

The Hashemite Kingdom of Jordan

**National Center for Agricultural Research
And Technology Transfer**

Country Report on the state of Animal Genetic Resources in Jordan

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INTRODUCTION

The Hashemite kingdom of Jordan is located in the eastern Mediterranean between latitudes 29° 30' and 32° 31'. It is bordered by Syria to the north, Iraq to the east, Kingdom of Saudi Arabia to the east and south and Palestine to the west. The land area of Jordan is approximately 8.92 million hectare and is characterized by the following topographical features:

The Rift Valley and the Wadi Araba: occupy a deep depression extending from the Gulf of Aqaba in the south to the Dead Sea (394 m below sea level). Lake Tabaria is in the northern part (212 m below sea level).

The Highlands: is composed of a narrow distinctive area, which lies almost parallel to the west side of the Rift Valley.

The Steppe: is located to the east of the Highlands and bordered from the north by Syria and from the east by the Azraq-Wadi E-Sirhan Basin and the escarpment of Ras El-Naqab in the south.

The Desert Zone: is located to the east side of the Steppe and extends east towards Saudi Arabia and Iraq.

The total human population in 2000 was 5.039 million capita, of which 78.8% urban, 21.3% rural, and 1.92 million capita live in Amman. The annual human population growth in Jordan is 2.8. The number of employees in agriculture has increased from 61800 in 1995 to around 75000 in 2000, which constitute about (6.1%) from the total labor force (Table 1-7 in Annex 1). The labor force is about equally divided between the Jordan Valley and the Uplands.

Climate in Jordan varies a lot from one region to another. West of Jordan has Mediterranean climate, characterized by dry hot summer and mild wet winter and extreme variability in rainfall within and among years. Mild summer and a cold winter characterize the climate in the high lands of

Jordan. Aqaba governorate and Jordan valley regions are very similar in their temperature pattern to subtropical climate; being hot in summer and warm in winter. The steppe and steppe desert regions have continental climate with large amplitudes of temperature. Topography of the land is the main factor controlling the spatial distribution of temperature.

Rainfall occurs in the period from November to March. The annual rainfall averages (30-100) mm in the steppe desert while it exceeds 800 mm in some areas of the high lands, with large variability between and within the regions. Rangelands in the semi-desert regions constitute 91% of the total lands area. Of the approximately 8.1 million hectares of rangelands, about 5.9 million hectares receive less than 50 mm of rainfall annually while about 2.2 million hectares receive between 50 and 200 mm. The rainfall in the semi desert regions is irregular and of uneven distribution, and moreover, these lands suffer from general state of degradation due to harsh environmental conditions and misuse due to overgrazing and cultivation especially in the marginal areas.

Rainfall decreases considerably from west to east and from north to south. The average annual rainfall volume in Jordan is 8.5 billion cubic meters. About 12% of this volume is available for use from springs; runoff or groundwater while the remaining 88% is lost through evaporation. Water consumption from all sources is divided as follows: 300 MCM for municipal and industrial use and about 700 MCM for the agricultural sector. Snowfall is rare and conferred, generally, to high elevations (e.g. Shoubak and Ajlun mountains). The land area of Jordan can be distributed into five Agro-Climatic Regions as shown in Table 1 and Map 1 (in Annex 2).

There are two main wind regimes affecting Jordan, the northeastern flow during summer and the north- and south-western wind during the rest of the year. Relative humidity varies largely from season to another and

during the day. This variation depends on the region and the nature of soil cover. Relative humidity is low during summer. It is about 50% in high lands while it drops to about 30% in the steppe. Maximum values of more than 75% were recorded in the high lands during winter and values of 40 - 45% in the steppe (J. N. G. C., 1984).

The land resources of Jordan are utilized as shown in Table 1-2 (in Annex 1) and in Table 2 (in Annex 2). There were 92258 holdings in 2000, where 75978 land holdings with an average of 4 hectares per holding, and about 15 hectares for the rest. Livestock holdings are shown in Tables 1 to 4, 1-5 in Annex 1.

Areas of production in the rain fed areas and irrigated lands as well as the major crops grown on them are shown in Table 3 (Annex 2). This Table gives some indication of the variability of land use for the period 1995-2000. About 41% of the total irrigated area is located in the arid and semi-arid regions, 39% in the very arid region, and the remaining 20% of the total irrigated area is located in the semi-desert region. The irrigated area of the Jordan Valley and southern Ghor is about 30.4 thousand hectares. The main source of irrigation water is from surface water.

Agriculture's contribution to the gross domestic product (GDP) has declined in recent years from 173.7 million Jordanian Dinar (JD) (1 JD= 1.5 US\$) in 1995 to 134 million in 2001. Its share of the GDP has generally remained below 3%, falling from 4.26% in 1995 to 2.25% in 2000. However, when agri-business activities were included in the calculations; agriculture contributed 29% to the GDP. The livestock contributed 58% to the agric sector (Table 1-1 in Annex 1)

Farming system in Jordan is mainly dependent upon water availability. The average area under rain-fed agriculture in Jordan during 1980-1991 was 0.23 million hectare, 0.14 million hectare planted with winter crops (wheat, barley, lentils, broad beans and forages). The area

planted with summer crops is 8.1 thousand hectare (chickpeas, sesame, corn, and tobacco). In addition, 8.1 thousand hectares are planted with vegetables (tomato, eggplant, squash, cucumber, cabbage, onions, potatoes, watermelon, lettuce, spinach, okra, and others) whereas; 70.7 thousand hectares are planted with fruit trees and about 10 thousand hectares with forages (Table 1-3 in Annex 1; NCARTT strategy, 1994). The average export for the country in 1997 was 181 million JD, whereas the average import was 686 million JD.

Animal production systems differ according to farm animal species. The main system for cattle is the intensive system. Cows raised under this system are totally imported cows (Holstein-Friesian) and dependant on imported concentrates. Cattle farms are scattered allover the countryside but concentrated on middle and northern parts of Jordan. On the other hand, the local breeds and crossbreeds are raised under semi-extensive system. In few farms, productivity under intensive system is comparative to figures reported for farms in developed countries.

For sheep and goats, the main production system is semi intensive. Small ruminants depend mainly on rangeland and stubble grazing. Sheep are distributed mainly in the east and south of Jordan while goats are mainly concentrated in the mountainous areas. Intensive system for small ruminants is so rare and only found in few governmental stations and private farms. Many farmers mix sheep and goats in one flock, but raising small ruminants with cattle is so rare and found in irrigated areas in few numbers (home raising). In Jordan, there are no large governmental farms, only three stations for sheep, and two for Shami goats. The aims of these stations are to conduct research and for breed improvement (Table 2-1 in Annex 1). Poultry is raised under intensive system, same as cattle. In recent years a trend of completely integrated poultry farms was established where

the farms include hatcheries, feed plants, chicken houses, and slaughterhouses.

The future trend for livestock production in Jordan is towards increased intensification, larger farms, and increasing the animal productivity and improving product quality. Intensification in the future will include sheep and goats because of the rangeland degradation and the current drought minimized the quantity of feedstuff available for grazing. Trend will include strengthening the farmer associations and increasing their number. Moreover, the national agriculture strategy emphasizes the establishment of several quality counsels for milk, red meat, and poultry to organize the livestock sector in Jordan. Reasons behind this future trend in livestock are the competition with imported animals products (open free markets) as a result of the free world trade, the increase of demand on animal products due to increase in population and to the improvement in the standard of living and education.

All cattle and poultry farms belong to the private sector. The cooperative system is very weak in Jordan especially in poultry and small ruminants sector. However, there is one farmer union but its activity in the animal sector is non-significant.

Due to scarcity of water and low rainfall, only about 380,000 ha are suitable for cultivation and only 17% of this area is irrigated, which accounts for less than 0.1 ha/capita. Jordan imports partly the basic food commodities (wheat, legumes, red meat and fish), and some vegetables. Rice and sugar are totally imported. Food of animal origin occupies the first position among family food expenditures (14.4%) in Jordan, as found in a study conducted recently.

Animals and animal products amount to 39% of the total value of imported foods (Table 9 in Annex 1, and Table 9 Annex 2). The value of imports will increase due to the increases in population and the

improvement in the standard of living. The average per capita consumption of red meat, milk, eggs, and chicken broilers per year is about 11 kg, 76.6 kg, 152 eggs, and 24 kg, respectively.

The animal production sector has a very important role on food security in Jordan, more than (45000) families are dependent mainly on sheep and goat raising.

In Jordan, there are 8000 agriculture engineers about 900 of them are animal production specialists. In addition, there are around 1000 veterinarians. Furthermore, there are many associations and NGO'S involved in this sector.

The poverty line (minimum amount of money required for covering the food, clothing, shelter, primary health services, basic education and transportation) per family per month is estimated in 1992 to be 150\$ for family not paying rent and 180\$ for households paying rent. The percentage of families living below the absolute poverty line was 21.3% in 1992 and reached 33% in 1997.

Government of Jordan practices different types of intervention in support of agriculture sector in form of price support, subsidies, enforcing cropping patterns, and adopting foreign trade policy aiming for ensuring reasonable income to producers. For example, the government purchases wheat, barley, chickpeas, and lentils in subsidized prices.

In 1989, the government adopted a comprehensive package of economic adjustment program aimed at increasing the rate of growth of gross domestic products. This economic adjustment program especially the removal of subsidy has mostly affected agricultural sector.

Sixty percent of non-farm income for rural poor comes from government wages, while less than 20% of rural areas inhabitants receive their income form non-farm resources. The policy of the government is concerned with increasing production of food commodities, improving the

efficiency of resources allocation, adopting of new technologies to increase productivity of plant and animals, improving the quality of products, improving the standard of living, producing competitive agriculture products and encouraging the rural food industry.

To achieve the aims of the food security policy the government established several agricultural projects of those projects:

- * The economic adjustment program
- * Income diversification project (introducing credit and loans that enable the beneficiaries to purchase improved sheep and goats, fruit trees plantations, feed production)
- * The Jordan Badia research and development program
- * Development of integrated crop (livestock production systems in low rainfall area)
- * Promotion of herbal and medicinal plant sector in Jordan
- * Bio-diversity project
- * Integrated natural resources management of Yarmouk basin
- * On-farm water use husbandry
- * Integrated best management project
- * Develop the agriculture at Wadi Al-Arab basin
- * Develop the rural women in food processing
- * Improve after harvesting technique
- * Management of natural resources in Wala basin

FAO is preparing a Global Report on the State of the World Animal Genetic Resources. In this context FAO has asked the Government of Jordan to prepare the National Report on State of the World Animal Genetic Resources. It is in this context that this report is prepared.

PART I. ASSESSING THE STATE OF AGRICULTURAL BIODIVERSITY IN THE FARM ANIMAL SECTOR OF THE COUNTRY

1.1 Overview of the Country's Animal Production Systems and Related Animal Biological Diversity

During the past few decades, several changes took place in the livestock sector. Number of sheep and goats increased several folds since 1950 up to the mid of nineteenth then decreased by 30%. Small ruminants are raised mainly under semi intensive system and consist mainly of indigenous breeds. Poultry and dairy sectors have gone through huge expansion due to the increase in the demand on animal products. Both are considered as industries dependent on exotic breeds, which resulted in increasing significantly their contribution to food security. On the other hand, the number of the local breeds of poultry and dairy significantly decreased, and as a sequence, their contribution to food supplies became negligible. Main animal products are meat, milk, eggs, and with less degree wool and hair. Self-sufficiency of animal products is improved compare to previous years. It is 100% for broilers and eggs, around 60% for milk and 35% for red meat.

The general trends for the small ruminants' populations are decreasing while the population of cattle almost not changes over the last ten years. The number of local and crossbred cattle, Shami, and local goats have decreased by 66%, 33%, and 52% respectively during the last ten years. Same trend exists in camels where the number declined from 32000 in 1991 to 5000 in 2000.

In spite of the lack of information or even the desire for data collection regarding horses, mules and donkeys, their numbers are also decreasing. The characteristics of local chickens breed(s) are not studied or well defined. Turkey, ducks, and geese are almost completely belonging to

the Baladi (native) breeds. They are very rare and home raised in scattered areas by few families. For pigeons, there are local breeds but the number and characteristics are not studied or determined to any significant degree

Production systems:

Transhumant (open system)

This system harbors only sheep and goats. Flock owners in this production system travel according to availability of range plants throughout Jordan Badia. They supply their animals with feed at times of lacking good range. The traditional management is dominating in this system and no new technologies are used. Sheep and goats in this system account for 5% of the total flocks in the country with medium to large size of holdings.

Semi-intensive system

Sheep, goats, and local breeds of cattle are raised under this system. It is the dominant system in Jordan. Flock owners feed their sheep and goats and utilize range whenever it is possible. They also use some new technologies and process milk. It is popular in villages, depends on family work, consists of medium holdings, and flocks are mostly stationary. More than 90% of sheep and goats, 50% of camel, and all the local cattle breeds are raised under low to medium inputs system (Table 2-1 in Annex 1).

Intensive system

This system is stationary and therefore depends on hand feeding and new techniques are widely used. However, only few private farms, governmental and university research stations are applying this system with small- size holding of sheep and/or goats. Flock owner employ labors, and manufacture milk. Specialized dairy cattle and poultry are raised under this system using imported and highly productive breeds/hybrids.

1.2 Assessing the State of Conservation of Farm Animal Biological Diversity

Many breeds of sheep were introduced to Jordan mainly for meat consumption from Australia, Romania and other countries. Very few, however, were left for breeding purposes. The main sheep breed in Jordan is Awassi, with population of around 1.45 million heads. Limited numbers of other breeds are available in the country such as Najdi (200 – 300 heads), Assaf (100 heads) and Chios (70 heads). Najdi is found around the border with Saudi Arabia where the breed originated. Chios was imported from Cyprus and Romanov (10 heads) from Czechoslovakia for specific research project, and both are found in the universities for research and in few private farms (Tables 3-1 to 3-2 in Annex 1). Good baseline information about morphological and production characteristics of Awassi sheep in Jordan is available in Jordan. Performance recording and genetic evaluation at individual level is known only for research purposes. However, no information is available about the other breeds of sheep in Jordan. However, one research study was conducted to compare the productivity of crossbred (Romanov X Awassi) with pure Awassi.

There are several breeds of goats in Jordan: Mountain black, Desert goat, Dhawi goats and Shami (Damascus) and their crosses. Mountain black is the main breed with estimated population of around 150 thousands heads. Desert goat comes in the second place with population of around 50 thousands heads. Dhawi population is around 30 thousands heads. Shami goat comes at last with around 12 thousands heads. The rest of around 425 thousands heads are the crosses of all breeds together. However, Shami is the main breed used in the crosses. There are other imported breeds of goats such as Saanen (100 heads) and Anglo-Nubian (60 heads). However, they are not widely spread in Jordan. Few researches were conducted in Jordan to study the differences in goat breeds in productivity and

morphostructural characteristics (Tables 3-1 to 3-2 in Annex 1). Genetic distances were also calculated. Recording, genetic evaluation and molecular evaluation on individual level was performed under limited research level. However, no comparative characterization studies conducted in Jordan except for few breeds of goats. A recent study was conducted on comparing goats using DNA molecular marker (Tables 3-1 to 3-2 in Annex 1). In most of these studies, research period extended for one season only.

Cattle in Jordan belong to several breeds; the most important of which is the Holstein-Friesian (61 thousand heads) which was imported from Europe, USA and recently from Australia. The local breeds of cattle are not defined and very little information is available on them. They are low producer of milk and have low growth rate and fertility. There are two indigenous breeds found in Jordan in addition to crossbred; Shami and Okshi (Tables 3-1 to 3-2 in Annex 1). Their morphological and production characteristics are available from a quick survey conducted by the authors. No other information is available about the local breeds. Farmers usually mate their cows to bulls from the same breed. However, some farmers mate their cows to bulls from different breeds for both local and imported breeds to increase their productivity. In addition, importation of high producing European breeds is allowed in the country. Therefore, local breed population is decreasing and Holstein-Friesian population is increasing in the country and the relative importance of the locals is severely reduced. The population of all local breeds and their crosses with Holstein-Friesian is 4 thousand heads. The crosses may include more than 30 % of that number which leaves both Shami and Okshi at risk of extinction. Therefore, some attention should be paid toward keeping these breeds before losing their genetic integrity.

There are no accurate estimates of the camel population, available estimate being about 18 thousands heads.. Nevertheless, the number is decreasing yearly. In a quick survey conducted by MAO and ACSAD (unpublished report, 2002), the local breed(s) of camel are not defined and very little information is available about them. They are low producer of milk (700kg/year). Camel owners usually categorize their animals according to several considerations:

- Pedigree: certificated pedigree (Mu'ssaleh), or not certificated.
- Color: red, black, white, mixed of black and red, and mixed of white and red.
- Home of camel: related to the ownership rather than anything else.

In general all these categories have no scientific bases, however, researchers believe that the camels in Jordan might be belong to two local breeds but there is no information about the number of each one or if any of them is at risk.

Donkeys' number has severely decreased during the past decades. Their number was estimated at about 18, 000 heads, but it is felt that the real could be much less. There are two indigenous donkey breeds found in Jordan, the first is the local (the black) characterized by black color and a small to medium size. The second one is called Qubressy (Cyprus) with a gray color and a large size. It is believed that both breeds are at risk. There is no scientific information available about them. The number of horses was estimated to be around 400 heads. It is believed that they belong to one indigenous breed, the Arabian one. They are raised for races, recreation, and tourism. There is no scientific information available about them.

Commercial strains of chicken are being imported from different countries. Therefore, local breeds are being neglected because of their low productivity and no or little information is available about their breeds or their numbers. Local breeds of chickens are categorized under one name

called Baladi (native) breed. The single comb breed is considered the major local breed, which forms (60%) of the total number of chickens in Jordan. The local chicken breeds are characterized with high resistance to disease and adapt well to local conditions.

Local pigeon breeds found in the kingdom are called Baladi; which accounts for more than half of the pigeon in the kingdom. Baghdadi, Masri, Baljeeki, Hazaz, Hindawi and Abkhari, breeds are distributed in equal numbers in the kingdom. No scientific information is available about their number or characteristics.

Local breeds of turkey are categorized under the universally known breeds, but it accentuated here that they are not pure, and this is due to the mating between the different breeds.

In general, there is a need for conducting studies on breed at risk. For instance, no characterization studies were carried on to study the local poultry and cattle breeds. There is no sufficient information about camel number or productivity either. Therefore, there is a need to increase the information about domestic animals in terms of their numbers and characteristics. However, this requires funds and human resources.

For several seasons in a row, the kingdom of Jordan was hit by severe drought condition. In 1999, about 25% of the country's population was threatened with this drought. They are mostly small-scale herders and landless members of rural households. The livestock sector in general has also been hit hard, with the domestic production of red meat and milk dropping 40% below usual level.

To cover the cost of increasing the hand feeding due to deteriorating range condition, livestock owners tend to sell part of their flocks. Furthermore, due to drought conditions and unsuitable nutrition, diseases are widespread, causing losses in animal and reducing productivity.

At the national level, veterinary services are carried out by the Veterinary Department (Ministry of Agriculture). More than 50 clinics belong to this department covering the whole kingdom. Cases are received and treated free of charge. Veterinary Department is also responsible of vaccination for infectious diseases, such as enterotoxaemia, brucellosis, render pest, foot and mouth disease. In addition to the government, the private sector has a major role in providing animal health services through private clinics and veterinary pharmacies.

Animals from local breeds of cattle are decreasing in number because of their low productivity and the indiscriminate crossing due to the availability of AI from foreign breeds. Camel number also is severely decreasing, due to rangeland degradation, decreasing demand of camel products and accessibility of modern transportation. Local breeds of poultries are decreasing and at risk. This might be due to high development of broiler and layer farms production, which utilizes imported strains and hybrids. Other animals such as donkeys almost diminished because farmers are not using them anymore for labor.

At present, there exist no programs or facilities for *in situ* or *ex situ* conservation of animal and avian breeds at risk.

1.3 Assessing the State of Utilization of Farm AnGR

The livestock population in Jordan is shown in the Tables 4 & 5 (Annex 2). The livestock population in 2000 was estimated to be approximately 1.9 million head of sheep, 0.43 million head of goats, 65000 head of cattle and about 13000 camels. Population of sheep was reduced to 1.457 million in 2001. It is concentrated in Mafraq and Amman provinces, which contribute 41.5 and 15.4% of the total, respectively. Awassi breed is considered the main breed in the country. Goats are concentrated in Amman and Balqa provinces with 15.5 and 12.9%, respectively. The total number of goats is 431 thousand head.

Sheep and goat supply the country with 5954 and 2812 ton of meat, which contribute, respectively 47.3 and 22.4% to the total meat production in Jordan in 2001. This satisfies self sufficiently of around 22%, where the per capita consumption is 8.1 kg/year (Tables 6, 9, 11 & 14).

Milk production in 2001 from sheep and goats was 28707 and 16800 ton, which contribute 13.8 and 8.1% to the national milk production, respectively, while dairy cattle are providing the rest of the total production. The self sufficiently of milk in Jordan is around 53.3% and the per capita consumption is 76.6 kg/capita/year (Tables 8, 9, 11 & 13 in Annex 2). National production of poultry meat is 111.7 thousand ton and 1.15 billion eggs. Jordan is self sufficient in both poultry meat and eggs (Table 1-8 in Annex 1). Nowadays, there is a rise in demand for camels' meat and milk. Horses are raised for sports and tourisms. Mules and donkeys are used for plowing and other farm labor.

Small ruminants have a social function especially for Bedwines. It is traditionally an indication for wealth and prestige to have large flocks. In addition, there is a preference for meat and milk of sheep. In year (2001) Jordan imported (15000) head of animal, (20000) ton of meat and (16500) ton of milk and milk products. While the exportation in year 2000 were 274800 head of sheep and 1540 ton of eggs.

The increase in demand for animal products due to increase in population and improved the standard of living caused change in the contribution of livestock to the food security. Increasing demand on poultry meat resulted in huge expansion in the poultry industry, while home raising of poultry decreased. This resulted in dependence on international hybrids, which substituted the local breeds. Same trend took place in dairy cattle. The exotic breeds dominated because of high productivity while the local breeds are almost disappearing. This means that the management system

moved from the low inputs towards medium (sheep, goats, and high inputs (dairy and poultry; Table 2-1 and 2-2 in Annex 1)

The management of intensive production in poultry and dairy is completely different when compared with the home raising of local breeds. There are specific programs for health and nutrition. However, the inputs differ according to the type of operation. For instance, 60% of dairy units operated as subsistence type have low input while 100% of the large-scale commercial type has high inputs. A similar trend is noticed for other breeds of livestock (Tables 2-2 to 2-8 in Annex 1). The government established several animal farms to introduce the highly productive exotic stocks of cattle and poultry, and for Awassi sheep and Shami goats. Then the private sector took the lead in establishing large farms for dairy and poultry.

Moreover, Ministry of Agriculture is disseminating imported semen from dairy cattle breeds through AI. On the other hand, local stocks of cattle and poultry were not given enough attention. Improved rams and bucks, yearling ewes and does were produced and sold to farmers to improve their flocks in terms of meat and milk. The government subsidized the feed for sheep only, which led to huge increase in sheep numbers during the seventies and eighties. When subsidy policy was lifted number of sheep and goat decreased by about 30%.

The statistics divisions in each governorate of Jordan collect information related to number of animals in each breed within each animal species yearly. Usually every 5-10 years there is a general survey however, these surveys are not totally accurate or complete.

The information on Jordan's animal genetic resources available is similar to that contained in DAD-IS. The information is very important for the policy of importation of feedstuff and the country requirements for red meat and other animal products. In addition, there is information collected yearly related to milk, meat and wool produced. However, this information

is not very accurate, especially that for sheep because the majority of sheep are raised under transhumant system and producers do not release information easily. For dairy, layer hens and broiler the information is more accurate because they are raised in farms under intensive production system. Few studies about the productivity of some breeds of dairy cattle, sheep, and goat are available.

PART II. ANALYZING THE CHANGING DEMANDS ON NATIONAL LIVESTOCK PRODUCTION AND THEIR IMPLICATIONS FOR FUTURE NATIONAL POLICIES, STRATEGIES AND PROGRAMMES RELATED TO AnGR

2.1 Reviewing Past Policies, Strategies, Programs and Management Practices (As Related to AnGR)

Ministry of Agriculture, National Center for Agricultural Research and Technology Transfer, Jordanian universities, cooperative associations, Agricultural Engineering and Veterinary Associations, NGO's and Ministry of Education play roles in AnGR research, education, and training. Beside these local institutions, Arab Center for the Studies of Arid Zones and Dry Lands (ACSAD) has a significant role on AnGR in Jordan.

Ministry of Agriculture in Jordan has taken the responsibility for planning and monitoring all farm animals including the AnGR indirectly. Plans depend on information collected at the field level. The Department of Statistics is responsible for data collection related to number and distribution of animals in the country. The Finance Ministry discusses the annual budget requested by the Ministry of Agriculture for the animal production sector. Planning ministry supports projects funded from outside the country and seeking funds for new projects.

The Ministry of Agriculture, Animal Wealth Department, is responsible for AnGR conservation in Jordan. The private sector has activities in poultry and cattle intensive systems, but not for conservation purposes. The country has an action plans for AnGR, but this plan is not specific for conservation of AnGR as such and it does not include all domestic animals as local breeds of poultry and donkeys. It is more directed towards small ruminants and imported dairy cattle. Government offers vaccines free of charge and during drought season the government supplies free of charge water for sheep and goats and subsidies barley by

\$15 per ton. This is to help livestock owners to continue their business. Government introduced low interest rate loans to farmers to feed their animal and improve their productivity. They also provide the farmers with improved animals at low prices compared to market prices. Good attention is given to Shami goat but camels are not considered.

There are no specific formal or informal programs for AnGR, unlike to what exist for plants. AnGR activities are included within several projects at different institutions. No organization is available in the country to involve all parties interested in AnGR. However, there is communication, joint work and different activities involving AnGR, but not in particular. There is a fund for supporting animal production research in general.

The Ministry of Agriculture supports research and extension services, which help to better use AnGR. There are several projects funded from external agencies aiming to improve the rural life and women rural income. These projects emphasis is on raising Shami, Baladi goats and local poultry breeds. For dairy, there are few associations concerned with marketing dairy products.

The policy is to support the local breeds and the exotic ones (Table 6.1 in Annex 1). The policies enhance improvement of productivity for both and decrease the gap between production and country needs from animal products. The government encourages the importation of dairy cows and semen for insemination both the local and the imported breeds. As a result, the quantities of milk produced increased significantly so the self-sufficiency from milk reached about 58%. At the mean time, number of pure local breed decreased significantly and they became at risk. The same thing is happening for poultry where the policy encourages the introduction of the exotic stocks (Table 6-2 in Annex 1). The impact of that is self-

sufficiency for eggs and broilers but all the local breeds are almost disappearing.

Training and field days are being held to farmers to support the proper management of livestock. Vaccines and some limited drugs are offered free of charge. Extension plays a role in advising farmers about new management aspects and introducing new technologies.

The government holds the regulations for the export and import of live animals. Imported animals should be free of disease so they are kept in quarantine for the necessary period to be sure it is free of disease. Ministry of agriculture imports frozen semen for dairy cattle. Breeding programs for improvement of sheep and Shami goats are carried out on in research stations. There is a plan to improve the productivity of camels. An initial study was conducted and in the near future, a center for camel studies will be established. Several programs are applied for the control of livestock diseases, external & internal parasites.

Several projects were launched to encourage raising local poultry breeds, depending on the indigenous knowledge of farmers. This was to improve rural families' income.

National Center for Agricultural Research and Technology Transfer (NCARRT), Animal Health Department (Ministry of Agriculture), Jordan Cooperative Association, and the Universities are involved in using AnGR and conducting research to evaluate performance of small ruminants under research station condition. Moreover, several research activities were conducted at the farm level where farmer participate in recording and evaluating the breed performance. There are programs for improving Awassi sheep and Shami goats via selections in governmental stations. The improved rams are sold to farmers to improve their flock productivity. In addition, improved yearling Shami goats are sold to the farmers for the same purpose.

Different institutions, organizations, and NGO's have activity on AnGR, but not directly toward conservation, except for horses. There is one NGO concerned with recording Arab horses, in cooperation with the Ministry of Agriculture. However, there is no specific fund for conservation. The fund for conservation comes from the government in an indirect way through covering the research work, maintaining the research and management stations, and supplying the imported semen for dairy cattle.

NGO's are leading a trend for finding market for local poultry products and for a lesser degree for sheep and goat. However, up to date local markets are not effective and there are no permanent markets. On the other hand, there are great opportunities to find a foreign market for the local breed products. For instance, Awassi meat and cheese are preferable in the Gulf area. This is because animals in Jordan are fed on pastures where neither chemical (pesticide) nor hormonal treatment or animal-origin feeds are used. Therefore, it is very important to emphasize on producing such products and controlling their quality by suitable processing and packaging. One important aspect to consider is the livestock crop integration in order to reduce prices of animal products to compete for export. To compete with imported products, it is vital to produce cheaper animal feedstuff. One promising sources beside the rangeland is the agricultural by-products. Different programs and projects encourage using the agro-industrial by-products in ruminant nutrition.

Dairy farmers in the intensive production sector and under the prevailing production conditions evaluate the exotic stocks as more profitable than local cattle. This has led to a significant decrease in number of local cows during past few decades while number of Holstein-Friesian and crossbreds are increasing. Therefore, local breeds are almost totally replaced by the imported breeds.

There is an agreement between the government and ACSAD to exchange the genetic materials. ACSAD is cooperating in selection programs for Awassi and Shami goats. Many improved Awassi rams and Shami bucks were imported to research stations in Jordan from Syria via ACSAD. Offspring of these animals were distributed to farmers.

Importation of live animal products is open under usual health regulations. Food of animal origin should be suitable for human consumption with no traces of hormones and genetically modified materials. These rules help in protecting the local breeds from diseases and prevent the importation of low quality meat (low prices) to prevent lowering the prices of local animal products. There is no restriction on using AnGR. This might encourage the introduction of Holstein-Friesian breed and different stocks of poultry.

The main farm animal breeds raised by farmers and important for food production in the country are one breed for the sheep, four breeds for goats and their crosses. There are two breeds of camels, but they were not well studied. Because of imported commercial strains of poultry for eggs and meat production, local poultry breeds are severely decreasing in number. Number of imported dairy cows is increasing yearly. This has a large impact on decreasing the numbers in local breeds.

Most farmers concentrate on number of sheep and goats owned rather than their productivity. Absence of recording system at the farm level is a great problem for an effective selection program. Recording system is essential for evaluating the males produced and distributed by the ministry.

Awassi sheep are raised as pure. Only under research crossbred are available. Shami, Black, Dhawi, and Desert goats are raised as pure. However, farmers try to upgrade Black with Shami. Cross-breeding of Shami goats with other local goats is to improve the productivity of local

breeds. However, no clear program is followed by farmers. Rams and bucks are produced locally. However, few improved ones are imported from Syria (Table 4.3 – 4.4 in Annex 1).

In general, there are no *in situ* or *ex situ* stations for breeds at risk. Except for Awassi sheep and goat breeds, all other breeds are at risk. Several stations were established to improve and conserve breeds such as Awassi and Shami goats. There is a plan for establishing a center for camels. Through Income Diversification Project, several units were founded for multiplying the Shami goat and improved Awassi sheep, which are both not at risk. In general, these programs aim at improving the productivity, but not for conservation of breeds at risk.

Dairy cows are imported. In addition, pure local cows are usually inseminated with imported semen. Artificial insemination in dairy cattle is applied in Jordan since 30 years ago using imported semen. This has caused reduction in number of cows of the pure local breeds of cattle due to crossing with imported semen. Bulls are also produced locally in most farms. Semen is imported from wide rang of countries (Table 4.3 – 4.4 in Annex 1).

For poultry, the introduction of highly productive commercial stocks caused poultry to become a large industry, which resulting in neglecting the local breeds. In addition, the changes that were introduced to the life style of rural community reduced the importance of local breeds. Commercial chicken strains are imported. However, Jordan has chicken breeder companies, which raise parent and grandparent stocks to produce hatchery eggs.

In the past, farmers used to keep 1 - 2 local cows and a small flock of goats and sheep (3-5) and a few chickens for home consumption. Using tractors and vehicles caused the disappearance of donkey.

For camels, there is a recent increase in demand for its meat and milk. Therefore, the government is now establishing a center for camel raising. Introduction of vehicles, degradation of rangeland, and the high prices of camel products are factors causing significant decreased in their numbers. No work was performed to evaluate camel productivity; a significant decrease in number was observed.

Horses and camels have a social meaning too. Horses are used for recreation. Only wealthy people could afford to have horses. Highly significant decrease in number of donkeys is observed and they are about to disappear.

No programs until now were developed for collection and storing the genetic materials or even programs for monitoring the breeds at risk. Moreover, there are no programs for the collection and storage genetic materials such as semen, ova or embryos for animal not at risk (Table 5.1 in Annex 1).

During the past ten years, there has been slight increase in the levels of support, which would lead to conservation of local breeds. However, there is no fund allocated particularly for conserving breeds at risk. There is increase in fund for research, training, and technology transfer. The main source of fund comes from government and few projects support animal activities at farm level included health care programs.

Programs of conservation have great impact on agriculture production and food security. Domestic production of meat and milk covered 35 and 50% of needs. In spite of the increase in human population size and decrease in number of sheep and goats the gap between production and needs becomes less than that was 10 years ago. The increase in number of cows and higher productivity per head is responsible for reducing the gap.

There are no wild relative species to domestic animals in Jordan and no conservation programs for domestic animals; however, there exist conservatory for wild animals. There is a conservatory for several deer species, ostrich and fox and some other wild animals. Wild animals in Jordan have no economic role in terms of food contribution. Only birds or deer are being hunted in certain time of the year and in very limited numbers.

Characterization of breeds is mainly the responsibility of Ministry of Agriculture and the universities. The priority was given to Awassi sheep and Shami goats for development. The future plan is to genetically improve cattle breeds and camels. In the near future, a study will be developed to identify animal breeds using DNA fingerprinting.

No legislation is available yet related to ethical concerns regarding animal welfare or use and release of Genetically Modified Organisms. However, there is an ongoing work to have legislation for Genetically Modified Organisms. There is legislation and policies related to intellectual property rights. The effect of these new legislations on AnGR is not clear yet.

The rural woman in Jordan has a great role in sheep and goat raising. She is almost fully responsible of all the daily fieldwork. There are several projects directed for rural women to raise local poultry or local and crossbred goats. Public awareness for AnGR is not high enough, compared to that for plant sector or wild animals.

Owning a flock of sheep has a social meaning in Jordan. It is an symbol of power and prestige. So, Bedwins tend to increase flock size regardless of productivity. Most farmers prefer to have a uniform flock. Sheep meat is preferred in Jordan especially in the social events and during Eid Al Adha.

Meat and milk production do not meet the country requirements. Therefore, Jordan is importing live animals, meat (fresh and frozen), and dairy products. Sheep, goats, poultry, and cows are the main sources for milk and meat in the country while camel, rabbit, and local poultry (turkey and geese) have very limited role. Consumer preference and prices are reasons behind that, in addition to, lack of experience in raising these animals or the special requirements for raising them; geese need water and Jordan suffer from severe water shortages. Awassi sheep have good market in the Gulf area and the government gives permissions to export males each year. However, because Shami goat is decreasing in number no permissions for exporting was given. Turkey and Ostrich are raised commercially for export (Table 4.1 – 4.2 in Annex 1).

Due to the increase in demand on animal products, large increase in size and number of poultry farms (egg and meat production) took place in the country. Poultry farming became a very important industry and has a significant contribution to food and agriculture. The same trend is noticed in the dairy sector where number and size of dairy farms increased dramatically. At the same time, local breeds of poultry and cows were almost neglected. Prices of meat and milk of sheep and goats are determined according to supply and demand, which are highly affected by the income of citizens and by the competition with the imported products. Market for live animals is not well developed. Selling is still on head basis not on weight of animals.

2.2 Analyzing Future Demands and Trends

There are great potential for increasing the productivity of animals by improving management and selection programs. Selection is conducted only in Awassi sheep and Shami goat breeding stations considering production traits such as growth rate and milk production. However, they are still under research stations with little releasing of some good rams to

farmers. Only, researchers are working on technologies for breeding (Table 4.5 in Annex 1). In general, breeding programs are conducted by the government and the country lack associations for animal improvement or breeding companies. Implementing of tools related to development of breeds is very limited and mainly at the governmental stations (Table 4.6 4.8 in Annex 1).

There is only one main breed of sheep, Awassi, which is not at risk. However, local goats are intercrossed and crossed with exotic breeds with no clear plan. This will result in mixing breeds at the farmer levels with no information about degree of crossbreeding and breeds involved. Some local goat breeds maybe at risk.

Dairy cattle improvement is dependent on importation of dairy cows according to their records from their original countries and imported semen. Animal Wealth Department (Ministry of Agriculture), National Center for Research and Technology Transfer (NCARTT) and the University of Jordan are involved in breeding programs. Recently, one private center for cattle AI started to operate to provide imported semen to local farmers.

The international policies might affect the future of our breeds, especially those of the World Trade Organization treaty (open market). If real steps were not taken to decrease the cost of production there will be a great fear on the future of poultry industry and the number of sheep and goats and farmers could be out of business. This should push farmers toward more sustainable intensive production of sheep and goats and encourage importing exotic breeds and crossbreeding might take place.

Jordanians prefer to consume the product of local breeds. They consider it of higher value and they pay higher prices for it compared with products from imported breeds. This will help raise the public awareness about the importance of AnGR.

2.3 Discussion of Alternative Strategies in the Conservation, Use, and Development of AnGR

The strategy for maintaining and developing the local breeds in the country includes breeding program for sheep and goats, offering balanced feeding and health control. In the past, the policy was to interfere with cows' milk prices; nowadays, this policy is not in effect anymore. The policy now is to prevent the use powder milk in dairy products to keep market at suitable prices for local milk producers.

Government pays good attention to the changes on international markets and the expected effects on the future of AnGR in Jordan. Therefore, the programs emphasize producing high quality animal products with lower cost to compete with imported products. The plan of the ministry of agriculture is to keep and increase the number of local breed of sheep -Awassi and Shami goats. Research workers are concerned with increasing productivity using selection programs, improving the nutrition and health status of animals. The policy depends on producing pure improved male and female to sell farmers to improve their production.

Serious attempts are taking place to promote marketing of animal products from local breeds, for instance white cheese from Awassi sheep and eggs from the local poultry breeds. However, these attempts need more efforts and organization.

Programs for improving the productivity of local breeds exist in Jordan, especially for sheep and goats. Several projects were conducted or still ongoing related to nutrition, breeding and health care. The objectives of these projects include producing highly productive animals to distribute to farmers. Private sector does not participate actively in conserving local breeds. We need to encourage the private sector to invest in establishing farms for local breeds at risk, such as local poultry and camels (Table 5.4 in Annex 1).

2.4 Outlining Future National Policy, Strategy and Management Plans for the Conservation, Use and Development of AnGR

The government puts several plans and strategies to remove constraints to increase genetic improvement such as regulations related to export and import of improved dairy cattle. To improve recognition and understanding of the various roles played by men, women and children in the utilization and conservation of AnGR several activities need to take place, such as holding meeting, training, workshops, TV programs, and lectures at schools. However, there is a need for research to determine those AnGR at risk and the need to conserve them.

The objective of sustainable use and conservation of AnGR has a linkage with the national and international bio-diversity objectives. However, there are no separate organizations or specific plans for animal bio-diversity in the country.

The main constraints in implementing conservation program in the country are lack of information about breeds at risk and their genetic potential and productivity. Lack of fund and well-trained technicians for the new technologies are other constraints. However, the topic of breeds at risk has low priority in the ministry plans. The priorities are given to sheep, imported dairy cattle, and poultry farms.

There is need for developing legislations to conserve the local breeds. This might include granting prizes, making shows, and carnivals for local breeds, establishing animal zoos and conservation for farm animals at risk. It is also necessary to establish special department for conserving the AnGR and establish data bank and gene bank for AnGR, using the latest technologies of semen and embryo conservation. These necessitate the support from the international institutions for funding such activities.

Part III. REVIEWING THE STATE OF NATIONAL CAPACITIES AND ASSESSING FUTURE CAPACITY BUILDING REQUIREMENTS

3.1 Assessment of National Capacities

Ministry of Agriculture, National Center for Agricultural Research and Technology Transfer, Jordanian universities, cooperative associations, Agricultural Engineering and Veterinary Associations, NGO's and Ministry of Education play roles on AnGR research, education, and training. Beside these local institutions, ACSAD has significant role in AnGR in Jordan.

There is an agreement between the government and Arab Center for the Studies of Arid Zones and Dry Lands (ACSAD) to exchange genetic materials. ACSAD is cooperating in selection programs for Awassi and Shami goats. Many improved Awassi rams and Shami bucks were imported to the research stations in Jordan from Syria via ACSAD. Offspring of these animals were distributed to farmers.

Ministry of Environment and Ministry of Agriculture are responsible for the bio-diversity affairs for plant and domestic animals. For wild animal, there is the Royal Society for Nature Protection, which developed regulations, policies, and legislations for wild animal conservation.

The present agriculture engineers specializing in animal production are around 500 – 600, including 30 – 40 MSc and 30 – 40 PhD, working in various activities of production and administration in the country including those in the private sectors. However, those who are actively involved in working in research, education, and extension related to AnGR are estimated to be 100, which include 10 – 15 MSc. and 30 – 40 PhD. In addition, there are around 200 vets in the country, of which 30 – 40 involved with AnGR. However, there are only 2 specialists in animal breeding and genetics at the PhD level and around 10, the MSc level in Jordan.

Basic communication such as phone covers all stations and departments related to animal sector. Internet and E-mail are available in all institutions and the ministry departments. In most stations and administrations, information is recorded electronically in the stations and communicated through e-mail (if available) or diskettes.

There are great opportunities to establish and improve a network inside and outside the country. There is a unit established recently in the Ministry of Agriculture under the title of "Pasture Resources Information Monitoring and Evaluation" (PRIME) funded by UNDP. It has activities for monitoring sheep and goats in the country by collecting related data and has communication with all livestock holders. Such programs are needed to cover activities on conservation of AnGR.

Government strategy plan needs more funds and awareness program toward those breeds at risk. However, this strategy lacks the tools to identify animal (tagging) to initiate recording system throughout the country. The government strategy needs fund, training to build-up human capacity and recording system. The strategy needs to establish an institute to conserve the local breeds of goats, cattle, poultry (including turkey and geese and other species), and rabbits.

Local poultry breeds, donkeys, horses, and local cattle are not studied in particular. Productivity of goat breeds is not well known or documented. In addition, there is no enough information about their number, distribution, and productivity. In addition, Jordan lacks information on camel productivity, distribution and breeds. Therefore; there is a need to generate studies to determinate the productivity for each species, monitor their breeds, and conduct DNA fingerprint for each breed. Moreover, we need to have relationship with other countries and institutions to exchange information about common breeds. Finally, the

strategy lacks the vision of finding special market for the local breed's products.

To understand the state of animal genetic diversity in Jordan capacity building is needed in:

1. Establishing a database for information on the AnGR and characterize all local breeds.
2. Conducting studies on AnGR, molecular DNA identification, conservation, and uses of the genetic materials.
3. Establish gene bank to conserve breeds at risk.
4. Training the local staff on various levels on AnGR. This includes PhD, MSc, and BSc.
5. Conduct awareness programs on the national level directed towards farmers and local communities for keeping the AnGR.
6. Improving the productivity of AnGR through research and improvement of management, health, and feeding.
7. Establishing associations concerned with the local breeds at risk of various species.
8. Funding and establishing centers with latest technologies to assist the local communities to improve their AnGR productivity.

PART IV. IDENTIFYING NATIONAL PRIORITIES FOR THE CONSERVATION AND UTILIZATION OF AnGR

4.1 National Crosscutting Priorities

The priority of capacity building in the country is to establish recording system, and a union or association for animal owners and improving the marketing channels for farm animals products. Marketing of products at suitable prices encourage farmers to use new technologies to produce more efficiently. Most farmers are not well educated or trained to accept and adopt new technologies easily.

Owning a flock of sheep has a social meaning in Jordan. It is a symbol of power and prestige. So, Bedwines tend to increase flock size regardless of productivity. Most farmers prefer to have a uniform flock. Sheep meat is preferred in Jordan especially in the social events and during Eid Al-Adha. Absence of recording system at the farm level is a great impediment for an effective selection program. Recording system is essential for evaluating the males produced and distributed by the ministry.

4.2 National Priorities among Animal Species, Breeds, Country's Regions, and Rural Communities

Priorities for the needs to enable the development of AnGR policies in Jordan and the future need in policy development for AnGR conservation programs are presented in Tables 6-3 to 6-5 in Annex 1. It includes human capacity building, infrastructure, finances, research and technology transfer, and legislations. The priorities for capacity building in the management of AnGR are evaluation and characterization the local breed at risk. Then conduct training on preservation technologies, GIS, and molecular genetics.

The priority is for overcoming the gaps in research capacity, education, training, and policy development. Research for characterization of the local breeds, awareness program for AnGR, institute conservation

for breeds at risk and training on AnGR conservation are needed to the country.

The government strategy is to enhance information exchange, build units for information system, link station and extension agencies with electric lines, have database for animal breeds, train technicians, and start programs for management of AnGR.

The most important pure breed of goat in the country is the Shami goat. This breed has high potential for milk and meat production (twining rate is high). In addition, there is high demand for this breed for export market. However, numbers of Shami goat is decreasing. A special program is needed to improve productivity, might be with international institution participation. Population size of this breed needs to be increased using AI and embryo transfer techniques. In addition, camels are at risk, so they need a program to increase their number and maximize the benefit from their products.

There are no network to share information and data about Shami goat and Awassi sheep being regional breeds. So, network is needed to share information and data regarding these breeds. However, a camel world network is available (Table 4.9 in Annex 1).

Government strategy plan needs more funds and awareness program toward those breeds at risk. However, this strategy lacks the tools to identify animal (tagging) to initiate recording system throughout the country. The government strategy needs fund, training to build-up human capacity and recording system. The strategy needs to establish an institute to conserve the local breeds of goats, cattle, poultry (including turkey and geese and other species), and rabbits. Local poultry breeds, donkeys, horses, and local cattle are not included in particular in any plan. Productivity of goat breeds is not well studied and documented. In addition, there is no enough information about their number, distribution, and

productivity. Jordan lacks information on camel productivity, distribution and breeds. There is a need to generate studies to determine the productivity for each species, monitor their breeds, and conduct DNA fingerprint for each breed. Moreover, we need to have relationship with other countries and institutions to exchange information about common breeds. Finally, the strategy lacks the vision of finding special market for the local breed products.

The priorities for enhancing the capacity for developing and implementing conservation are finding resources of funds to establish suitable infrastructure for *in situ* conservation and conducting research on both *in situ* and *ex situ*, within a clear program included training for human capacity building. For the *in situ*, we should have a lab for AI and embryo transfer. The country has several research stations, good successful projects directed toward farmers, specialists at the universities in these areas, and wide range of activities with ICARDA, IFAD and other regional and international institutions. The country has also a well-developed communication tools and computer skills. Facilities for training are also available. Jordan needs a project at the country and regional level for conservation of AnGR. For instance, Awassi sheep, Shami goat, Black (Mountains) goat, and camels exist in Jordan, Syria, Lebanon, and other countries. Therefore, a network would have a great benefit, and recording system is highly needed. Exchange of genetic materials at the region level is also needed (Table 5.5 in Annex 1).

Priorities for the needs to enable the development of AnGR policies in Jordan and the future need in policy development for AnGR conservation programs are presented in Tables 6-3 to 6-5 in Annex 1. It includes human capacity building, infrastructure, finances, research and technology transfer, and legislations. The priorities for capacity building in the management of AnGR are evaluation and characterization the local

breed at risk. Then conduct training on preservation technologies, GIS and molecular genetics.

The priority is for overcoming the gaps in research capacity, education, training, and policy development. Research for characterization of the local breeds, awareness program for AnGR, institute conservation for breeds at risk and training on AnGR conservation are needed to the country.

The government strategy is to enhance information exchange, build units for information system, link station and extension agencies with electric lines, have database for animal breeds, train technicians, and start programs for management of AnGR.

Part V. FORMULATING RECOMMENDATIONS FOR ENHANCED INTERNATIONAL CO-OPERATION IN THE FIELD OF FARM ANIMAL BIODIVERSITY

5.1 Recommendations

The scattered effort in the past by the scientists should be consolidated. A mechanism for animal genetic material collection, conservation evaluation, distribution, and utilization of animal genetic material should be developed. Research on storage should be encouraged.

Conservation of genetic resources requires funds and the technology, because developing countries generally lack these funds and the technology to protect and conserve these resources. Funds should be made available from bilateral and multilateral aid programs. Therefore, international and regional cooperation is needed to advance the interest in the animal genetic resources to a high priority level since it is hard for a nation, troubled by food production problems and high national debts to have genetic resources on their high priority agenda. There is significant similarity in animal breeds between Jordan, Syria, Iraq, and Palestine. So joint regional projects in animal conservation and exchange the genetic materials could greatly serve these countries.

In the light of the weak infrastructure, availability funds, availability of trained human resources in many developing nations including Jordan, the international agriculture research centers should take a leading role in the biodiversity activities.

Human resources development is very essential for the maintenance of biodiversity activities. Higher education outside the developing countries is expensive and therefore unless scholarships are made available for people from these nations it would be difficult to build such base. Furthermore, short-term courses for technicians can be held at the international centers or regional institutes.

PART VI. OTHER ELEMENTS SUGGESTED FOR INCLUSION IN THE COUNTRY REPORT

6.1 How the Country Report was Prepared

A national committee of seven members was assigned from the ministry of agriculture to prepare the country report for the AnGR. The committee includes multi disciplinary specialist and multi disciplinary institutions (Names, institutions and addresses are in Annex 4). To prepare the report the committee conducted the following activities:

- Several meetings to discuss the report structure and contents.
- Quick surveys to collect data on local breeds of poultry and cattle.
- Secondary data related to livestock breeds were collected from different related departments.
- FAO instructions for report preparing were reviewed and predefined Tables were filled.

6.2 An Executive Summary

Jordan is set in the center of the Middle East with a population of approximately 5 millions. Four main climatic zones occur within an area of 89.2 km². The contribution of the agricultural sector to the GDP in Jordan is below 3%. The contribution to this figure by livestock is 58%. Poultry has the main contribution of the livestock sector (50%), followed by sheep and goats (33%), then by cattle (16%).

Animal production systems differ according to farm animal species. The main system for cattle is the intensive system. Cows raised under this system are totally from imported breeds (Holstein-Friesian). While the local breeds and crossbreds are raised under semi-extensive system.

For sheep and goats, the main production system is semi intensive. Poultry is raised under intensive system, same as dairy.

The future trend for livestock production in Jordan is increasing the intensification, larger farms, and increasing the animal productivity and improving the products quality.

All cattle and poultry farms belong to the private sector. The cooperative system is very weak in Jordan especially on poultry and small ruminants.

Increasing demand on poultry meat and milk resulted in huge expansion in poultry and dairy raising as an industry. This resulted in dependence on international hybrids, which substituted the local breeds. Number of camel is decreasing significantly, and other animal such as donkeys almost diminished.

The main sheep breed in Jordan is Awassi. Limited numbers of other breeds are available in the country such as Najdi, Assaf and Chios. There are several breeds of goats in Jordan; Mountain black Desert goat, Shami (Damascus) and Dhaiwi goats and their crosses.

The most important breed of cattle is the Holstein-Friesian, which was imported from Europe, USA and recently from Australia. There are two indigenous breeds of cattle found in Jordan in addition to crossbred; Shami and Okshi.

The strategy for maintaining and developing the local breeds in the country includes breeding program for sheep and goats, offering balanced feeding and health control.

The international policies might affect the future of our breeds, especially those of the World Trade Organization (open market). If real steps were not taken to decrease cost of production there will be a great fear on the future of poultry industry and the number of sheep and goats and many farmers could go out of business.

Several stations were established to improve and conserve breeds such as Awassi and Shami goats. There is a plan for establishing a center

for camels. There are activities through NGO's and other projects to encourage the rural women to raise local breed of poultry. In general, there are no *in situ* or *ex situ* stations for the conservation of breeds at risk.

No programs until now were developed for collection and storing the genetic materials or even programs for monitoring the breeds at risk. Moreover, there are no programs for cryopreservation, i.e. the collection and storage genetic materials such as semen, ova or embryos for animal not at risk. The main constraints in implementing conservation program in the country are lack of information about the breeds at risk and their genetic potential and productivity. Lack of fund and well-trained technicians trained in the new technologies are other constraints. However, the topic of breeds at risk has low priority at the ministry plans. The priorities for enhancing the capacity for developing and implementing conservation is finding resources of fund to establish suitable infrastructure for *in situ* conservation and conducting research on both *in situ* and *ex situ*, within a clear program included training for human capacity building. For the *in situ*, we should have a lab for AI and embryo transfer. No legislation is in place yet related to ethical concerns regarding animal welfare or use and release of Genetically Modified Organisms. However, there is an ongoing work to have legislation on Genetically Modified Organisms. There are legislations and policies related to intellectual property rights. The effect of these new legislations on AnGR is not clear yet.

6.3 Annexes

Annex 1. The Predefined Tables.

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)	\$67	2001
Other agricultural production (official statistics)	\$67	
Best estimate of additional value of livestock		

Table 1.2 Land use and current trends (1000 ha)

Category	Area (1000 ha)	Area (1000 ha)	Current trend
	1990	2000	
Arable land	193	149	-
Permanent crops	71	87	+
Permanent pastures	8000	8000	0
Agricultural area	8880	8880	
Land area	8934	8934	
Total Area	8934	8934	

Table 1.3 Land use for livestock and current trends

Category	Area (1000 ha)	Area (1000 ha)	Current trend
	1990	1999	
Cropping for food		10.24	
Cropping for feed		7.05	
Cropping for food and feed	153.41	56.85	-
Natural pasture	9000	8500	0
Improved pasture	74.17	74.17	0
Fallow	9	9	0
Forest	130	130	
Non-agricultural			
Total	9366.58	8787.31	

Table 1.4 Land tenure for livestock production

Category	Area (1000 ha)	%
Private	90	1
Government and communal	8000	99
Total	8090	100

Table 1.6 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	65	865	2386	82
Buffalo	-			
Sheep	1581	35000		
Goats	631	7000		
Camels	13	160		
Lamas and Alpaca				
Horses	3			
Donkeys	18			
Pigs				
Chicken	2514		23248	508
Turkey				
Ducks				
Geese				
Rabbits				

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

Species	Meat (t)		Milk (t)		Eggs (t)		Fiber (t)		Skin (No.)		Animals (No.)	
	1990	2000	1990	2000	1990	2000	1990	1999	1990	1999	1990	2000
Cattle	11	21	97	128							6.3	34
Buffalo												
Sheep	9	10						1			236.8	595.3
Goats											26	62
Camels												
Lamas and Alpaca												
Horses												
Donkeys												
Pigs												
Chicken	14	2				0						
Turkey												
Ducks	0											
Geese												
Rabbits												

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

Species	Meat (t)		Milk (t)		Eggs (t)		Fiber (t)		Skin (No.)		Animals (No.)	
	1990	1999	1990	1999	1990	1999	1990	1999	1990	1999	1990	2000
Cattle												
Buffalo												
Sheep											456	265
Goats											15	10
Camels												
Lamas and Alpaca												
Horses												
Donkeys												
Pigs												
Chicken						40						
Turkey												
Ducks												
Geese												
Rabbits												

Table 2.1 Distribution of livestock by production system (%)

Species	Production systems			Total
	Low input	Medium input	High input	
Cattle		15	85	100
Buffalo				0
Sheep	29	70	1	100
Goats	20	70	10	100
Camels	50	50		100
Lamas and Alpaca				0
Horses				0
Donkeys				0
Pigs				0
Chicken	5	5	90	100
Turkey				0
Ducks				0
Geese				0
Rabbits				0
				0

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

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

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	60	30	10	100
Smallholder	20	30	50	100
Small-scale-commercial	2	18	80	100
Large-scale-commercial	0	0	100	100

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

Type of operation	Production systems			Total
	Low input	Medium input	High input	
Subsistence	80	20	0	100
Smallholder	50	50	0	100
Small-scale-commercial	5	5	90	100
Large-scale-commercial	10	10	80	100

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

Type of operation	Production systems			Total
	Low input	Medium input	High input	
Subsistence	80	20	0	100
Smallholder	50	50	0	100
Small-scale-commercial	5	5	90	100
Large-scale-commercial	10	10	80	100

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

Type of operation	Production systems			Total
	Low input	Medium input	High input	
Subsistence	70	30		100
Smallholder	50	50		100
Small-scale-commercial				0
Large-scale-commercial				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	90	10		100
Smallholder	10	10	50	70
Small-scale-commercial	0	5	95	100
Large-scale-commercial	0	0	100	100

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

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

*Only one farm in Jordan

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	3						
Buffalo							
Sheep	1				1	1	
Goats	4				4	2	
Camels							
Lamas and Alpaca							
Horses							
Donkeys							
Pigs							
Chicken							
Turkey							
Ducks							
Geese							
Rabbits							

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	79	3					40							
Buffalo							10	1						
Sheep	15	7					2							
Goats	6	2												
Camels		0												
Horses										100				
Donkeys								99						
Chicken		89	100				48							
Turkey														
Ducks														
Geese														
Rabbits														
Total	100	100	100	0	0	0	100	100	0	100	0	0	0	0

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

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

Table 4.4 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					yes	yes		
Buffalo								
Sheep	1		1	1	1			
Goats	1	1		1				
Camels								
Horses								
Donkeys								
Chicken	commercial							
Turkey								
Ducks								
Geese								
Rabbits								

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

Technology or Methodology	Used for:	
	Research	Breeders
Multi-trait selection index construction	5	
Optimization tools for breeding plans	5	
Electronic database related to recording schemes	30	1
Genetic evaluation Software for: phenotypic selection breeding values	30	
Reproductive technologies (AI, ET, etc)	35	10
Microsatellite linkage maps for QTL identification for Marker Assisted		
Other technology (PCR-RAPD)	5	

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
State Government	2	2	2	3	1
Local Government	1	1	2	1	1
Breeder's	2	1	2	2	1
Private companies	1	1	1	1	1
Research	1	1	1	1	1
NGO's	1	1	1	1	1

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

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

Table 4.8 Stakeholders preference for animal genetic resources

Stakeholders	Locally adapted breeds	Imported within region	Imported exotic breeds
State Government			
Local Government	3	3	3
Breeder's associations			
Private companies	1	1	4
Research	5	1	3
NGO's	1	1	1

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

Technology	Needs			
	Knowledge	Training	Financial resources	Breeder's organization
Recording	3	4	4	5
Genetic evaluation	2	4	4	5
AI / ET	1	5	5	5
Molecular techniques	1	4	4	5
Breed organisation techniques	1	4	4	5

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

Species	Incentives				Technical tools			
	Gov.	NGO	Market	Private	Recording	AI	ET	Others
Cattle								
Buffalo								
Sheep								
Goats								
Camels								
Horses								
Donkeys								
Chicken								
Turkey								
Ducks								
Geese								
Rabbits								

Table 5.4 Stakeholders involvement in the management of conservation programmes

Stakeholders	<i>In situ</i> Conservation	<i>Ex situ</i> Conservation
Government	3	
Breeder's associations		
Private companies	1	
Research institutions/universities	3	
NGO's	1	

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

Technology	Needs			
	Knowledge	Training	Financial resources	Technology
Recording	3	3	4	5
Genetic evaluation	2	4	4	4
AI / ET	1	4	4	4
Molecular techniques	2	4	4	5
Breeder improvement techniques				

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

Species	Urban/peri-urban systems		Rural production	
	Industrial systems	Small-holder systems	Industrial systems	Small-holder systems
Cattle	3	3	3	3
Buffalo				
Sheep	2	2	1	2
Goats	2	2	1	2
Camels	1	1	1	2
Lamas and Alpaca				
Horses				
Donkeys				
Pigs				
Chicken	3	1	1	1
Turkey	1			
Ducks	1			
Geese	1			
Rabbits	1			

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

Goats	2	3	2	2
Camels	1	2	1	1
Lamas and Alpaca				
Horses	1	1	1	1
Donkeys	1	1	1	1
Pigs				
Chicken	4	1	1	3
Turkey	1	1		1
Ducks	1	1		1
Geese	1	1		1
Rabbits	1	1		1

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

Needs	Required		
	Short term	Medium term	Long term
human capacity building	x	x	x
Infra structure	x		
budget	x x x	x x	x x
technologies	x x	x	x
legislation	x x	x	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	3	3	4	3	5
Buffalo					
Sheep	1	1	1	1	1
Goats	2	2	4	3	5
Camels	3	3	4	3	5
Lamas and Alpaca					
Horses	2	2	2	2	2
Donkeys	3	3	4	3	5
Pigs					
Chicken	3	3	4	3	5
Turkey	3	3	4	3	5
Ducks	3	3	4	3	5
Geese	3	3	4	3	5
Rabbits	3	3	4	3	5

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	2	3	2	1
Sheep	2	2	2	2	1
Goats	4	2	3	2	1
Camels	4	2	3	2	1
Horses	3	2	3	2	1
Donkeys	2	2	3	2	1
Chicken	4	2	3	2	1
Turkey	4	2	3	2	1
Ducks	4	2	3	2	1
Geese	4	2	3	2	1
Rabbits	4	2	3	2	1

Annex 2. Secondary Data Related to Livestock in Jordan.

Map 1: Jordan

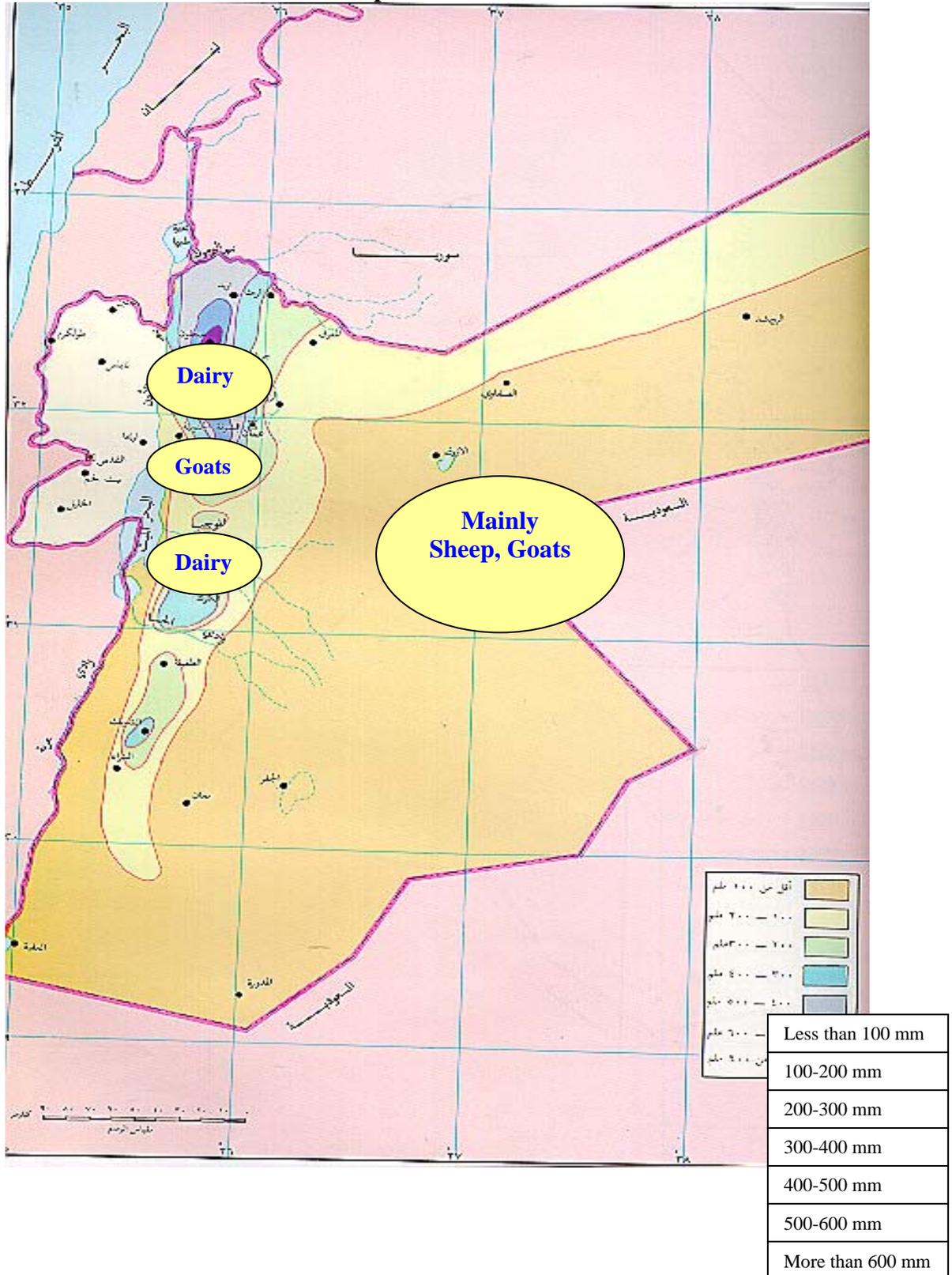


Table 1. Land area in Jordan according to agro-climatic zones.

Zone	Annual Rainfall (mm)	Land use	Area (M ha)	% Total area
Semi Desert	<200	Rangelands, irrigated cereal and forage	8.08	90.5
Arid	200-350	Wheat and Barley	0.51	5.7
Semi-Arid	350-500	Wheat, Barley and food legumes	0.19	2.1
Semi-Humid	500	Fruit trees	0.10	1.1
Water Area	--		0.05	0.6
TOTAL			8.93	100.0

Source: Water Authority, National Water Master Plan.

Table 2. Land utilization in Jordan.

Utilization pattern	Area (M Ha)	% Total area
Rangelands	8.07	90.4
Buildings & Public Utilities	0.17	1.9
Land used for Forestry	0.07	0.8
Land registered as Afforested	0.06	0.7
Water Area	0.05	0.5
Agriculture Land	0.51	5.7
Total	8.93	100.0

Table 3. Area of crops grown in Jordan for the period from 1995-2000. (1000 ha).

	1995	1996	1997	1998	1999	2000
Field crops	150.0	121.0	161.0	172.0	184.0	116.0
Vegetables	42.9	27.2	30.3	7.4	35.7	32.9
Fruit trees (bearing & non-bearing)	70.7	71.9	83.1	84.6	85.7	86.9
Total	263.6	220.1	274.4	264.0	305.4	235.8

Source: MOA, Dept. of Economics, and Statistics.

Table 4. Livestock population in Jordan, 1995-2000 (1000 head).

Year	Cows			Sheep	Goats			Camels
	Friesian	Local	Total		Shami	Local	Total	
1995	44.3	13.9	58.2	2182	-	-	851.9	32.0
1996	52.1	9.5	61.6	2375	22.5	784.5	807.0	25.0
1997	51.6	11.9	63.5	2144	30.5	782.0	812.5	22.0
1998	50.7	10.5	61.2	1935	25.6	624.0	649.6	18.0
1999	58.7	6.0	64.7	1581	16.0	615.4	631.4	13.0
2000	61.0	4.2	65.2	1933	12.0	419.0	431.0	13.0

Table 5. Numbers of poultry farms and hatcheries.

Year	Laying hens		Broilers		Broilers mothers		Hatcheries	
	Total	Capacity	Total	Capacity	Total	Capacity	Total	Capacity
1995	266	5049	2125	21415	54	1872	39	196.3
1996	259	4533	2137	21991	60	1985	36	237.7
1997	268	4716	2205	23746	61	2094	41	204.7
1998	276	5412	2288	22410	61	2814	42	251.4
1999	274	5095	2149	24290	91	2473	38	229.2
2000	272	5096	2074	23882	98	2754	39	268.6

Table 6. Red meat production in Jordan.

Year	Red Meat (1000 ton)				Total
	Sheep	Goat	Cow	Camel	
1995	8.9	3.1	2.3	0.3	14.6
1996	9.6	3.0	3.3	0.3	16.2
1997	8.7	3.0	3.5	0.3	15.5
1998	14.9	3.8	3.1	0.3	22.1
1999	13.4	3.4	3.9	0.3	21.0
2000	9.3	2.1	3.4	0.3	15.1

Table 7. White meat and egg production in Jordan.

Year	Chicken meat (1000 ton)		Table Eggs (Million)		Fish (1000 ton)	
	Produced	Imported	Produced	Exported	Produced	Imported
1995	107.6	1.7	715.0	2.5	0.5	13.5
1996	100.0	2.8	726.0	6.8	0.5	7.6
1997	94.3	3.6	814.0	9.1	0.6	11.2
1998	93.1	6.0	810.9	3.0	0.8	13.2
1999	110.7	2.5	761.6	4.2	0.7	12.8
2000	118.5	1.5	752.0	8.5	1.1	12.8

Table 8. Total milk produced in Jordan.

Year	Fresh Milk (1000 ton)			Total
	Sheep	Goat	Cow	
1995	35.3	20.1	92.7	148.1
1996	38.5	20.1	106.5	165.1
1997	34.7	19.7	114.8	169.2
1998	31.3	16.4	123.1	170.8
1999	20.5	12.0	140.6	173.1
2000	31.3	11.5	161.8	204.6

Table 9. Imported animals and animals' products.

	1995	1996	1997	1998	1999	2000
Sheep and Goat (head)	522.5	494	366.7	240.2	406.3	621.3
Cows (heads)	23439	24591	23939	13457	21710	34147
Meat (Cow)	14287	15632	18208	11193	15264	20496
Meat (Sheep and Goat)	9127	11088	9234	12525	10257	10495
Sealed Meat	2984	1948	1711	1483	1960	1415
Meat (Chicken)	2000	2796	3620	6162	2909	1474
Fish	9417	4738	6051	7353	8145	7019
Milk	12119	20264	10403	13431	10341	12280
Butter	1454	1024	1459	936	1333	1744
Margarine	1175	704	814	1153	0	0
Cheese	5558	6347	7080	7307	7130	9236
Jameed	1471	862	1258	1245	1215	1477
Caned Fish	4127	2857	5167	5891	4630	5781
Qeshta	1398	1725	2182	2614	2208	3101
Eggs (for hen)	0.08	0.573	0.567	0.759	1.849	3.637

Table 10. Exported animals and animals' products

	1995	1996	1997	1998	1999	2000
Sheep and Goat (heads)	295300	739500	890700	568800	471100	274800
Cheese (ton)	366	319	485	319	636	1324
Jammed (ton)	0.0	7.0	0.0	15.0	14.0	8.0
Table Eggs (million)	2.5	6.8	9.1	3.0	4.2	8.5
Eggs (for hen) million	12.0	9.8	32.7	44.9	35.4	20.4

Table 11. Product balance for animal products (1000 ton)

	1995	1996	1997	1998	1999	2000
Cow meet (produced)	2.3	3.3	3.5	3.1	3.9	3.4
Imported	14.3	15.6	18.2	11.2	15.3	20.53
Available	16.6	18.9	21.7	14.3	19.2	23.9
% Sufficient	13.9	17.5	16.1	21.7	20.3	14.2
Sheep and goat meat	12	12.7	11.7	18.7	16.8	10.5
Imported	9.1	11.1	9.2	12.5	10.3	14.3
Available	21.1	23.8	20.9	31.2	27.1	24.8
% Sufficient	56.9	53.4	56.0	59.9	62.0	42.3
Yogurt products	148.2	165.1	169.	170.8	173.1	204.6
Imported	162.7	140.4	131	215.4	160	189.4
Exported	2.3	2.1	0	0.1	0.6	8.7
Available	308.6	303.4	300.2	386.1	332.5	385.3
% Sufficient	48.0	54.4	56.4	44.2	52.1	53.1
Chicken meat	107.6	100	94.3	93.1	110.7	118.5
Imported	1.7	2.8	3.6	6	2.9	1.3
Available	109.3	102.8	97.9	99.1	113.6	119.8
% Sufficient	98.4	97.3	96.3	93.9	97.4	98.9
Table Eggs (million)	715	726	814	810.9	761.6	752
Exported	2.5	6.8	9.1	3	4.2	8.5
Available	712.5	719.2	804.9	807.9	757.4	743.5
% Sufficient	100.4	100.9	101.1	100.4	100.6	101.1
Fish (ton)	520	533	552	752	700	1075.7
Imported (ton)	13544	7595	11218	13244	12775	12800
Available (ton)	14064.0	8128.0	11770.0	13996.0	13475.0	13875.7
% Sufficient	3.7	6.6	4.7	5.4	5.2	7.8

Table 12. Number of sheep and goats in Jordan according to province in 2001.

Province	Sheep		Goat	
	No	%	No	%
Amman	225280	15.4	65930	15.5
Balqa	86190	5.9	55040	12.9
Zarqa	112580	7.7	44290	10.4
Madaba	100740	6.9	27990	6.6
Irbed	133980	9.2	43510	10.2
Mafraq	604970	41.5	54450	12.8
Jerash	5920	0.44	17590	4.1
Ajloun	7770	0.56	27680	6.5
Kerak	91520	6.3	40310	9.5
Tafila	15550	1.1	11820	2.8
Ma'an	58720	4.0	17280	4.1
Aqaba	14690	1.0	20030	4.6
Total	1457910	100.0	425920	100.0

Source: Department of Statistics, Statistical year book. 2001.

Table 13. Milk production (ton) in Jordan during 2001.

Source	Sheep	Goat	Cow	Total
Quantity	28707	16800	162765	208272
%	13.8	8.1	78.2	100.0

Source: Ministry of Agriculture, Annual Report. 2001

Table 14. Meat production (in ton) in Jordan during 2001.

Source	Sheep	Goat	Cow	Camel	Total
Quantity	5954	2812	3563	250	12579
%	47.3	22.4	28.3	2	100.0

Source: Ministry of Agriculture, Annual Report. 2001

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