for improving traits are:

- Selection within breed for increased quality products and the efficient use of feedstuffs
- Making use of successful crossing results especially in small ruminants

The little information available on the local breeds as far as their production and adaptability are concerned showed the possibility for improving the quality and quantity of these AnGR and the use of the so-far-neglected feed resources.

5. State of Conservation of AnGR

AnGR play a recognized role in securing different products, farm labor, transport and other services in the rural communities especially in arid areas where dependence on animals is nearly total. The particular characteristics that the local AnGR have as compared to exotic ones, e.g. adaptation to scarce feed resources, adverse weather and ability to coexist with natural enemies and predators, make them valuable resources to protect. However, the actual maintenance of these AnGR is beyond the actual practice due to the absence of concerned agricultural policies, lack of awareness, limited financial resources and lack of trained manpower. However, AnGR is often mentioned in the environment programs especially in the Island of Soqatra where the maintenance of these resources is currently considered the responsibility of the government.

Table 5.1 Current number of breeds in managed conservation programmes

Species	Number of locally adapted breeds at risk			
	Total	Managed <i>in situ</i>	Managed <i>ex situ</i>	Both (<i>in</i> and <i>ex situ</i>)
Cattle	non existent	non existent	non existent	non existent
Buffalo	non existent	non existent	non existent	non existent
Sheep	non existent	non existent	non existent	non existent
Goats	non existent	non existent	non existent	non existent
Camels	non existent	non existent	non existent	non existent
Horses	6	0		0
Donkeys	non existent	non existent	non existent	non existent
Chicken	non existent	non existent	non existent	non existent
Turkey	non existent	non existent	non existent	non existent
Rabbits	non existent	non existent	non existent	non existent

Comment

Among factors that are affecting the maintenance of AnGR within the species are those concerned with market forces leading to the replacement of local breeds with exotic ones in the poultry industry and issues related to feed and animal health. The preparation of programs for the conservation of AnGR *in situ* and *ex situ* is considered a step forward to increase the awareness in the society.

Cultural and social factors also impact on the conservation of AnGR through the pride a community could have in conserving a resource that is considered part of its heritage. But this requires awareness and finance to train manpower and to make technologies available. These (trained manpower and finance) are needs of first priorities to address issues related to AnGR.

Table 5.2 Priority of needs for utilization of technologies for *in situ* conservation programmes

Technology	Needs			
	Knowledge	Training	Financial resources	Technology
Recording	4	4	4	4
Genetic evaluation	3	4	3	3
Molecular techniques	1	1	1	1
Breeder improvement techniques	3	3	3	3

1= no priority, 2=low priority, 3=average priority, 4= high priority, 5= very high priority

Table 5.5 in training pack

6. Development of Policies and Institutional Organizations

The Ministry of Agriculture and Irrigation, represented by the General Directorate for Animal Wealth is considered the official office responsible for activities related to AnGR according to the bylaws of its establishment, while the Ag Res. Authority representing the Ministry of Agriculture and Irrigation is the body responsible for carrying out research in this field. The coops represent some farmers and breeders while the private sector is represented by the Commercial Groups. Each of these bodies prepares its own program but the official programs having the overall responsibility and which are financed by the government are that of the Directorate of Animal Wealth and Ag Res. Authority. While very little coordination takes place at preparing respective programs, these institutions collaborate at a later stage through mutual consultation, exchange of experiences and facilitating the work of each other.

Under these considerations of the preparation of matters related to AnGR, the periodical meetings and seminars held to discuss policy issues are the responsibility of the Ministry of Agriculture and Irrigation that is, also responsible for financing such gatherings. While the increasing demand on animal products is itself an incentive for producers, the government tries to offer further incentives in the field of AnGR, especially dairy activities, through soft loans and the reproduction of AnGR of local and exotic resources in addition to offering reduced custom duties on inputs for animal and plant production.

This fruitful cooperation between the government and producers has attracted the private sector and some state and coop institutions to invest in dairy production and the establishment of Friesian-based dairy farms. This has led to adequate supply of milk and dairy products in the urban and semi urban markets. However, this experience has not been thoroughly evaluated but initial evaluations conclude that it has been a positive experience.

The linkage between the sustainable utilization and conservation of AnGR and the socio-economic development has not been closely observed so far. This is due to the current cultural realities, economic stagnation and the animal production system being non responsive to the forces of changes. But Yemen tries to link these issues with the agreement on biodiversity which Yemen considers as one of the most important agreements that it is a member of.

Carrying out surveys, breed characterization and evaluation, herd/flock management and establishing databases are currently the highest priorities in capacity building. Ag. Res. Authority is preparing a program for that starting with a project with ACSAD (Arab Center for the Studies of Arid Zones and Dry land).

The utilization and development of locally adapted and exotic AnGR is in need for legislation to regulate their use and conservation. The veterinary and quarantine legislations issued in the seventies of the last centuries need to be revisited in order to cope with new developments. The legislations concerned with standards of animal products, however, are not an urgent matter at present, since most of the traditional local animal products are consumed in their respective rural community and have not yet faced real competition yet.

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

Species	Industrial systems	Small-holder systems	Industrial systems	Small-holder systems
Cattle	2	2	1	2
Sheep	1	2	1	2
Goats	1	1	1	2
Camels	1	1	1	1
Horses	?	?	?	?
Donkeys	?	?	?	?
Chicken	?	?	?	?

1=none, 2= few, 3=moderate, 4= more than a few, 5= high degree of

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

Species	Activities			
	Use of exotic breeds	Use of locally adapted breeds	Training, research and extension	Organization of breeders/farmers
Cattle	3	1	2	3
Sheep	2	2	3	1
Goats	2	2	3	1
Camels	1	3	3	3
Horses	1	1	3	3
Donkeys	1	1	1	1
Chicken	3	2	3	3

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

Needs	Required		
	Immediately	Medium term	Long term
Legislation for protecting and organising livestock	x		
Legislation for pastureland management	x		
Legislation for quarantine improvement		x	

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	2	3	3	4	2
Sheep	2	3	3	2	2
Goats	2	3	3	2	2
Camels	4	5	5	5	5
Horses	5	5	5	5	5
Donkeys	4	5	2	5	4
Chicken	4	3	3	3	2

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	3	3	3	3	3
Sheep	3	3	3	3	3
Goats	3	2	3	2	2
Camels	2	2	2	2	2
Horses	4	5	5	5	4
Donkeys	5	5	5	5	5
Chicken	3	3	3	3	3

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.

PART 2

2.1 Policies, Strategies, Programs and Previous Practices Related to AnGR

Although there exist institutions like Ag. Res. and Extension Authority and its experiment stations, agricultural colleges and other agricultural and veterinary schools and veterinary laboratories and clinics, a clear strategy to develop AnGR is almost completely absent. Efforts in that endeavor are scattered and centered mainly on characterization of some local breeds but even this information needs much updating. This failure is due to many factors, most importantly, legislation factors, production factors, socio-economic factors and institutional factors. Currently, there are some positive trends for the maintenance and conservation of animal wealth as:

1. Legislation for the protection of animal wealth, not issued yet.
2. Legislation for environmental protection.
3. Drawing livestock production strategy.
4. Legislation for slaughterhouses.
5. Legislation for Ag. Res. And Extension Authority.
6. Agenda for restructuring the agricultural sector.
7. Establishing a special fund for the promotion of fish and agricultural production.
8. Social Development Fund.
9. Agricultural Loan Bank

Policies for agricultural research and livestock production for 2000 as set in Aden Agenda for Reforms in the Agricultural Sector (2000) have not been implemented yet. This Agenda is:

2.1.1 Animal Wealth policies

- a) The issuing of needed legislations necessary for the protection of animal wealth, ban of the slaughter of young females and setting minimum slaughter age and weight.
- b) Encouraging of small farmers to form small dairy units and the organization of milk collection centers.
- c) Activation of the role of entry quarantines to prevent incoming diseases.
- d) Enhancing veterinary services and encouraging the private sector to participate in this field.
- e) Increasing production of white meat, improving its quality and reducing cost.
- f) Increasing the production of red meat through the propagation of fodder crops of high nutritive value.
- g) Improve animal extension service, especially for rural women.
- h) Improving centers for the development of local breeds.
- i) Improving the level of technical veterinary and animal production training.
- j) Paying due attention to pastoral areas and increase the awareness of good range management.

2.1.2 Policies for agricultural research and extension related to livestock

- a) Improve productivity with emphasis on selection, veterinary care and feed resources.

- b) Improve productivity of ranges and pastures through the participation of users and rehabilitation.
- c) Improve institutional structure the of extension service.
- d) Strengthening the link between research and extension for the better flow of improved technologies.

2.2 Analysis of Future Demands

2.2.1 Factors affecting changes on demand for animal products

- a) Population growth, 3.5% annually.
- b) Increase of the prices of animal products or lack of their supply.
- c) Decrease in the purchase power and average income, and local currency depreciation.
- d) Availability of competitive alternatives.
- e) Preference of special brand name commodity.
- f) Availability of products with known standards and hygienic quality.
- g)

2.2.2 Changes in livestock sector

Statistics show that during the period 1997-2001, sheep and goats increased by 3.4%, cattle 4.3%, camels 2%, local chickens 2% and commercial chickens 10%. The increase in animal products during the same period was 6.9% for red meat, 8.6% for white meat, 4% for milk, 5.8 for table eggs. It is concluded that though there was increase in animals and their products, this increase is short from satisfying needs. Statistics for 2001 also show that red meat, white meat, milk and table eggs covered 61%, 58%, 53% and 100%, respectively, of the domestic demand (Table 7.1) (Ag. Statistics Book, 2001). The balance was imported.

2.3 Alternative Strategies

The currently ongoing practices are a set of regulations that are more or less implemented in *ad hoc* manner and with personal efforts from breeders, except those practices related to epidemics and quarantine which are taken more seriously. Thus livestock production is in great need for a proper strategy based on well defined factors, with the objective to develop and improve the utilization of livestock to be able to meet future demand. This objective can be met with the same number of animals Yemen has got

2.3.1 Policies and Strategies for the management of AnGR

For animal production to become more efficient and able to cope with future demand there must be cooperation among all stakeholders including public and private sectors.

a) Role of the public sector:

Issuing legislations dealing with the utilization, development and conservation of AnGR, among these are,

- Improve and develop production characteristics through appropriate means of selection and crossbreeding, AI, MOET etc.
- Legislate for animal slaughter, ban the slaughter of young females and immature animals, ban slaughter out of slaughter houses, and strict veterinary supervision on slaughtering animal and marketing meat.
- Legislation to protect local products from imported products.
- Legislation for investment and reduction of cost of inputs.

- Increase awareness among breeders and producers through the extension service and linking the latter with the research community.
- Adoption of official policy to conserve endangered species and breeds, e.g. horses and to lesser extent donkeys. Make use of the experiences of other countries in this field, e.g. Egypt in conserving local chicken breeds, and establishing *in situ* and *ex situ* conservation facilities.

Table 1.7. Expected trend in the export of animal products, % of domestic production

Year	Wool	Skins/hides	Table eggs	Milk	White Meat	Red Meat
2002	0	39	0	0	0	0
2003	0	40	0	0	0	0
2004	2	40	0.5	0	0	0
2005	2	42	1	0	0	0
2006	3	42	3	0	0	5
2007	3	44	3	0	0	5
2008	5	44	5	0	0	10
2009	5	45	5	0	0	10
2010	6	47	6	0	0	15
2011	6	47	6	0	0	15
2012	7	48	8	0	0	20
2013	7	48	8	0	0	20
2014	8	49	9	0	0	25
2015	8	50	10	0	0	25
2016	10	50	10	0	0	30

Table 2.7. % of local animal products consumed locally

Year	Wool	Skins/hides	Table eggs	Milk	White Meat	Red Meat
2002	100	61	100	100	100	100
2003	100	60	100	100	100	100
2004	98	60	99.5	100	100	100
2005	98	58	99	100	100	100
2006	97	58	97	100	100	95
2007	97	56	97	100	100	95
2008	95	56	95	100	100	90
2009	95	55	95	100	100	90
2010	94	53	94	100	100	85
2011	94	53	94	100	100	85
2012	93	52	92	100	100	80
2013	93	52	92	100	100	80
2014	92	51	91	100	100	75
2015	92	50	90	100	100	75
2016	90	50	90	100	100	70

b) Role of private sector:

This role is played by corporations and breeders in the commercial sectors, breeders associations, farmers' organizations etc. There must be clear role for this sector to play in the alternative strategies as:

- Active participation in drawing the policy.
- Adoption of operations where this sector usually has the larger share, e.g. investment, marketing, export etc.
- Responding to and interacting with the extension process and the application of promising experiments.

Species and breeds that play a role in meeting the future demand on animal products and services

- Cattle, especially local breeds if due attention is paid to them.
- Sheep, most of the breeds according to their geographical distribution.
- Goats, most of the breeds according to their geographical distribution.
- Chickens, local and imported stocks.

2.4 Discussion of Alternative Strategies

These strategies should form the general framework and programs supposed to replace current practices incapable of developing AnGR. These strategies should make use of the farmers' accumulated knowledge and experiences. These new strategies and programs should be carefully laid out for them to be able to overcome constraints for developing AnGR.

2.4.1 Expected benefits from alternative strategies

For breeders:

- Increased income for the same or little inputs
- New job opportunities and increased interest in marketing
- Improved production due to the introduction of modern methods in animal breeding (new technologies and/or new knowledge)

For consumers:

- More accessibility to animal products
- Improved quality
- Better prices

For national economy:

- Realization of self sufficiency
- Improve alleviation in rural communities
- Improving employment

2.4.2 Possible negative consequences of the alternative strategies

- Dampening prices
- The lack of confidence in some government action may lead to possible non-response on the part of farmers which may result in the failure of these programs or simply rendering them to obstacle in the face of development.

PART 3

3. THE STATE OF NATIONAL CAPACITY AND EVALUATION OF FUTURE CAPACITY BUILDING

According to the legislation by which the Ministry of Agriculture and Irrigation was established and other related by-laws in connection with AnGR, the Ministry of Agriculture and Irrigation is considered the body responsible for the regulation of AnGR affairs through the General Directorate for Animal Wealth and Ag. Res. And Extension Authority.

Table 8.1. Dairy and other farms in different sectors

Sector	No. of dairy farms	No. of sheep farms	No. of goat farms	No. of cattle/calve fattening farms
Public	3			
Coop	3	4	4	2
Private	1	2	1	1
Total	7	6	5	3

There exist 3 authorities and 4 projects for integrated agricultural and rural development. These are state activities which contribute modestly to the agricultural extension services in the sites of importance to AnGR. The future institutional structure should be to activate the current administrations, prepare priority programs at the national level and training manpower in all AnGR relate fields. In Yemen, there are 175 vets at different levels from PhD, MS. to BS, 800 vet assistants , approximately 200 animal production specialists, 8 range/pasture/fodder/forestry specialists, 137 (53 PhD & 84 MSc) researchers in different related fields, 1364 ag extensionists (Moharram, 1988). Few of these qualified persons enjoy high degree of experience but the experience of many is only modest. Due to lack of proper personnel development and rehabilitation policy, these cadres suffer from the lack of current knowledge, especially in the fields of feeding, veterinary health and AnGR. There is gender imbalance where females are not represented in the field of veterinary and AnGR.

General Directorate for Animal Wealth also got one national vet lab, 3 regional labs, 8 field labs, 7 quarantines at borders, seaports and airports and 22 vet service centers. The Ag. Res. and Extension Authority supervises 10 research centers and stations. There are 30 small and central slaughterhouses.

There are 3 colleges of agriculre and mid-level schools for agriculture and vet and a training center that belongs to the General Directorate for Animal Wealth. It is believed that the graduates of these learning institutions are below the level desired to tackle the real problem facing the agricultural sector.

The lack of qualified cadres in AnGR , agricultural research , continuous and on-job training and surveys , studies and research to establish information databases for AnGR , all constitute weak links in that sector.

Lack of centers for training, vet extension, AnGR associations specialized in animal breeding and AI and the nonparticipation of women in these activities also represent constraints.

In midst f all these constraints, the government occasionally and according to available resources makes use of multi- and bilateral aid to carry out activities in this

field, e.g. FAO, AOAD, specialized centers and Arab unions, ICARDA, ACSAD etc. There is a joint project with the latter to establish a camel breed, utilization and management database.

International trade in AnGR is limited and below the desired volume due to:

- Weak data bases, inadequate development policies and lack of emphasis on livestock export.
- Lack of modern marketing institutions aware of international demands and standards and proper technologies and able to open new marketing opportunities.
- The red tape involved in import/export acts as a deterrent.

PART 4

SETTING OF NATIONAL PRIORITIES FOR THE DEVELOPMENT, UTILIZATION AND CONSERVATION OF AnGR

The setting of national priorities for the development and utilization of AnGR requires full awareness of the constraints discussed in the last Parts 1, 2&3 facing the realization of these objectives. These constraints are briefly mentioned below.

4.1 Obstacles and Constraints

1. Absence of strategies, plans and legislations related to development, utilization and conservation of AnGR.
2. Inefficient management of AnGR in as far as breeding, husbandry, feeding and veterinary care are concerned.
3. Lack of national databases regarding breeds and species beside non-documentation of traditional framers' knowledge.
4. Absence of marketing infrastructure, weakness of the private sector role and absence of clear official directions.
5. No or little effort to increase awareness among breeders for proper livestock management, husbandry, veterinary, genetic improvement ...etc.
6. Lack of or no research and study results to direct development or the implementation of their results.
7. Absence of training programs for specialized cadres to update staff on technologies and administration for the development of AnGR.
8. The inefficiency of the present administrative system for the development of animal wealth and lack of networking among different bodies related to AnGR.

4.2 Opportunities and Possibilities for Improving the Utilization, Development and Conservation of AnGR

The constraints stated above are viewed as much bigger than opportunities available to the public or even private sector. Even dealing with these constraints, priority setting and defining needs in the short and long runs will need the prevalence of many factors and availability of facilities. Table 4.1 shows these priorities, needs and possible bodies to carry out these tasks.

Table 9.1 shows that there are many activities and that can be carried out to improve the AnGR situation without necessarily increasing the number of livestock. Increasing efficiency should be the real target.

Table 1.9. Priorities and needs required and bodies proposed to carry them out

Task	Executing bodies	Priority	Needs
Establishment of stations for conservation of breeds at risk	state, private sector, regional & international org.	as soon as possible	studies, research, conservation programs, tech. & financial facilities
Legislations for AnGR & natural pasture	state, private sector	as soon as possible	alternatives to breeders, fattening lots
Restructure Livestock sector	state	as soon as possible	experts, political will
Breeders awareness of sustainable genetic improvement	state, int'l org	short term	extension programs, experts, tech. & financial facilities
Establishment of AnGR information center	state, international organizations	short term	tech. & financial facilities
Training rural cadres including women on production and health	state, international organizations	short term	tech. & financial facilities, experts
AnGR development programs	state, private sector, regional & international org.	long term	studies, research, , tech. & financial facilities
Disease and zoonosis control	state, regional and int' org.	as soon as possible	programs, strategies, experts, tech. 7 financial facilities
Training for specialized cadres in AnGR conservation	state, private sector, int'l org.	short term	experts, tech. & financial facilities
Establish marketing channels	state, private sector	long term	rural awareness, plans, policies
Increase trade in animal & animal products with neighbor countries	state, private sector	long term	legislations, strategies, executive experts in all the above

PART 5

RECOMMENDATIONS

1. Rendering AnGR the due importance they deserve in agricultural policies and strategies and issuing needed legislations and regulations for their utilization, management and conservation..
2. Restructuring the General Directorate for Animal Wealth and networking it with other relevant research and executive bodies and issuing needed legislations and regulations regarding all aspects of livestock, production, investment, slaughter, competition for export ...etc.
3. The immediate establishment of animal conservation centers for breeds at risk (all horse breeds) in cooperation with regional and international organizations concerned with these aspects.
4. Establishing marketing channels in rural areas that enable breeders to market their products at rewarding profit as an incentive to improve means of production.
5. Take stock of the traditional knowledge in breeding methods and range management and make use of useful practices.
6. Training specialized cadres on sustainable development and the management of AnGR. Training of breeders and producers on animal husbandry, animal breeding and animal health care.
7. Studying local feed resources and determination of their nutritive value.
8. Promoting traditional range management and the introduction of improved pasure species.
9. Building a national information system covering the range of fields related to AnGR, e.g. populations, species, breeds, performance, development, conservation, disease control, marketing...etc, and linking it to regional and international networks for AnGR.
10. Study of local breeds and species, for they are the base for any improvement. The introduction of exotic breeds cannot be the ultimate or the ideal solution in all cases.
11. Collaboration with international organizations in the establishment of animal research centers and animal improvement stations, e.g. AI, embryo transfer, DNA technology etc.

PART 6

ANNEXES

Annex 1. Executive Summary

Yemen area is estimated at 555 thousand km². The country lies in the southern part of the Arabian Peninsula within the northern extensions of the tropics. Agro environmental conditions are not favorable and characterized by erratic rainfall and high evaporation rate. However, topographical and geological nature and variation in altitude within short distances have created great variation in agro ecological zones resulting in a great biodiversity.

Human population of Yemen is 18 million with an annual increase of 3.8. Cultivable land is about 1.6 million ha of which 72% is actually cultivated. An estimated 35% of this area is rainfed and the rest is irrigated. Natural pastures make up 70% of the total area, which provide some 40% of national animal feed for livestock and game.

Agricultural sector contributes effectively to the national economy, 19% of GDP and 57% of labor force. Livestock sector is estimated to contribute 12% of the agricultural contribution. Livestock populations are estimated as 1.4 million cattle, 5 million sheep, 4.5 million goats, 198 thousand camels plus donkeys, horses, chickens, rabbits and pigeons.

The value of livestock is not only its contribution to the national GDP but as importantly as a main support for thousands of rural families, especially in dry regions. However, these resources are still generally much undervalued in agricultural policies. The state provides services through the General Directorate of Animal Wealth and AG. Res. & extension Authority while private and coop sectors pay attention to breed importation, especially the Friesian and crossing.

Agro ecological, productive and socio-cultural conditions have helped to create two main animal production systems in the country, traditional extensive systems and the intensive production system. The traditional system includes five sub-systems all concerned with local breeds. The intensive system is concerned with exotic dairy breeds (7 farms with 3000 cows plus 2 fattening lots of 1200 calves) and commercial chicken farms. The present production systems may be characterized as low input in all but the extensive systems in cattle, poultry and horses where the level of inputs is medium to high. These production systems have been static in Yemen for the last twenty years, the only change being that in dairy cattle and commercial poultry. Animal breeds are decreasing in numbers and reaching alarming stage in horses and to some extent in chickens and donkeys. Farmers keep more than one species and women carry out most of the work related to livestock (80%). Breeding methods have no particular structure. There is very little selective breeding or crossing that is going on. There are 39 local breeds in nine species plus three imported goat breeds. Very little is known about the characteristics of these breeds and information needed for proper planning of these AnGR. These AnGR are used in the production of meat and milk and eggs. Sheep contribute most to the production of red meat followed by goat and cattle, while the latter contribute most to milk production and hides. Cattle, equine and camels are also used in agricultural labor and in socio-cultural activities.

For reasons of prices and incomes, the Yemeni consumer has shifted to the consumption of white meat. Despite the low per capita consumption of red meat, the local production covers only 61.4% of the demand while white meat covers 57.7%.

During the last five years, animal products increased by 4-6% while number of ruminants increased by 3-4%. This constituted an extra pressure on the pasture resources which caused a gradual move away from the age-tested traditional grazing systems. The increase in the number of ruminants was due to changes in the consumption pattern of the rural society and the increased dependence of rural families on these resources to satisfy their needs beside religious, social and cultural practices.

The limited feed resources, high mortality rate among animals, inefficient animal and veterinary extension services, lack of trained manpower and lack of research, all constitute obstacles for the development of AnGR and assessing their potential, but the opportunities are there to overcome these obstacles. The Ministry of Agriculture and Irrigation is mandated to prepare legislations and policies related to AnGR, but government agencies, coops and the private sector work in isolation with little coordination. The modernization of marketing channels, establishing information system and preparation of information material on the importance of AnGR will encourage the private sector to invest in this field. However, the conservation of AnGR is a relatively new issue in Yemen and the specialized agencies do not have programs in this new field.

The indicated vital importance of AnGR requires a genuine and serious effort to draw policies and issue and enact legislations to safeguard and develop these AnGR. If the current situation is not rectified and in view of present high human population growth rate, increase in ruminant numbers, irrational use of natural resources especially water and plant cover, many livestock breeds will become endangered or even be at risk and grazing resources damaged, hence crippling true development.

Annex 2. How This Report Was Prepared

Due to insufficient funding and limited time to hold a training workshop for the national network, specialists in fields related to AnGR were invited from different districts in the country for a seminar on the subject. There were 25 of them. After a briefing and brain storming session, the group was subdivided into smaller groups for intensive meetings, discussions and initial training on how to prepare the national report. Dr. Salah Galal, the Regional FAO Facilitator catalyzed the meeting and discussions and acted an information source. Five specialists from the delegates, three of whom from the General Directorate of Animal Wealth, were selected to actually prepare the national report. This process was financed by FAO. Table 6.2.1 shows these five specialists while table 6.2.2 shows the names of those who participated in the seminar.

Table 6.2.1. Specialists who prepared the National Report

Name	Role in the preparation team	Occupation
Dr. Ghaleb Eliriani	Team Leader	Gen. Directorate Anim. Wealth
Eng. Jameel Almamry	Team Assistant Leader	Gen. Directorate Anim. Wealth
Eng. Abdelhady Elrifai	Team Member	Gen. Directorate Anim. Wealth
Eng. Ali Abdelmalek	Team Member	Ag. Research
Eng. Rowida Elnahary	Team Member	Ag. Office, Lahg.

Table 6.2.2. Participants in AnGR seminar

Name	Occupation
Dr. Kahled Elmoqtory	Faculty of Agric., Sanaa Univ.
Dr. Ashraf Elhakeemy	Sanaa Slaughterhouse
Eng. Gamal Elhaj	Central Statistics Org. (Agri. Statistics)
Eng. Saeed Ehammady	Central Statistics Org. (National Statistics)
Eng. Saeed Elbakry	Ag. Res. & Extension Authority
Eng. Wafaa A. Nasher	Directorate for Rural Woman
Eng. Mohammad Abdelaziz	Ministry of Supplies & Trade
Eng. Abdelbaset M. Nasher	Veterinary School
Eng. Sharaf S. Elazazy	Ag. Experimental Station, Dhamar
Eng. Jameel A. Almasaady	Taez Agricultural Office
Eng. Mohammad Makki	Usaifera Res. Station (Taez)
Dr. Hamed Abdelshakour	Breed Improvement Center, Lahg
Dr. Mohammad Adam	Nasser College of Agriculture, Lahg
Eng. Ahmad F. Saleh	Agricultural Office, Abyan
Dr. Essam Abcelkarim	Gen. Organization for Slaughterhouses
Dr. Sharaf M. Elhakemy	Ag. Vet. Institute
Eng. Abdegahny Elshargaby	Agricultural Office, Saada
Eng. Mahfouz S. Romida	Agricultural Office, Hadramout
Abdelghany A. Elsaghir	Central Statistics Org.
Farouk Q. Sallam	General Directorate for Animal Wealth

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Annex 3. Yemen Geography

Agro-ecologically, Yemen is divided into 5 regions as follows:

1. *Eastern Region*, Maareb, Aljouf, Albida, Hadramout and Almahara, covers about 31.8 million ha and has got 15% of all cultivable land, 50% of natural pasture and 18% of livestock numbers.
2. *Coastal Lowland Region*, Tihama, Elhudaida, parts of Hagga , Elmohuit, Taez, Lahg, Abyan, Shibwa and Aden, covers 12.7%, has 2/3 of the total cultivable land, more than 1/3 of livestock numbers. Rainfall is low and temperature and humidity are high.
3. *Central Highland Region*, Sanaa, Dhamar and Elmohuit, covers nearly 70% of the rainfed areas and 18% of livestock numbers. Altitude is about 2000 m and temperatures go down as altitude increases.
4. *Northern Highland Region*, Saada, parts of Sanaa and Hagga, covers about 10% for the total area and has more than 14% of livestock numbers.
5. *Southern Highland Region* has an altitude of 500-1500 m and it includes the ends of southern main chain. It has about 17% of the total livestock number.

Annex 4. Animal Production Systems

1. *Nomadic System.* Most of nomadic families move in mass along with their animals which gives the impression that this system is really large. Moving groups take with them necessary services like water tanks, tents and means of transport, motor vehicles that now largely replaced camels. The more spread of water bores allowed grazers to go for longer distances covering wider areas of ranges. In case of pasture scarcity, grazers concentrate in areas belonging to other tribes where they may be surplus. In this case permission must be sought from the host tribe. Animals are mainly managed by women and children. Veterinary services are rarely available for such system but there are less disease problems. Mortality rate reaches 15% among the young and 10% among adult animals. Young sires are used for one 4-6 months then sold. Typically young females are all kept and sold when they get old. When there is surplus of animals or the owner is in need for cash, flocks/herds are moved to the proximity of agricultural settlements where this surplus is sold directly in the markets or through middlemen. In times of drought, nomads sell their animals to settled farmers but camels which are more drought tolerant are kept for transport and for milk production. Most of natural pastures are open and free, but in difficult years owners buy feeds (green fodders, crop residues, fish meal etc). When grazing areas are far from water sources, water is hauled by trucks and animals are watered once every 3-4 days.
2. *Transhumance System.* This system does not provide enough income for the family. Usually the labor involved is 2-3 persons per family. There are essentially two subsystems under this system, namely,
 - a) Daily transhumance, where settled families live in proximity of crop land and animals graze through the day and return in the evening of the same day.
 - b) Extended transhumance. Members of one or more families move with their animals for a week or so looking for feed and come back to their settlement. Grazing is done usually by young men. Feed resources for this subsystem are not enough. Supplement are bought from nearby farms, e.g. sorghum, corn stalks and leaves, crop residues, grains and oil seed cakes, and hauled to settlements. It is estimated that 30% of feeding needs are purchased while grazing provides the rest. Average ownership is 50 head of small ruminants, average mortality 10-15%. Good young males are kept as sires while the rest of males are sold at the age of 4-5 months. All females are kept in the flock/herd.
3. *Stationary system.* This subsistence system involves most breeders. It is a crop-livestock mixed system where farmers sell some crop products to meet their needs. Most farmers own cattle, sheep, goats, donkeys and poultry. Farmers in this system follow more advanced husbandry than other systems.
 - a) Traditional highland system
This system is practiced by farmers living in the mountains and valleys. They depend on rain and irrigation from well to cultivate their land. Terrace agriculture depends on rain while that in the valleys

depends on wells. Farmers live in villages close by the fields. Land ownership is usually small and often scattered, averaging 1.5-2 ha in the terraces and 3-4 ha in the valleys. Main feeds are berseem and maize and sorghum stalks. Lack of feeds is made up for by purchases from the plain areas. Plowing is by tractors in plain areas but animals are used sometimes. In terraces plowing is by animals if feasible otherwise by men. Average share of natural pasture is 1-2 ha per farmer. Shared agriculture is practiced in both crops and animals, where the owner gets half of the yield or half of the born young and the other half goes to the actual tiller or shepherd or herdsman. Cattle are kept around the homestead and handfed while young calves stay indoors until they are 3 months of age. Cattle are fed green fodder in the season and grains and bran mixed with water sometimes during the off season. Cow is milked three times a day and produce 600-700 liter of milk per lactation. Bulls are kept in some villages and serve many villages around and their owner charge for bull service. Average calving interval is 14 months. Small ruminant graze natural pasture and stubbles during the day but are kept indoors at night. The young stay indoors all the time. Each family owns an average of 6-10 local chickens fed on house leftovers and by scavenging. This backyard chicken production has been greatly affected the commercial chicken production.

b) Traditional lowland system

Average land holding is about 0.5 ha plus 5 ha of natural pasture per family. About 80% of the land is cultivated with maize, fodder maize, sesame, vegetables and fruits. It is still common to use animals in plowing. Cattle are the most common species. The average animal ownership is 2 cattle, 7 small ruminants and less than a donkey. Cattle herd is kept for work and production, one or two oxen are kept for work while cows for milk production where the surplus is sold in the highlands. Cattle graze around the village near cultivated fields. Diet is stubbles, bran and fodders. Calving interval is 15-16 months and milk production is 500-1000 liter per cow per lactation. Male calves are sold for slaughter at 70-8 kg weight. Sheep and goats graze all year round but are supplemented during the dry season. Shepherds select for breeding rams the larger and healthier animals. Young rams are often neglected and isolated from their mothers which are milked. Milk is processed into cheese and ghee. Vet services are available but in the flood areas clostridium is a problem. Average mortality in small ruminants is 10-12%. Chickens are raised in the same way as in the highlands. In the lowlands, livestock contribute about 14% to the returns from agriculture.

4. *Commercial System.* This system includes the large commercial companies that import most of the inputs. Friesian is the main cattle breed used in this system. There are 7 farms in different governorates that produce milk and calves. Other companies specialize in fattening both calves and sheep and sell the fattened animals during religious occasions. Average daily gain in calves is 550-750 g.

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