

Livestock Dynamics in the Arabian Peninsula



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A Regional Review of National Livestock Resources
and International Livestock Trade

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CONTENTS

Summary	iv	3.2 Iraq.....	16
Acronyms	vi	3.2.1 Geography and People	16
Acknowledgements	vi	3.2.2 Agriculture and Livestock.....	16
1. Introduction	1	3.3 Jordan	17
1.1 Geographical Focus	1	3.3.1 Geography and People	17
1.2 Structure of Report	1	3.3.2 Arable Land.....	17
2. Regional Overview.....	3	3.3.3 Land Use in the Rangelands	18
2.1 Human Population and Land Use.....	3	3.3.4 Livestock Resources.....	19
2.2 Farming Systems	4	3.3.5 Small Ruminant Production Systems.....	20
2.3 Livestock Production Systems	5	3.3.6 Transformation of Traditional Transhumance	20
2.4 General Environmental Constraints.....	7	3.3.7 Livestock Imports and Exports	20
2.5 Livestock Resource Profiles	7	3.4 Kuwait.....	21
2.6 Livestock Trade	10	3.4.1 Geography and People	21
2.6.1 Live Animal Trade Profiles	10	3.4.2 Arable Land.....	22
2.6.2 Live Sheep Exports from Australia	11	3.4.3 Livestock Resources.....	22
2.6.3 Livestock Import Restrictions.....	13	3.4.4 Livestock Imports	23
2.7 Urban:Rural Population (Producer:Consumer) Ratio.....	13	3.5 Oman	23
2.8 Variation in Demand for Live Sheep	13	3.5.1 Geography and People	23
2.9 Key Factors Shaping Pastoral Livestock Production	14	3.5.2 Arable Land.....	24
3. National Assessments.....	15	3.5.3 Livestock Resources.....	24
3.1 Bahrain	15	3.5.4 Changing Patterns of Rural Trade	25
3.1.1 Geography and People	15	3.6 Qatar	26
3.1.2 Arable Land	15	3.6.1 Geography and People	26
3.1.3 Livestock Resources	15	3.6.2 Arable Land.....	26
		3.6.3 Livestock Resources.....	26
		3.6.4 Livestock Imports	26

3.7 Saudi Arabia.....	27	4. Conclusions and Recommendations	41
3.7.1 Geography and People	27	4.1.1 Changing Modes of Livestock Production.....	41
3.7.2 Traditional Agriculture and Pastoral Nomadism	27	4.1.2 Intensification and Modernisation.....	41
3.7.3 Agricultural Development	28	4.1.3 Transitional Pastoral Production.....	42
3.7.4 Transformation of Pastoral Livestock Production.....	29	4.1.4 Livestock Movement.....	42
3.7.5 Livestock Resources	29	4.2 Livestock Trade	42
3.7.6 Modern Poultry Production	29	4.2.1 External Trade Records.....	42
3.7.7 Modern Dairy Production	30	4.2.2 Internal Movement Records.....	43
3.7.8 Beef and Veal Production.....	30	4.2.3 Main Markets.....	43
3.7.9 Demand for Sheep.....	30	4.2.4 Variation in Demand (and Trade Movements)	43
3.7.10 Livestock Imports	32	4.3 Epidemiological Significance of Findings	43
3.8 Syria.....	32	4.4 Critical Information Gaps	44
3.8.1 Geography and People	32	4.5 Suggested Remedies	45
3.8.2 Arable Land	32	4.5.1 Strengthen Regional Networking.....	45
3.8.3 Livestock Resources	32	4.5.2 Obtain Better Understanding of Livestock Trade.....	45
3.8.4 Livestock Distribution	33	4.5.3 Enhance Monitoring.....	45
3.8.5 Hima System of Range Use.....	34	4.5.4 Strengthen GIS and Database Management Capacity ...	45
3.8.6 Changing Modes of Production.....	34	5. References and Annotated Bibliography	46
3.8.7 Institutional Change.....	34	6. Selected Websites.....	66
3.8.8 Livestock Marketing.....	35	Appendix 1: Terms of Reference.....	67
3.8.9 Livestock Trade	35	Appendix 2: Demographic and Economic Indicators (2001).....	68
3.9 United Arab Emirates	36	Appendix 3: Farming Systems	69
3.9.1 Geography and People	36	Appendix 4: Global Livestock Productions Systems.....	70
3.9.2 Agriculture	37	Appendix 5: Trans-Continental Livestock Distribution Maps	72
3.9.3 Livestock Resources	37	Appendix 6: Animal Health and Production Addresses	74
3.10 Yemen	38	Appendix 7: Questionnaire	75
3.10.1 Geography and People	38		
3.10.2 Arable Land	38		
3.10.3 Livestock Resources	39		
3.10.4 Livestock Production Systems	39		
3.10.5 Livestock Trade	40		

LIST OF FIGURES

Figure 1: Predicted and Observed Disease Occurrences Scores.....	2
Figure 2: Human Population Density in West Asia.....	3
Figure 3: Land Use in West Asia.....	3
Figure 4: Farming Systems in the West Asia.....	4
Figure 5: Livestock Production Systems in the West Asia.....	6
Figure 6: Predicted Small Ruminant Distribution In West Asia.....	7
Figure 7: Predicted Bovine Distribution in West Asia.....	8
Figure 8: Livestock Distribution Profiles.....	9
Figure 9: Live Animal Trade Profiles.....	10
Figure 10: Live Sheep Exports from Australia.....	12
Figure 11: Proportion of Human Population Living in Rural Areas.....	13
Figure 12: Livestock Population Trends in Jordan 1995-2000.....	19
Figure 13: Jordan's Small Ruminant Trade.....	21
Figure 14: Kuwait's Livestock Populations 1995-2000.....	23
Figure 15 : Kuwait's Imports of Australian Live Sheep.....	23
Figure 16: Qatar's Imports of Live Sheep from Australia.....	27
Figure 17: Saudi Live Animal Imports: 1990-2001.....	31
Figure 18: Syria's Live Sheep and Goat Trade.....	36
Figure 19: UAE Livestock Populations 1997-2001.....	38
Figure 20: Yemen's Livestock Imports and Exports 1990-2000.....	40
Figure 21: Major Farming Systems of West Asia and North Africa.....	69
Figure 22: Global Livestock Production Systems.....	70
Figure 23: Small Ruminant (Sheep and Goats) Distribution.....	72
Figure 24 Bovine (Cattle and Domesticated Buffalo) Distribution.....	73

LIST OF TABLES

Table 1: Proportion of Total Land Area Cultivable.....	7
Table 2: Recorded Livestock Imports in 2000.....	11
Table 3: Recorded Live Sheep Trade in 2000.....	11
Table 4: Key Factors Shaping Pastoral Livestock Production.....	14
Table 5: Bahrain's Livestock Populations 1995-97.....	15
Table 6: Iraq's Sheep Population by Governorate.....	16
Table 7: Jordan's Livestock Populations by Region - 2000.....	19
Table 8: Kuwait's Livestock Populations: 1999/2000.....	22
Table 9: Oman's Livestock Populations.....	24
Table 10: Oman's Vaccination Returns.....	25
Table 11: Qatar's Livestock Populations.....	26
Table 12: Saudi Arabia's Livestock Populations by Region in 1998.....	29
Table 13: Syria's Livestock Populations 2001.....	33
Table 14: UAE'S Livestock Populations by Region in 2001.....	37
Table 15: Yemen's Livestock Population by Region in 2000.....	39
Table 16: Livestock Distribution by Mode of Production.....	40
Table 17: Global Livestock Production Systems and Examples.....	71

SUMMARY

This review of livestock dynamics in the Arabian Peninsula presents a synthesis of available information about livestock distribution, trade and movements relevant to epidemiological analysis of trans-boundary animal diseases in the Arabian Peninsula (Bahrain, Kuwait, Qatar, Saudi Arabia, United Arab Emirates, Yemen) and neighbouring Iraq, Jordan and Syria.

Information has been compiled from a variety of sources, including: consultancy reports, scientific publications, government departments, international agencies and research organisations. Extensive use was made of the internet and a list of key sites is provided. A search of the scientific literature revealed a range of relevant papers, which are presented in an annotated bibliography. This report is accompanied by a CD-ROM with a series of digital files of supplementary information obtained during the investigation.

Environmental Constraints

The Arabian Peninsula, eastern Jordan, south-eastern Syria and south-western Iraq are characterised by their aridity, sparse vegetation and minimal surface water, which are not conducive to arable farming and animal husbandry, unless exceptional measures are taken to overcome these constraints.

Less extreme conditions prevail in western Jordan, northern and western Syria, northern Iraq, the Mesopotamian region between the Euphrates and Tigris rivers, and the highlands of Yemen to the south-west and Oman to the south-east.

Livestock Resources

The composition and abundance of livestock resources in the ten countries under consideration reflect the exigencies of prevailing environmental conditions:

- After chickens, sheep and goats are the most numerous livestock species, with the number of sheep generally exceeding that of goats;
- Syria, Saudi Arabia and Iraq have the largest sheep populations;
- Saudi Arabia and Yemen have the most goats;
- Iraq, Syria and Yemen have the largest cattle populations;
- Yemen and Iraq have the most equines;
- Equines are generally more numerous than camels;
- Saudi Arabia, the United Arab Emirates and Yemen have the most camels;
- Except for sheep and goat populations in Jordan, population trends were upwards or stable for all species in all countries during the nineties.

Livestock Trade

Livestock trade in the region is driven by demand from the Gulf States (Bahrain, Kuwait, Oman, Qatar, Saudi Arabia and UAE), which collectively imported 71% of the recorded 11.3 million live sheep, goats and cattle imports.

Imported animals are drawn in from as far a field as Australia and New Zealand, but also from Yemen, Pakistan, Sudan and the Horn of Africa, as well as Jordan and Syria, and almost certainly Iraq, Turkey and Iran.

Key features of livestock trade in the region are:

- Imports far exceed exports for all countries and species, except for sheep exports from Syria and Yemen, and there is, therefore, a major net inflow of livestock into the region;
- In 2000, Saudi Arabia was by far the largest importer of live animals, with 4.17 million sheep, 2.97 million chickens and 1.1 million goats;
- Kuwait was the next largest sheep importer, followed by UAE, Jordan, Oman, Bahrain and Qatar;
- The limited scale of recorded sheep exports from Iraq is inconsistent with an estimated sheep population of 6.7 million;
- Syria was the largest exporter of sheep, followed by Yemen, Jordan and the UAE;
- Oman was the main exporter of live goats with 855,000 recorded exports in 2000.

Changing Modes of Livestock Production

Significant changes in the modes of livestock production have taken place in recent decades, including increased availability and utilisation of crop residues, widespread supplementary animal feeds, mechanised pastoralism and introduction of modern dairy and poultry production units.

Seasonal and tribal movement patterns of traditional nomadism and transhumance have been transformed, especially in countries such as Jordan, Saudi Arabia, Syria, and almost certainly Iraq.

With transport to supply animal feeds and tank trailers to provide water, pastoral livestock production is not so dependent on rainfall and range conditions as it used to be. Traditional seasonal patterns of movement to and from specific areas are no longer followed and have been replaced by more erratic and opportunistic movements to areas with seasonal crop residues and natural pasture, and where water and supplementary feed can be supplied.

Recommendations

Critical gaps in available information relevant to the spread of trans-boundary diseases are identified and various remedies are proposed, including:

- Enhancing regional networking arrangements;
- Commissioning a study to obtain standardised, up to date information about livestock trade and marketing in the region;
- Improving livestock trade monitoring and dissemination;
- Strengthening national and regional Geographical Information System (GIS) and database management capacity.

ACRONYMS

ACSAD	Arab Centre for the Studies of Arid Zones and Dry Lands
AGA	Animal Health and Production Division
CABI	CAB International (formerly Commonwealth Agricultural Bureau)
ERGO	Environmental Research Group Oxford Limited
ESRI	Environmental Systems Research Institute
EU	European Union
FAO	Food and Agriculture Organisation
GCC	Gulf Cooperation Council
GIS	Geographical Information System
GNI	Gross National Income
ICARDA	International Centre for Agricultural Research in the Dry Areas
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
IFAD	International Fund for Agricultural Development
ILRI	International Livestock Research Institute
NGS	National Geographic Society
OIE	Office International des Epizooties (World Organisation for Animal Health)
SPS	Sanitary and Phyto-Sanitary
WHO	World Health Organisation
WTO	World Trade Organisation

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Sources of information are given in the text, but the interpretations made and the views expressed are those of the reviewer.

1. INTRODUCTION

Human population increase and economic growth have raised demand for animal protein in developing countries and resulted in a major expansion of international trade in livestock and livestock feeds, which is set to continue (Delgado *et al.*, 1999; FAO, 2000).

Many millions of live ruminants are imported into West Asia¹ each year from around the world, including Africa, Australia, East Asia, Europe and New Zealand. On various occasions over the past decade, diseases have spread from the Greater Horn of Africa to the Arabian Peninsula and from there into the Mediterranean Basin.

Another potential highway of animal disease transmission, through Turkey, Syria, Iraq and Iran, also links Europe and Asia (Slingenbergh *et al.*, 2002), as indicated in maps of observed (reported) and predicted disease occurrence shown in Figure 1, derived from multivariate analysis of disease incidence data in FAO/OIE/WHO Animal Health Year Books (Wint *et al.*, 2000).

Growing concern about these perceptions of the heightened risk of spreading disease, associated with globalisation and the increasing livestock trade, warranted further investigation and prompted the commissioning of this study.

1.1 Geographical Focus

This report presents the findings of a desk study review and synthesis of livestock resources and animal husbandry in countries of the Arabian Peninsula and the region immediately to the north, adjoining the Eurasian land mass.

The terms of reference for the study call for the compilation and collation of all available livestock information relevant to epidemiological analysis of trans-boundary animal diseases in the Arabian Peninsula (Bahrain, Kuwait, Qatar, Saudi Arabia, United Arab Emirates, Yemen) and neighbouring Iraq, Jordan and Syria from Internet searches, FAO documents, literature and records obtained through direct contact with livestock services (Appendix 1: Terms of Reference).

1.2 Structure of Report

The next section sets the scene with a regional overview of human population distribution, land use, farming and livestock production systems in West Asia, and a profile of livestock resource distribution and population trends across the region.

Section three presents a series of national assessments of livestock resources, production modes and trade in each country, and identifies some of the major changes that have taken place.

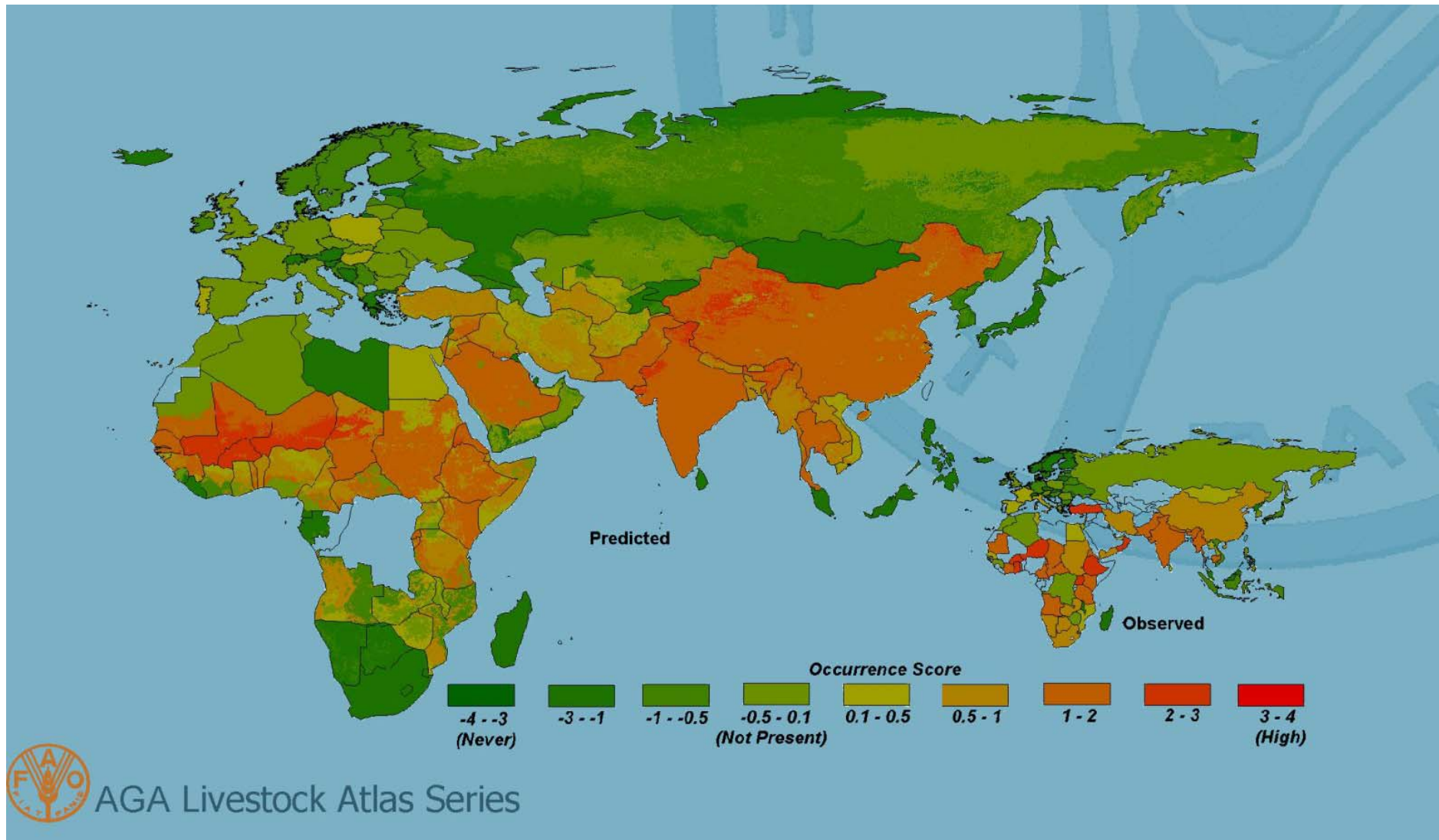
The concluding section highlights key findings; identifies critical information gaps; and suggest how these might be overcome.

Sources of information are presented in an annotated bibliography and a list of internet sites on the World Wide Web.

A series of appendices provide further information about subjects mentioned in the main text.

¹ The term “West Asia” is used here in preference to the Middle or Near East.

Figure 1: Predicted and Observed Disease Occurrences Scores



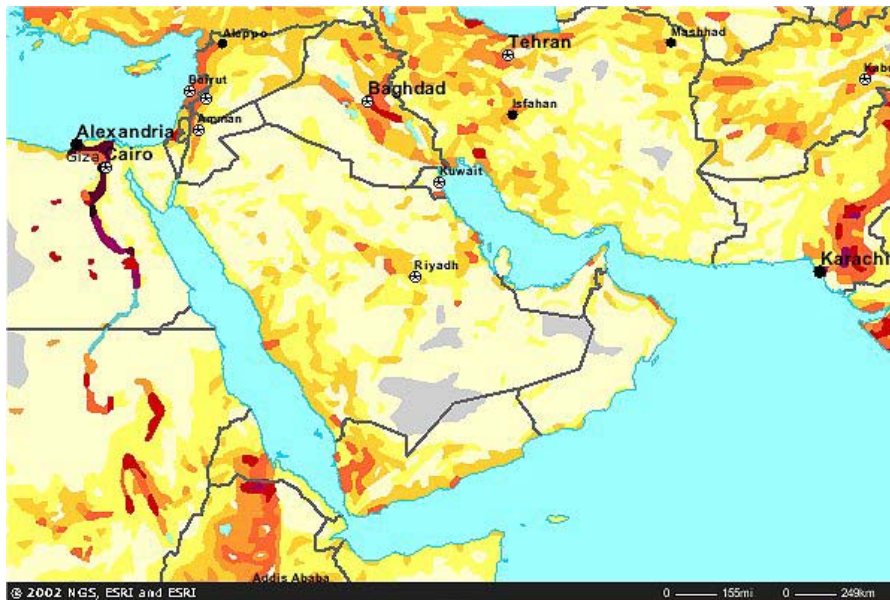
Source: Slingenbergh *et al.* (2002), based on ranked data derived from FAO/OIE/WHO Animal Health Year Books (Wint *et al.*, 2000).

2. REGIONAL OVERVIEW

This section provides an overview of human population distribution, land use, farming systems, livestock resources and the international trade in live animals in the Arabian Peninsula. For comparison of other national characteristics, including: geographical area; human population size; density, and growth rate; gross national income (GNI); and per capita income; see: Appendix 2: Demographic and Economic Indicators (2001).

Arabian Peninsula are characterised by generally low human population density and little cultivation. In addition to urban centres, people are concentrated in the highlands and coastal plain to the west and south, adjoining the Red Sea and the Gulf of Aden. In marked contrast, neighbouring countries to the north have higher human population densities and much more extensive agriculture, especially near the Mediterranean and in the Mesopotamian region, between the Euphrates and the Tigris.

Figure 2: Human Population Density in West Asia



Source: <http://plasma.nationalgeographic.com/mapmachine/>

Figure 3: Land Use in West Asia



Source: <http://plasma.nationalgeographic.com/mapmachine/>

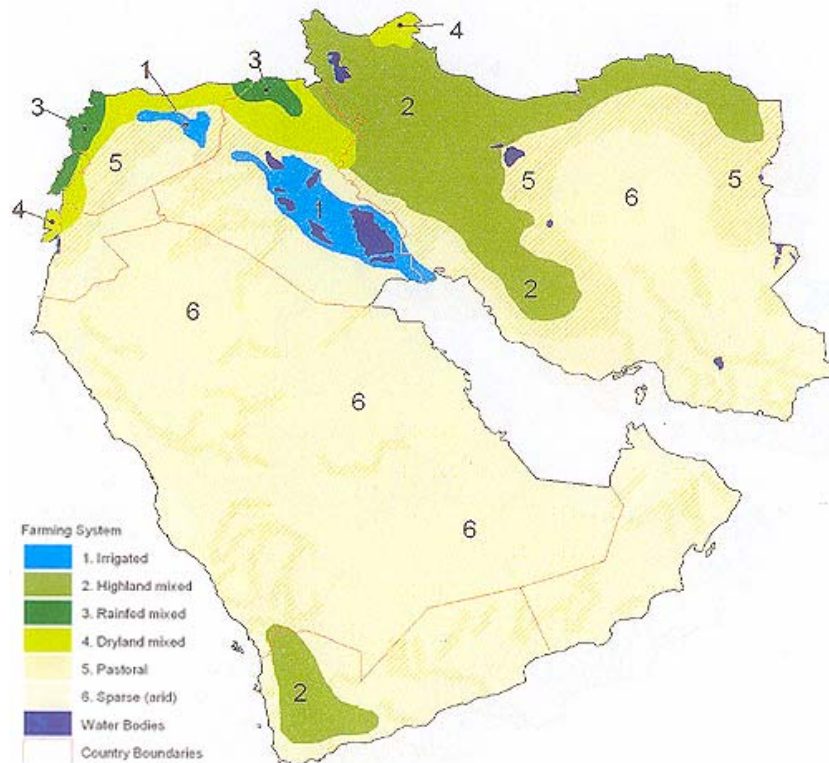
2.1 Human Population and Land Use

The patterns of human settlement and land use in West Asia are inter-related, as indicated in Figure 2 and Figure 3. The countries of the

2.2 Farming Systems

FAO's farming system assessment of West Asia and North Africa (Gibbon, 2001), based on a combination of criteria including natural resources and climate altitude and main crops, importance of livestock and access to irrigation, has identified eight major farming systems, as represented in Figure 4 and outlined below.

Figure 4: Farming Systems in the West Asia



Source: Derived from Gibbon (2001).

Irrigated Farming Systems. Large-scale irrigation schemes have been linked primarily to perennial surface water resources, but the intensification of traditional karez or qanat systems has also resulted in expansion of irrigated areas. Since the 1960s the spread of drilling and pumping technology has permitted the development of large groundwater-dependent schemes. They are found across all zones and include high-value cash and export cropping and intensive vegetable and fruit cropping. Patterns of water resource use vary greatly, but often water is not used efficiently and significant economic and environmental externalities are produced through excessive drawdown of non-recharged aquifers, and excessive irrigation resulting in rising groundwater tables, soil salinisation and sodication problems.

Small-scale irrigated systems occur in many places across the region and although they may not be important individually in terms of the numbers of people involved or in the amount of food and other crops produced, they are a significant element in the survival of people in dry areas. Such systems develop along small perennial streams and at oases, or are built where flood and spate irrigation is feasible as well as around boreholes. The major crops are mixed cereals and vegetables. These locations (where water is available) always provide a focal point for socio-economic activity but intense local competition for limited water resources between livestock owners and farmers is becoming increasingly evident. Areas with substantial small-scale irrigation are indicated by hatching in Figure 4.

Highland Mixed Systems. Two systems exist and occasionally co-exist. The first is dominated by rainfed cereal and legume cropping, with tree crops, fruits and olives on terraces, together with vines. In Yemen, qat and coffee are traditionally the most important tree crops in mountain regions. The second system is based on livestock (mostly

sheep) on communally managed lands in several countries. In some cases, livestock, and the people who control them, are involved in a transhumance system, migrating seasonally between lowland steppe in the more humid winter season and uplands in the dry season, as in parts of Iran and Morocco.

Rainfed Mixed Farming System. The crops in this system are primarily rainfed, although in some areas supplementary irrigation on wheat and full irrigation for summer cash crops are developing rapidly. There is some dry-season grazing of sheep migrating from the steppe areas. The humid area (1000-600mm annual rainfall) has 270-365 growing days. There are tree crops (olives and fruit trees), melons and grapes. There is also some protected cropping with supplementary irrigation for potatoes, sugar beet, vegetables and specialist crops and flowers. In the moist sub-humid area, with 500-300mm rainfall and a growing period of 180-269 days, there are fewer trees apart from more drought-resistant ones. Common crops are wheat, barley, chickpeas, lentils and the fodder crops, vetches and medics. Some supplementary irrigation may be used for vegetable and cut flower production.

Dryland Mixed Farming System. This system is dry sub-humid with 120-179 days growing period and annual rainfall about 300-150 mm. The main rainfed cereals are barley and some wheat with annual or two-year fallow. Sheep and goats interact strongly with the cropping and fodder system. Rainfed barley is grown as a whole crop fodder or in good years, for both grain and fodder. Local barley varieties are particularly well adapted to this system.

Pastoral System. Pastoral systems, mainly involving sheep and goats, are found across large areas of semi-arid steppe lands. They are usually found away from coastal zones and are characterised by a

growing season of between 1-119 days. Such systems have strong linkages to other farming systems, both in more humid areas and with large feedlots located in urban areas. The animals are involved in seasonal migration, which is dependent on the availability of grass, water and crop residues. These systems are often partially controlled and financed by urban capital.

Sparse (arid) System. This system covers the extensive desert areas of the region. It contains some oasis farming and a number of irrigation schemes, and provides opportunistic grazing for the herds of pastoralists from scattered storms and in good seasons. The boundary between pastoral grazing and sparse agriculture systems is indistinct.

Coastal Artisanal Fishing System. Along the coasts of the Mediterranean and the Atlantic Ocean, small-scale artisanal fishermen have lived for thousands of years. As modern technology and capital have been injected into the offshore fishing industry, the artisanal fishing system has shrunk.

Urban-based Farming System. Throughout the region a small population of urban residents engage in small-scale production of horticultural and livestock products, notably fruit, vegetables and poultry.

2.3 Livestock Production Systems

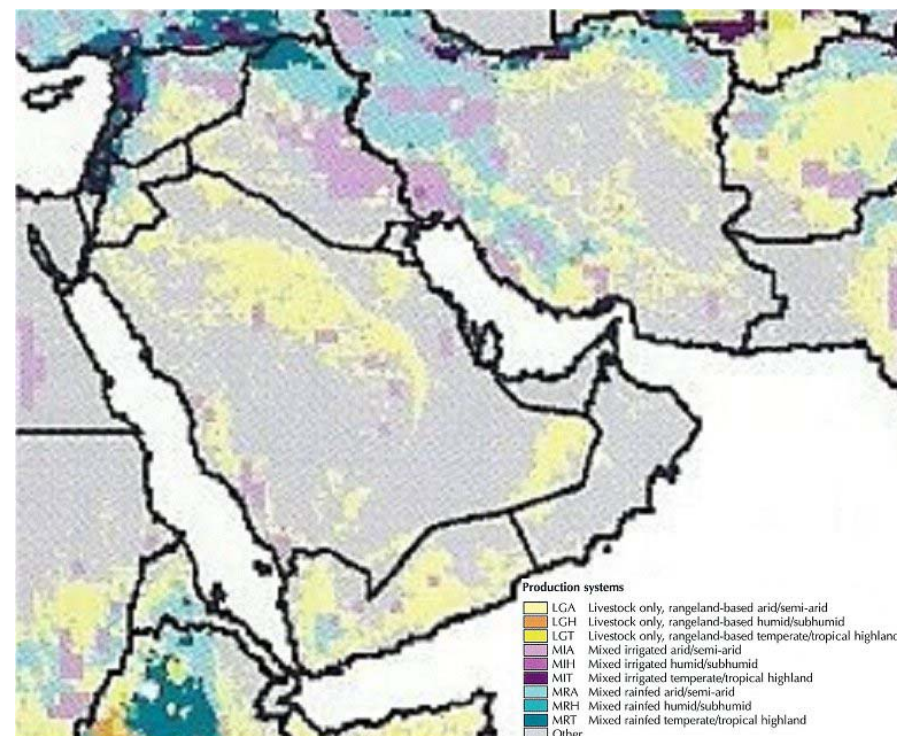
The multiple roles of livestock in agriculture and rural livelihoods, as sources of meat, milk, hides, skins, manure, traction and carriage, are underrated in general farming system classifications, such as that outlined in the previous section, which focus on the main crops grown, the level of technology and the intensity of management.

This deficiency has been addressed by Seré and Steinfeld (1996) and Thornton *et al.* (2002) in their classification of global livestock production systems that integrates human population density, land cover, length of crop growing period and extent of irrigation. Twelve global livestock production systems are defined as follows:

- LGA** Livestock only, rangeland-based arid/semi-arid;
- LGH** Livestock only, rangeland-based humid/sub-humid;
- LGT** Livestock only, rangeland-based temperate/tropical highland;
- MRA** Mixed rainfed arid/semi-arid;
- MRH** Mixed rainfed humid/sub-humid;
- MRT** Mixed rainfed temperate/tropical highland;
- MIA** Mixed irrigated arid/semi-arid;
- MIH** Mixed irrigated humid/sub-humid;
- MIT** Mixed irrigated temperate/tropical highland;
- LS** Landless systems in high population density areas;
- LMS** Landless metropolitan systems, high population density areas with significant urban infrastructure;
- Other** Residual category with very low human and livestock population densities.

The distribution of livestock production system in West Asia is shown in Figure 5. See Appendix 3: Farming Systems and Appendix 4: Global Livestock Productions Systems for more information.

Figure 5: Livestock Production Systems in the West Asia



Source: Derived from Thornton *et al.* (2002).

2.4 General Environmental Constraints

Key features of the Arabian Peninsula, eastern Jordan, south-eastern Syria and south-western Iraq are their aridity, sparse vegetation and minimal surface water, which are not conducive to arable farming and animal husbandry, unless exceptional measures are taken to overcome these constraints.

Less extreme conditions, however, prevail in western Jordan, northern and western Syria, northern Iraq and the Mesopotamian region between the Euphrates and Tigris rivers, where cereal farming and agricultural practices are likely to have originated, and the highlands of Yemen to the south-west and Oman to the south-east. These contrasts between countries of the Arabian Peninsula and their northern neighbours are reflected in the total areas and proportions of potentially cultivatable land in each country, indicated in Table 1.

Table 1: Proportion of Total Land Area Cultivable

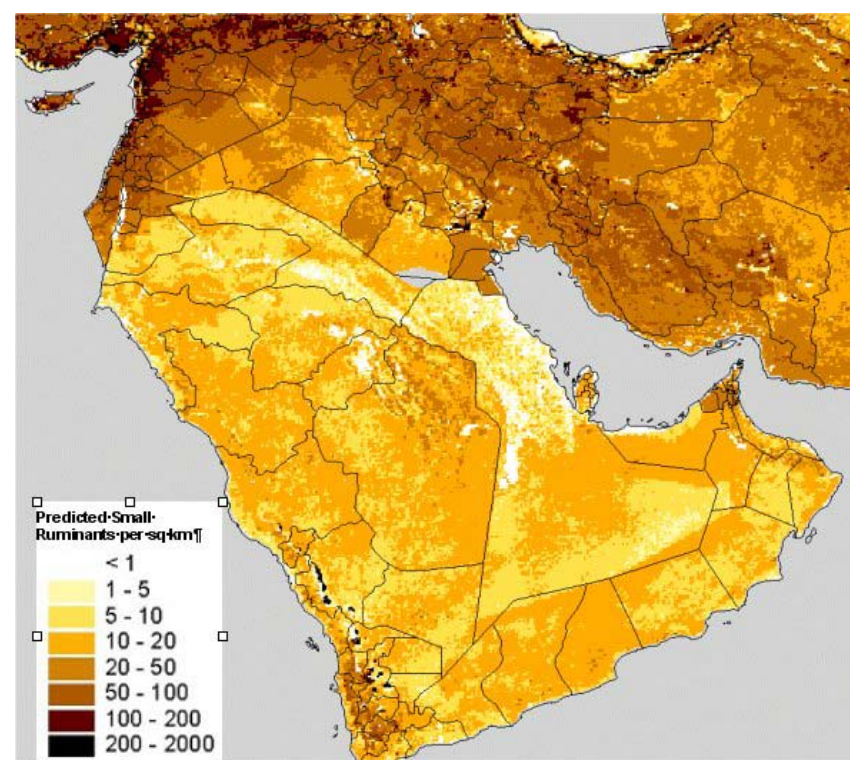
Country	Land Area km ²	Cultivable ha	Percentage
Bahrain	695	4,230	6.1
Iraq	438,320	11,500,000	26.2
Jordan	89,210	381,740	4.3
Kuwait	17,820	154,000	8.6
Oman	312,500	2,200,000	7.0
Qatar	11,000	28,000	2.5
Saudi Arabia	2,150,000	5,270,000*	2.5*
Syria	185,180	5,940,000	32.1
UAE	83,600	72,374	0.9
Yemen	527,970	3,620,000	6.9
Total	3,816,295	29,170,344	7.6

Source: <http://www.fao.org/ag/agl/aglw/aquastat/countries/> * adjusted.

2.5 Livestock Resource Profiles

An encyclopaedia of animal resources in Arab countries was compiled in the 1980s and published in Arabic by the Arab Centre for Studies of Arid Zones and Dry Lands in Damascus (Tleimat *et al.*, 1981). The 21-volume encyclopaedia is currently being updated and CDs for the main breeds are being prepared. Encyclopaedias of sheep and goat breeds (Khouri, 1997) have also been produced and an Atlas of Camel breeds is envisaged (Wardeh, pers. com.).

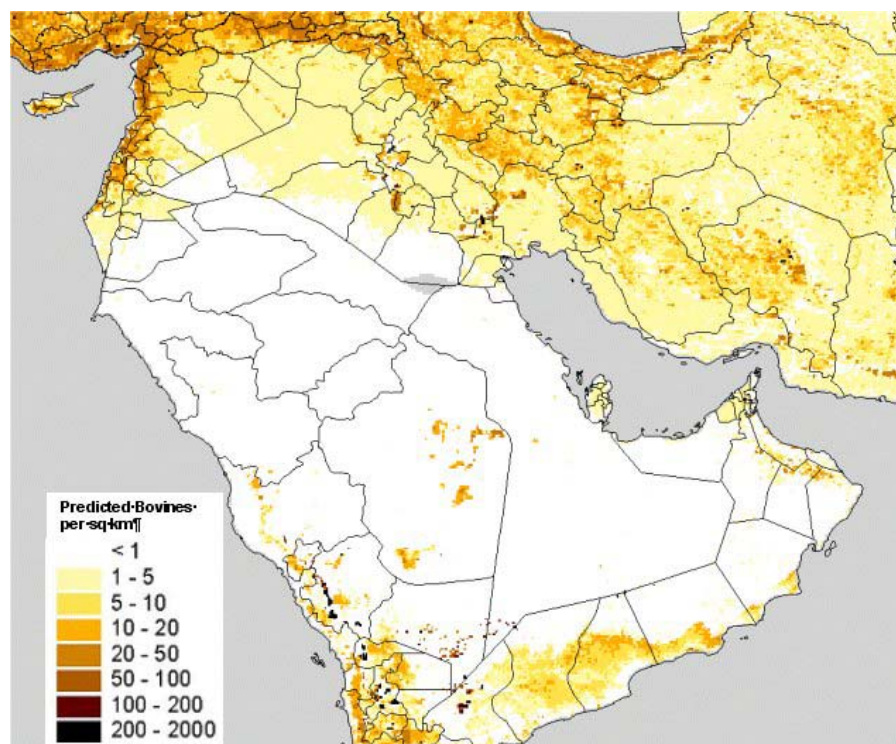
Figure 6: Predicted Small Ruminant Distribution In West Asia



Source: Wint *et al.* (2000).

Just like the animals themselves, data on the sub-national distribution of livestock in the Arabian Peninsula and neighbouring countries are generally sparse, or absent. Predicted distributions, based on densities found in other areas with similar conditions (Wint *et al.*, 2000), are shown in Figure 6 for small ruminants (sheep and goats) and in Figure 7 for bovines (cattle and domesticated buffalo).

Figure 7: Predicted Bovine Distribution in West Asia



Source: Wint *et al.*, (2000).

Indicative maps of small ruminant and bovine distribution across Africa, Asia and Europe can be found in Appendix 5.

Very low-density small ruminant populations of 1-10 animals per square kilometre were predicted for most of the Arabian Peninsula, with slightly higher densities in the highlands of Yemen, the Oman Peninsula, Qatar and Kuwait; and much higher densities in neighbouring countries to the north. Very few cattle were predicted for the Arabian Peninsula, except in the highlands of Yemen and Oman, and irrigated arable areas in central Saudi Arabia. Low cattle population densities were predicted for Iraq, Jordan and Syria, with higher densities to the west and north, and the Mesopotamian region.

For the purposes of this review, livestock resource profiles have been constructed from FAO's statistical database. The composition and abundance of livestock resources of the ten countries under consideration reflect the exigencies of prevailing environmental conditions, as depicted in Figure 8. The main features are:

- Sheep and goats are by far the most numerous livestock species, with sheep generally exceeding goats;
- Syria, Saudi Arabia and Iraq have the largest sheep populations;
- Saudi Arabia and Yemen have the most goats;
- Iraq, Syria and Yemen have the largest cattle populations;
- Yemen and Iraq have the most equines;
- Equines are generally more numerous than camels;
- Saudi Arabia, the United Arab Emirates and Yemen have the most camels;
- Except for sheep and goat populations in Jordan, population trends were upwards or stable for all species in all countries during the nineties.

Figure 8: Livestock Distribution Profiles

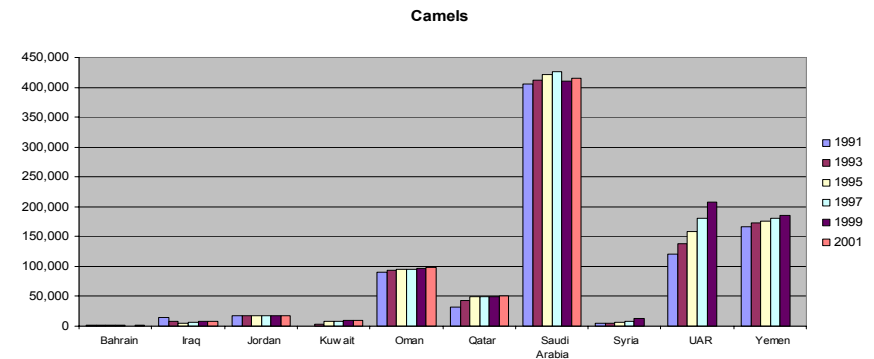
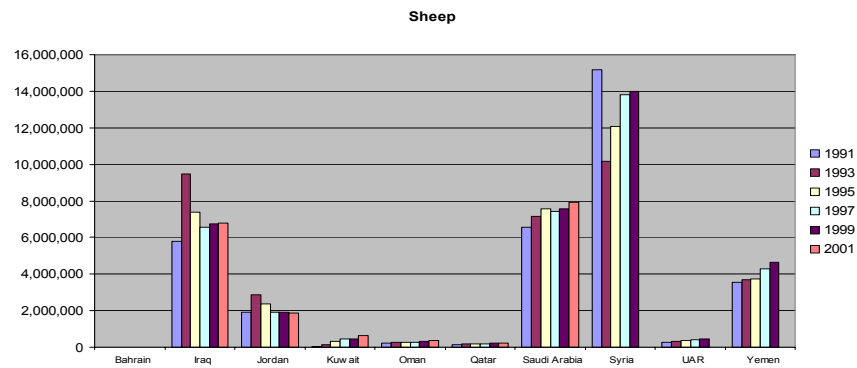
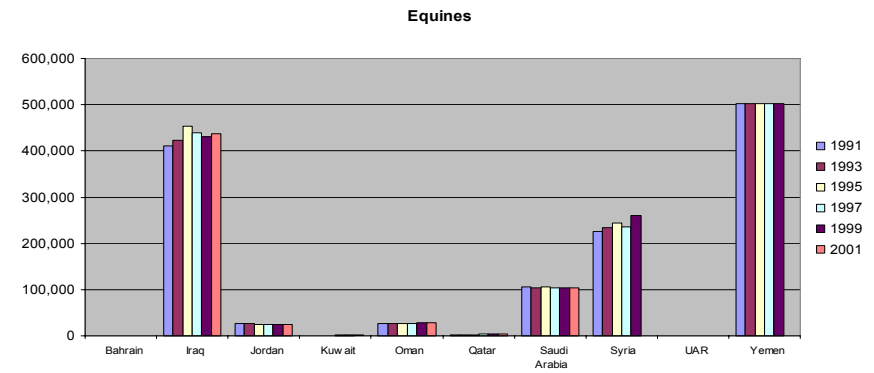
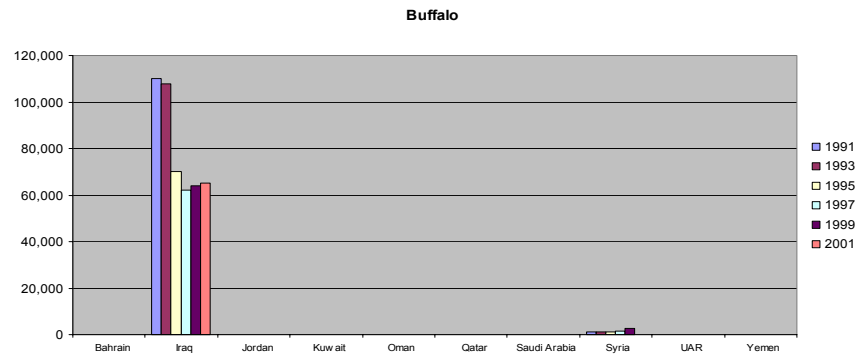
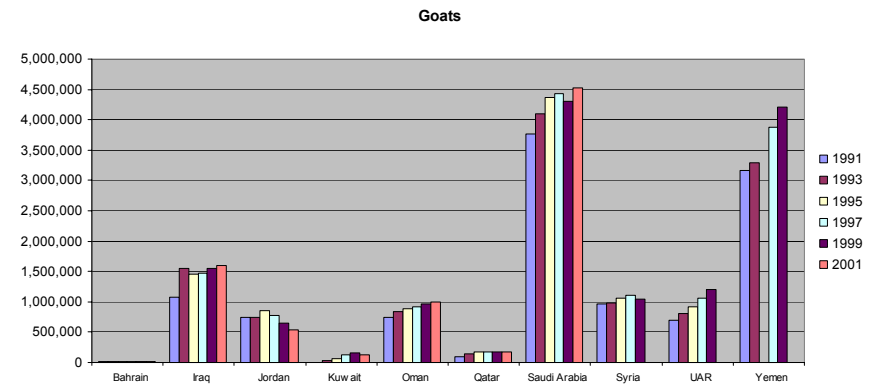
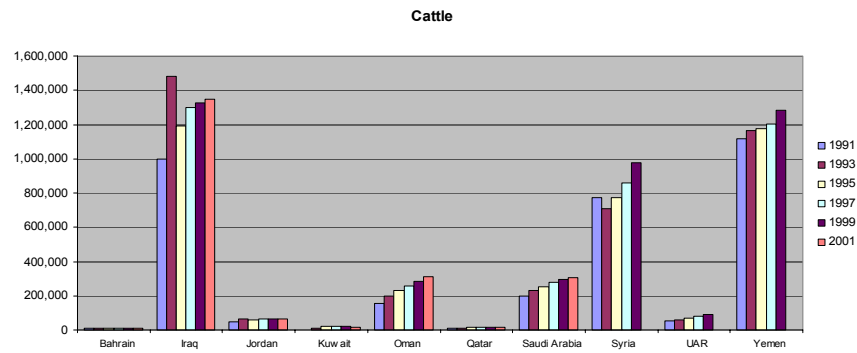
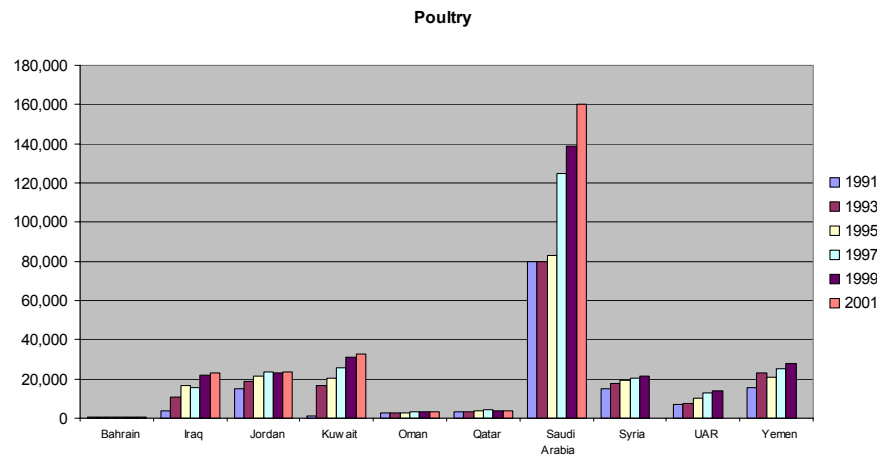


Figure 8: Livestock Distribution Profiles (continued)



Source: FAO's Statistical Database: <http://apps.fao.org/>

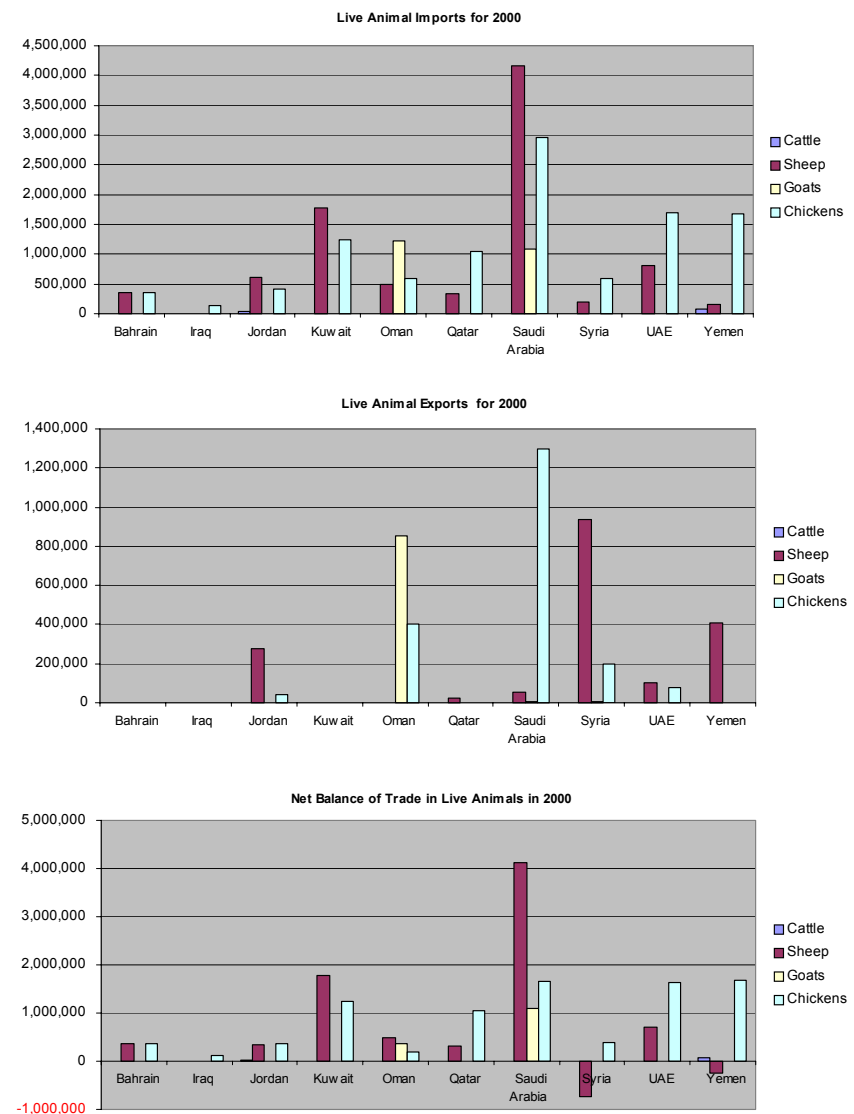
2.6 Livestock Trade

Analysis of global meat production and trade statistics indicates that Saudi Arabia is one of the world's largest importers of sheep and goat meat, and that Australia and New Zealand provide the bulk of supplies to the live sheep and sheep meat markets. Growth in Saudi Arabian demand in 1999 followed the lifting of a 16-month ban on imports of live animals and consequential increase in live sheep imports from neighbouring countries in West Asia and Africa (FAO, 2000; <http://www.fao.org/es/ESC/esce/escb/meat/pdf/Outlook.pdf>).

2.6.1 Live Animal Trade Profiles

FAO's online database indicates that the main international trade in live animals in the region during 2000 was in sheep, chickens and goats (Figure 9 and Table 2). Recorded imports and exports of camels, cattle and equines were minimal.

Figure 9: Live Animal Trade Profiles



Source: FAO's Statistical Database: <http://apps.fao.org/>

Table 2: Recorded Livestock Imports in 2000

Country	Cattle	Sheep	Goats	Chickens
Bahrain	1,967	356,822	1,636	365,000
Iraq				130,000
Jordan	33,947	609,643	656	409,000
Kuwait	3,240	1,771,600	180	1,234,000
Oman	318	499,377	1,227,320	590,000
Qatar	770	334,500		1,043,000
Saudi Arabia	336	4,170,944	1,094,258	2,966,000
Syria		205,000		600,000
UAE	4,400	817,000		1,700,000
Yemen	84,436	166,069		1,680,000
Total	129,414	8,930,955	2,324,050	10,717,000

Source: FAO's Statistical Database: <http://apps.fao.org/>

Table 3: Recorded Live Sheep Trade in 2000

Country	Live Sheep Imports	Live Sheep Exports
Bahrain	356,822	
Iraq		1,000
Jordan	609,643	277,425
Kuwait	1,771,600	54
Oman	499,377	
Qatar	334,500	21,200
Saudi Arabia	4,170,944	56,856
Syria	205,000	937,000
UAE	817,000	104,000
Yemen	166,069	410,358
Total	8,930,955	1,807,893

Source: FAO's Statistical Database: <http://apps.fao.org/>

Key features evident from these livestock trade profiles are:

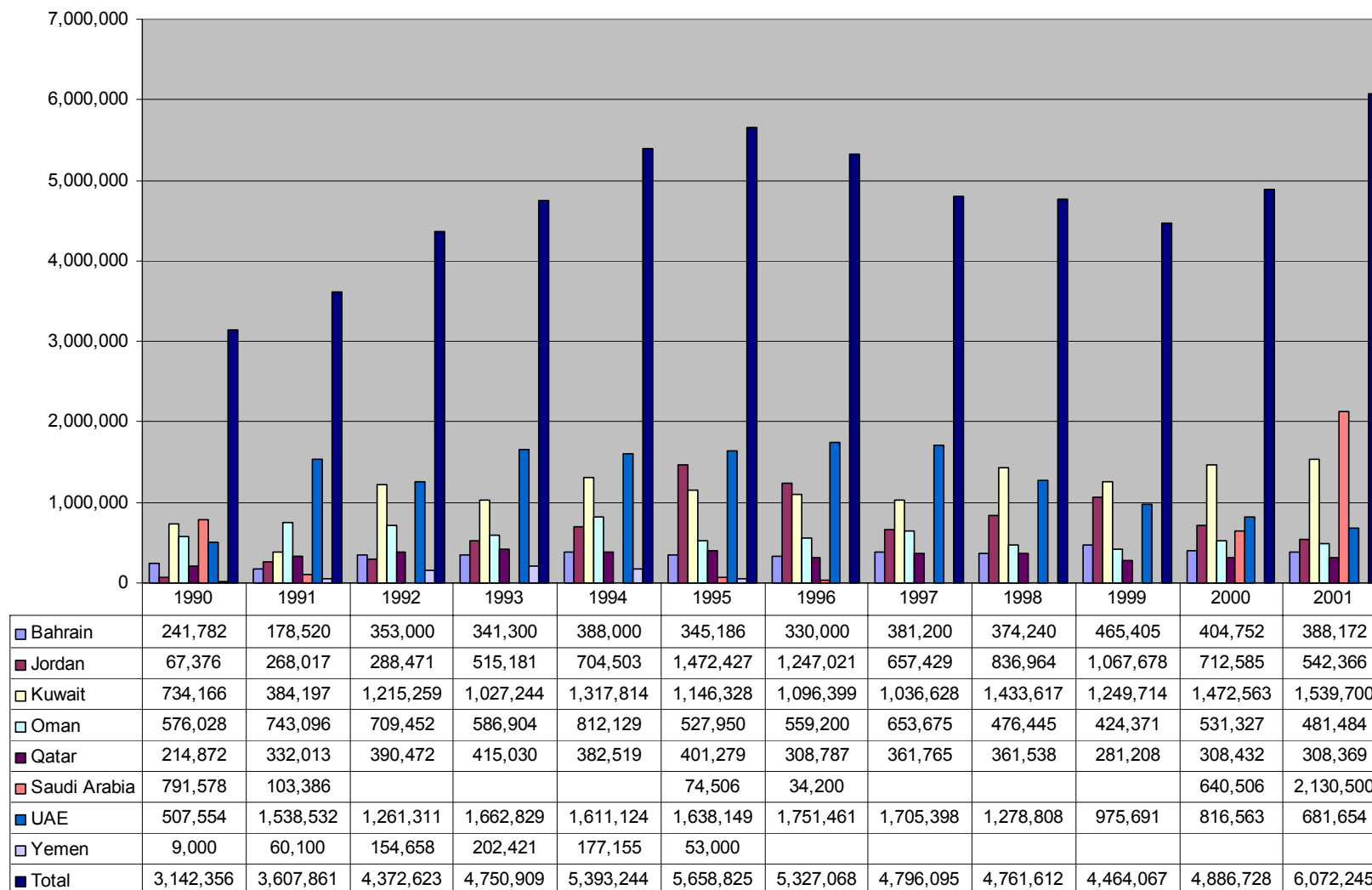
- Imports far exceed exports for all countries and species, except for sheep exports from Syria and Yemen, and there is, therefore, a major net inflow of livestock into the region;
- Saudi Arabia was by far the largest importer of live animals, with 4.17 million sheep, 2.97 million chickens and 1.1 million goats;
- Kuwait was the next largest sheep importer, followed by UAE, Jordan, Oman, Bahrain and Qatar as indicated in Table 3;
- The limited scale of recorded sheep exports from Iraq is inconsistent with an estimated sheep population of 6.7 million;
- Syria was the largest exporter of sheep, followed by Yemen, Jordan and the UAE;
- Oman was the main exporter of live goats with 855,000 recorded exports in 2000.

Livestock trade in the region is driven by demand from the Gulf States (Bahrain, Kuwait, Oman, Qatar, Saudi Arabia and UAE), (Table 2) which collectively imported 71% of the recorded 11.3 million live sheep, goats and cattle imports. Imported animals are drawn in from as far a field as Australia and New Zealand, but also from Yemen, Pakistan, Sudan and the Horn of Africa, as well as Jordan and Syria, and almost certainly Iraq, Turkey and Iran.

2.6.2 Live Sheep Exports from Australia

Australia is the largest exporter of live sheep in the world. Exports to West Asia rose progressively during the early nineties, declined during the late nineties, and began to rise again during the first two years of the new millennium, as indicated in Figure 10. A total of just over 6 million head were exported in 2001, the great majority of which went to Saudi Arabia (2.1 million) and Kuwait (1.5 million) (<http://www.meatlivestockaustralia.com/uploads/templates/otherpdf/FFSheep01.pdf>.)

Figure 10: Live Sheep Exports from Australia



Source: http://www.livecorp.com.au/Statistics_sheep_Dest.asp

2.6.3 Livestock Import Restrictions

Official bans on the importation of livestock for fear of spreading disease are indicative of the diverse sources of livestock trade in the Arabian Peninsula, but not necessarily the source of infection.

Saudi Arabia imposed a ban on livestock imports from five countries in the Horn of Africa and Yemen in February 1998, after an outbreak of Rift Valley Fever in Kenya prompted fears that the disease would spread into neighbouring countries. The ban was lifted some 16 months later after the World Health Organisation and the Food and Agriculture Organisation declared the area to be free of the disease.

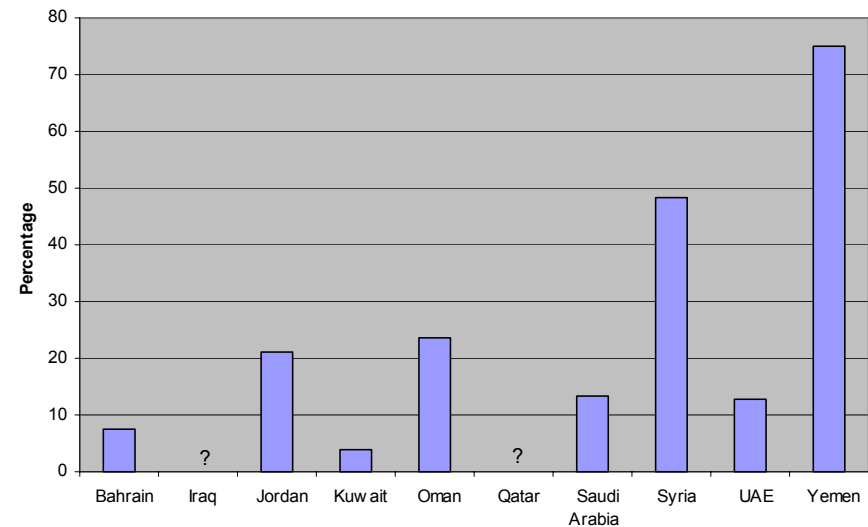
Subsequently, an outbreak of Rift Valley Fever occurred in Yemen in September 2000, involving 1,087 cases and 121 deaths (Nasher *et al.*, 2000). In response, the six member states of the Gulf Cooperation Council (Bahrain, Kuwait, Oman, Qatar, Saudi Arabia and UAE) banned importation of all live cattle, camels and goats and their meat from Djibouti, Eritrea, Ethiopia, Kenya, Nigeria, Somalia, Sudan, Tanzania, and Uganda (http://www.agjournal.com/story.cfm?story_id=997 and <http://www.fao.org/DOCREP/003/Y0482E/y0482e04.htm>).

2.7 Urban:Rural Population (Producer:Consumer) Ratio

Arguably, one of the most significant indicators of economic development is the proportion of rural inhabitants shown in Figure 11, which is also indicative of the ratio of producers as opposed to consumers of primary produce.

Yemen, with 75% of its population living in rural has by far the highest proportion, and Bahrain and Kuwait the lowest, with less than 10%. Jordan, Oman and Syria have between 20-50% of their populations living in rural areas, whilst in Saudi Arabia and the UAE rural dwellers account for only 10-15% of the population

Figure 11: Proportion of Human Population Living in Rural Areas



Source: <http://lnweb18.worldbank.org/mna/mena.nsf>

2.8 Variation in Demand for Live Sheep

Demand for sheep in Islamic countries varies over the course of a year, peaking during religious festivals. During the month of Ramadan, the ninth month of the Muslim calendar, adherents fast during the day and eat in the evening or early morning. When Ramadan ends, it is celebrated over a three-day holiday period known as Eid ul Fitr (Feast of Fast Breaking). Gifts are exchanged and friends and family gather for large meals. Lamb and mutton are popular choices for meals throughout Ramadan. A second festive occasion, Eid ul Adha (Feast of Sacrifice), is celebrated on the tenth day of the month of Zul-Hijja, a few months after Ramadan, when many Muslim families sacrifice a sheep.

2.9 Key Factors Shaping Pastoral Livestock Production

The main factors influencing pastoralism and livestock production in rangelands during the closing decades of the twentieth century, as identified by Blench (2001), are summarised in Table 4.

Table 4: Key Factors Shaping Pastoral Livestock Production

Factor	Impact
Modern veterinary medicine	Increases in productivity and greatly enlarged herds
Modern weapons	Major decline in predator threats, increasingly violent ethnic conflict and high levels of insecurity
Enclaving	Collapse of traditional 'safety-nets' in terms of long-distance migration in periods of climatic extremes
International pressure for hygiene in slaughtering and dairying	Declining market for pastoralist products
Declining prestige of dairy products	Terms of trade running constantly against pastoral livelihoods
World market in livestock products	Governments import cheap meat, milk etc. to satisfy urban demand at expense of pastoral sector
Ideological interference by the state	Inappropriate social and management strategies adopted and maintained by a combination of subsidised inputs and implied violence
Alternative calls on pastoral labour	Pressure for children to go to school and younger people to earn cash outside the pastoral economy
Modern transportation infrastructure	Replaces systems where transport is a major element of economic production (llamas, horses)
Introduction of high-input, high output exotic breeds	Makes pastoralists dependent on effective infrastructure where input supply is irregular, creating periodic crises
Emergency relief, restocking and rehabilitation programmes	Keeps non-viable households in pastoral areas, thereby accelerating the cycle of deficits
Conservation lobby	Pressure to turn previously pastoral land over to reserved wildlife/biodiversity regions with corresponding hard currency income from tourism
Encroachment on rangeland	Rangeland is being eliminated through the use of politically attractive but often uneconomic irrigation.

Source: Blench (2001).

3. NATIONAL ASSESSMENTS

3.1 Bahrain

3.1.1 Geography and People

The State of Bahrain is an arid, oil-rich, archipelago of 36 islands in the Gulf, with a total land area of 695km² and by far the highest human population density in the region.

In 2001, Bahrain had some 700,000 inhabitants, with a mean density of 986 people per square kilometre, increasing at 3.1% per annum. The rural population accounted for 7.5% of the total, and Gross National Income (GNI) per capita was US\$10,470.

(<http://lnweb18.worldbank.org/mna/mena.nsf>).

3.1.2 Arable Land

Historically, despite scant rainfall and poor soils, agriculture was an important part of the national economy. Before development of the oil industry, date palm cultivation dominated Bahrain's agriculture, producing sufficient dates for both domestic consumption and export. Economic development and urban expansion, however, have resulted in significant loss of traditional agricultural land. Salination of irrigated areas from contaminated groundwater has also contributed to a general decline in the extent of the cultivation.

The total cultivable area is estimated at 4,230ha, or 6% of the country. In 1994, the total cultivated area was about 3,165ha, all of which was irrigated, with 1,483ha of annual crops (vegetables and fodder crops) and 1,682ha of permanent crops (fruit trees and dates). In 1992, some 3,200 people (2% of the work force) were engaged in agriculture, and agricultural production amounted to 1% of GDP (<http://www.fao.org/ag/agl/aglw/aquastat/countries/bahrain/>).

3.1.3 Livestock Resources

Bahrain has relatively minor livestock resources, mainly, sheep, goats and cattle, with a few horses and camels (Table 5) and depends largely on imports for its supply of live animals and frozen meat, although some 13,000 head of cattle are maintained on intensive dairy farms.

Table 5: Bahrain's Livestock Populations 1995-97

Administrative Region	Area km ²	Cattle	Sheep	Goats	Camels	Chickens	Horses
Juzur Hawar	48	na	na	na	na	na	na
Al Manamah	26	na	na	na	na	na	na
Al Muharraq	20	na	na	na	na	na	na
Jidd Hafs	21	na	na	na	na	na	na
Sitrah	15	na	na	na	na	na	na
Al Mintaqah al Gharbiyah	201	na	na	na	na	na	na
Al Mintaqah ash Shamaliyah	24	na	na	na	na	na	na
Al Mintaqah al Wusta	30	na	na	na	na	na	na
Madinat Isa	14	na	na	na	na	na	na
Ar Rifa wa al Mintaqah al JanubiyAH	242	na	na	na	na	na	na
Madinat Hamad	12	na	na	na	na	na	na
Total 1995	653	13,444	20,000	17,000	1,016	na	3,800
Total 1996	653	13,013	17,066	15,511	1,000	na	3,911
Total 1997	653	13,055	18,151	15,433	1,000	na	4,111

Gulf Co-operation Council: <http://www.gcc-sg.org/agr56.htm>

No information available for regions.

As an indication of the scale of livestock imports, Bahrain has imported between 300,000-500,000 live sheep annually from Australia since 1992 (Figure 10).

3.2 Iraq

3.2.1 Geography and People

The country has a total area of 438,320km² including 924km² of inland waters. Topographically, Iraq lies in a basin, consisting of the Great Mesopotamian alluvial plain of the Tigris and the Euphrates rivers, surrounded by mountains to the north and by deserts to the south and west that cover more than 40% of the land area. Administratively, the country is divided into 18 Governorates, three of which are gathered in an autonomous region.

The climate is continental and sub-tropical and is characterized by cool to cold winters and hot to extremely hot, dry summers. Rainfall is highly erratic in time, quantity and location and ranges from less than 100mm to about 1,000mm/year. The substantial variation in rainfall is a perpetual risk to rainfed agriculture.

In 1989, the economy was dominated by the oil industry, which accounted for 61% of Gross Domestic Production (GDP). Agriculture contributed only 5% of GDP, but provided 20% of the employment (<http://www.fao.org/ag/agl/aglw/aquastat/countries/iraq/>). Sanctions imposed on Iraq after the Gulf War in 1990 have disrupted the economy and agricultural production, and distorted trade patterns within the region.

In 2001, Iraq had some 22 million inhabitants, with a mean density of 50 people per square kilometre. (<http://lnweb18.worldbank.org/mna/mena.nsf>).

3.2.2 Agriculture and Livestock

Just over a quarter of the land area (11.5 million hectares, or 26% of the country) is considered cultivable, but it is estimated that only 3.73 million hectares were cultivated 1993.

In 1995, the total human population was estimated at some 20.4 million, 25% of whom lived in rural areas. Average population density was 47/km², but ranged from 5/km² in Anwar Province, in the western desert, to more than 170/km² in Babylon Province, in the centre of the country. Average population growth during 1980-90 was 3.6%, but this has been reduced greatly by emigration of foreign workers and severe economic hardship since 1990.

Table 6: Iraq's Sheep Population by Governorate

Administrative Region	Area km ²	Cattle	Sheep	Goats	Camels	Chickens
Al Anbar	86,819	na	82,890	na	na	Na
Al Basrah	17,818	na	65,300	na	na	Na
Al Muthanna	51,959	na	333,500	na	na	Na
Al Qadisiyah	8,910	na	434,900	na	na	Na
As Sulaymaniyah	15,852	na	323,700	na	na	na
Babil	6,935	na	258,500	na	na	na
Baghdad	5,254	na	98,400	na	na	na
Dahuk	9,988	na	126,100	na	na	na
Dhi Qar	14,035	na	718,200	na	na	na
Diyala	18,347	na	1,111,422	na	na	na
Arbil	14,762	na	348,800	na	na	na
Karbala'	56,415	na	282,000	na	na	na
At Ta'min	7,800	na	479,200	na	na	na
Maysan	16,848	na	414,500	na	na	na
Ninawa	39,197	na	2,335,100	na	na	na
Wasit	17,407	na	715,700	na	na	na
An Najaf	27,609	na	111,400	na	na	na
Salah ad Din	20,541	na	654,100	na	na	na
Total	436,496		8,893,712	na	na	na

Source: Pers. Com. Hanan Mohammed. AGA, FAO, Rome.

In the aftermath of the Gulf War in 1990/91, subsequent sanctions and the current geo-political crisis, it has been difficult to find any credible information about the status of Iraq's livestock resources. Table 6 summarises the extent of sub-national information obtained and is confined to the distribution of Iraq's sheep population by Governorate.

An FAO/WFP crop and food supply assessment mission in 1993 was informed that livestock numbers had been reduced to less than half of their pre-war level of over 10 million, and that numbers continued to decline due to serious shortages of feed and veterinary drugs. The trade and movement of animals, particularly sheep and goats, into neighbouring countries where sale prices were substantially higher, was acknowledged to be a major factor in the decline of Iraq's livestock populations (<http://www.cam.ac.uk/societies/casi/info/undocs/fao1993.html>).

Another food and nutrition evaluation mission in 1995 reported that since 1991 cattle numbers had declined by 34%; buffaloes by 46%; sheep by 42%; and goats by 81% (FAO, 1995). The mission report referred to the attractive profits that could be made from the smuggling of cattle (sic) to neighbouring countries because of the weak Iraqi Dinar. Other contributory factors to the reduction in Iraq's livestock populations mentioned in the report were the ban on imported feeds and the conversion of rangeland pastures to grain production (<http://www.iacenter.org/fao.htm>).

The number of buffalo in Iraq has decreased from 141,450 in 1986; to 129,000 in 1990; and 98,700 in 1993. Three types are recognised: the marsh buffalo; the town buffalo; and the smaller mountain buffalo, found in northern Iraq (Magid, 1996).

3.3 Jordan

3.3.1 Geography and People

The Hashemite Kingdom of Jordan has a total area of some 89,210km² and is administered through eight Governorates: Amman, Zarqa, Irbid, Mafrqa, Balqa, Karak, Tafileh and Ma'an. The territory can be divided into four physiographic regions:

- Western Ghors, or lowlands, consisting of 3 zones: the Jordan valley from Lake Tiberias in the north (220m below sea level); the lowlands along the Dead Sea (405m below sea level); and Wadi Araba extending to the Red Sea (total 5,000km²);
- Longitudinal Highlands, between 600-1,600m above sea level (total area: 5,510 km²);
- Longitudinal plains, along the western borders of the desert (total area: 10,000km²);
- Eastern Desert (Badiah), an extension of the Arabian desert (total area: 68,700 km²).

In 2001, Jordan had some 5 million inhabitants, with a mean density of 56 people per square kilometre, increasing at 3.1% per annum. The rural population accounted for 21.2% of the total, and Gross National Income (GNI) per capita was US\$1,750 (<http://lnweb18.worldbank.org/mna/mena.nsf>).

3.3.2 Arable Land

Jordan has an estimated 381,740ha of cultivatable land, amounting to 4.3% of the country, 56% of which was being cultivated in 1991. The remaining 95.7% of the country are rangelands (<http://www.fao.org/ag/agl/aglw/aquastat/countries/jordan/index.stm>)

3.3.3 Land Use in the Rangelands²

3.3.3.1 Pastoralism

The single most significant economic use of the Jordanian rangelands is pastoralism and the most important animal herded is sheep, although goats are more numerous further south. This represents a major change from camel production, which was predominant until the 1940s. Camels are still kept in certain areas, but their numbers are much reduced. This change has almost certainly affected the vegetation patterns, since the large thorn bushes that camels browse cannot be eaten by sheep and goats, and small ruminants remove much of the ground cover.

The controlled system of land use in the rangelands, the hema system, persisted until the early twentieth century in some form, but grazing is now virtually uncontrolled.

3.3.3.2 Cultivation

One of the most visible uses of the Jordanian rangelands is for agriculture. Given the extremely low rainfall, this area is not usually regarded as suitable for agriculture. Despite this, cropping is common all along the western edge of the rangelands. The most common pattern is rainfed winter barley and the ploughing of undisturbed rangeland is usually associated with this pattern. Yields are so poor that it is difficult to demonstrate that such production is economic and its function may be as much to bolster land claims as to provide cereals and the practice has been referred to as “pseudo-cropping.”

Irrigated cultivation is usually based on drip-fed systems, using large rubber hoses with smaller feeder hoses and drawing water from

artesian sources. This is most apparent in the region between the Mafraq to As-Safawi road and the Syrian border. The artesian wells, as most in the northern border region, depend on the watershed with its source in the Jebel Druze. The watershed continues as far as Saudi Arabia, where, however, the water is saline. Extremely high rates of extraction are increasing the salinity gradient in Jordan and it is likely that within a few years much of the water from these wells will be unsuitable for agriculture.

3.3.3.3 Pastoral Movement

The conventional classification of pastoral movements in Jordan into: i) Vertical transhumance from mountains to valleys; ii) East-West transhumance; and iii) Nomadism, i.e., all-year-round movement; refers to an earlier period, and is no longer appropriate.

A combination of the use of vehicles to move flocks, the rise of detribalized producers with no respect for the traditional system of grazing rights, and the use of modern communications to establish areas of potential grazing, have all combined to produce considerably more fragmented and erratic patterns of livestock movement. Previously described tribal migrations along specific routes to specific areas are also no longer generally followed. Economic individualism has meant that each member of a particular tribe decides both whether to go on migration and, if so, where.

A major transformation of pastoral livestock production has occurred in Jordan's rangelands and many former pastoral families have settled and ceased to move their livestock on a regular basis. The need for education and health care, as well as the availability of animal feeds and water, have all contributed to widespread sedentarisation.

² This section and the next are derived from Blench (1998) and is based on an extensive field survey in 1995 for IFAD and the Ministry of Agriculture.

It is also worth noting, however, that it is perfectly possible to be a pastoral nomad and at the same time to have a settled family with a farm and children going to school. Indeed, because of the potential to have more than one wife, some pastoralists maintain two distinct families with two distinct lifestyles.

The gradual establishment of national borders and the increasing difficulty of seeking pasture in other countries has stimulated the development of a number of mechanisms to circumvent the inevitable restriction on access to pasture. One of the most intriguing mechanisms for persisting with cross-border migration is the use of re-sale rings. Essentially, if an owner wishes his herd to make use of pasture in another country, he “sells” it to another pastoralist, who herds it while the pasture is available. When the pasture is exhausted, the herd is “sold” back to the original owner, or on to someone else. Such rings may involve more than one country, and animals may move in large circles crossing from Syria to Jordan, Saudi Arabia and Iraq. For obvious reasons, it is difficult to obtain details on the extent of this practice.

3.3.4 Livestock Resources

The distribution of Jordan’s livestock resources by Governorate in 2000 is presented in Table 7. Sheep are by far the most numerous ruminant species, with more than 1.6 million head, but their number has declined progressively since 1995, as indicated in Figure 12. Goats have also decreased substantially over the same period, whilst cattle numbers have fluctuated between 40,000 and 60,000.

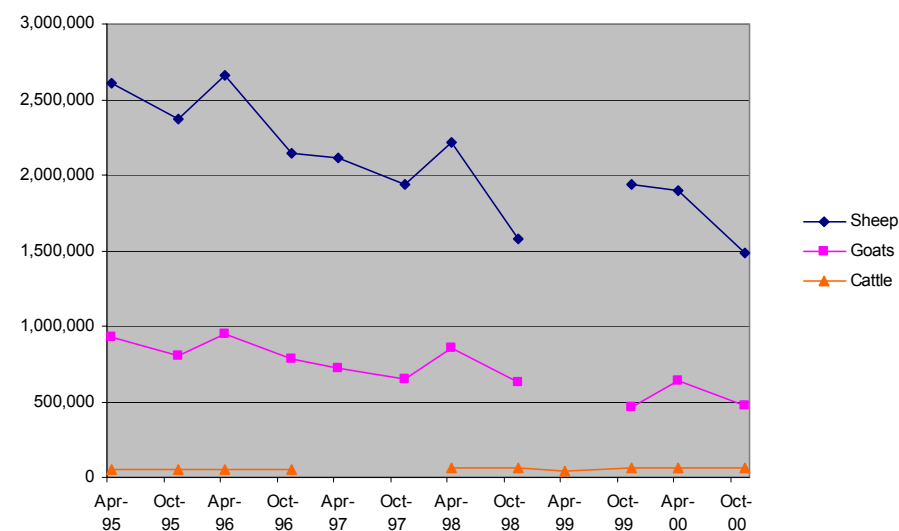
The reduction in small ruminant populations is believed to reflect the phasing out of government subsidies on imported grain that was widely used as a livestock feed during the nineties (ERGO, 1995).

Table 7: Jordan's Livestock Populations by Region - 2000

Administrative Region	Area km2	Cattle	Sheep	Goats	Camels	Chickens
Al Balqa'	1,227	6,029	80,778	39,712	na	na
Ma'an	39,204	15	132,997	107,862	na	na
Al Karak	3,868	19	116,538	43,796	na	na
Al Mafraq	25,677	6,935	561,873	50,124	na	na
'Amman	13,641	10,381	424,815	152,969	na	na
At Tafilah	2,238	0	22,009	7,084	na	na
Az Zarqa	830	22,105	215,258	54,503	na	na
Irbid	2,593	15,139	135,602	100,346	na	na
Total	89,278	60,623	1,689,870	556,396	na	na

Source: Pers. Com. Pius Chilonda. AGA, FAO, Rome.

Figure 12: Livestock Population Trends in Jordan 1995-2000



Source: http://www.dos.gov.jo/agr/stat_f_1.htm

3.3.5 Small Ruminant Production Systems

There are three main systems of rearing sheep and goats in Jordan (McDermott, pers. com.):

1. The “traditional” system of the village Bedouin. Around 70% of sheep and goats are in this system. Livestock movements are restricted to short distances from the village. Barley and other crops are grown. Sheep and goats graze on crop residues after the harvest. Movements are seasonal and more extensive in drought years. Mainly found in Northern and Eastern Jordan (Badia area).
2. Smallholder “village” systems in crop-livestock farming areas. Most farmers have less than 100 sheep and goats that graze on pasture and crop residues. More common in the North and West and some in the South of Jordan.
3. Fattening system, in which investors/small traders buy 100-150 sheep at weaning and fatten them. This is usually a seasonal trade associated with the Haj and other festivals.

3.3.6 Transformation of Traditional Transhumance

As previously noted, traditional patterns of seasonal transhumance, documented in the classic literature on the Bedu in Jordan and neighbouring countries, has virtually disappeared in favour of a more opportunistic system using trucks and telecommunications to exploit remote pastures (Blench, 1998).

The main reasons for these profound changes in traditional Bedu behaviour relate to: the availability of trucks to move animals and water; telecommunications to assess the availability of pasture; official closure of national frontiers to the pastoral movements;

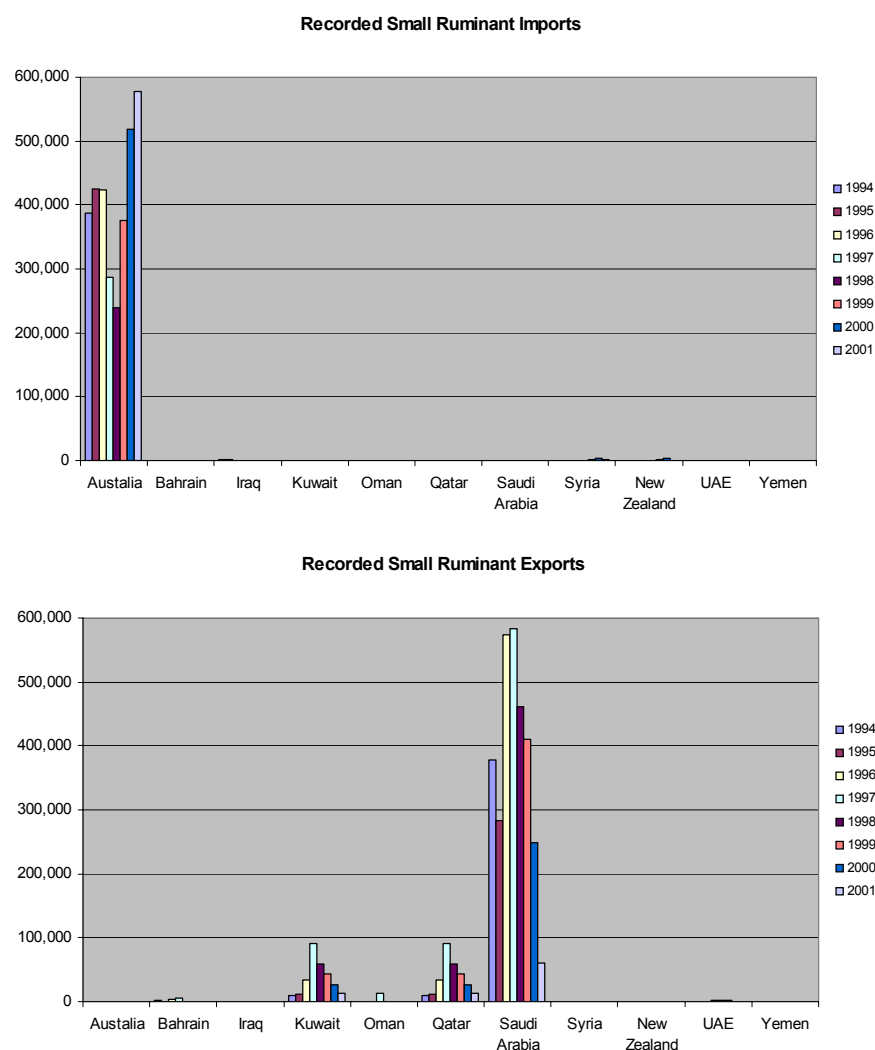
breakdown of traditional authority systems; and a relatively liberal political climate.

3.3.7 Livestock Imports and Exports

Livestock markets and exports in Jordan are complicated because many animals originating in other countries are sold through Jordan to Saudi Arabia and the Gulf States. For animals originating from Syria there is no problem, as animals are judged not to be healthy can be returned. However, if animals originate in other countries and pass through Syria (such as Turkey), there is no negotiated return-to-origin mechanism.

Both Jordan and Saudi Arabia are members of the World Trade Organisation (WTO) and abide by its Sanitary and Phyto-sanitary (SPS) agreements through OIE (McDermott, pers. com.).

Figure 13: Jordan's Small Ruminant Trade



Source: <http://www.dos.gov.jo/>

Jordan's official external trade statistics are available from the Department of Statistics website (http://www.dos.gov.jo/dos_home/home_e.htm). They include numbers of recorded live animal imports and exports from 1994 to 2001, and provide an indication of the scale and direction of the livestock trade. Information is available for equines, bovines, small ruminants, poultry and other livestock, but the small ruminant trade, shown in Figure 13, is by far the largest and is almost entirely sheep. From these figures, it would appear that virtually all Jordan's small ruminant imports come from Australia, and that the main destination of Jordan's small ruminant exports is Saudi Arabia and, to a much lesser extent, Kuwait and Qatar.

Imports from Australia rose steeply from 1998 to 2001, whilst exports to Saudi Arabia declined sharply from 1997 to 2001. The reason for this is unknown, but may relate to Saudi import restrictions. Animals imported from Australia are not necessarily re-exported to Saudi Arabia, as locally produced Jordanian sheep are preferentially exported because they command higher prices.

It is difficult to assess how comprehensive and reliable these statistics are, but it is worth noting that surprisingly few imports are recorded from Iraq, Syria and Turkey. Also, with such extensive land borders and close links between pastoral communities living in adjacent territories, it seems likely that significant numbers of trans-boundary livestock movements go unrecorded.

3.4 Kuwait

3.4.1 Geography and People

Kuwait is an arid, relatively small, oil-rich state of 17,820km² at the head of the Gulf, with limited water resources. Most of the territory is desert, with a few oases and sparse vegetation.

The terrain is generally flat or gently undulating, broken only by occasional low hills and shallow depressions. The elevations range from sea level in the east to 290m at Ash-Shaqaya peak, in the western corner of the country. The Az-Zawr escarpment, one of the main topographic features, borders the north-western shore of Kuwait Bay and rises to a maximum elevation of 145m above sea level.

Elsewhere in coastal areas large patches of salty marshland have developed. Throughout the northern, western, and central sections of Kuwait there are desert basins, which fill with water after winter rains; historically, these basins formed important watering places, refuges for Bedouin camel herds (Anon., 2001).

In 2001, Kuwait had some 2 million inhabitants, with a mean density of 112/km², increasing at 3.1% per annum. The rural population accounted for 3.9% of the total, and Gross National Income (GNI) per capita was US\$18,270 (<http://lnweb18.worldbank.org/mna/mena.nsf>).

3.4.2 Arable Land

About 154,000ha are potentially cultivable, but most of this is permanent pasture. Estimates of potential crop land vary between 25,000-37,500ha, located mainly near the southern border (Al-Wafra), near the northern border (Al-Abdally) and in the centre of the country (Al-Sulaibiya). In 1994, the total cultivated area was 4,770ha, of which 4,320ha consisted of annual crops, and 450 ha consisted of permanent crops, mainly date palms. (<http://www.fao.org/ag/agl/aglw/aquastat/countries/kuwait/index.stm>)

3.4.3 Livestock Resources

More than 80% of the livestock in Kuwait - mostly cattle, sheep and goats - died between the Iraqi occupation in August 1990 and the ceasefire in March 1991 (Loretz, 1991). Principal causes of death

were attributed to: starvation; dehydration; intentional, or accidental shooting; slaughter for food; and bombing. Some animals may also have been withdrawn temporarily to safer areas and subsequently returned.

Of the 34 dairy farms with 15,000 cattle operating in August 1990, only two dairies with 2,500 cattle were still functioning in any capacity after the ceasefire. Sheep had been reduced from 800,000 to 10,000; camels from 10,000 to 2,000; and horses, including many thoroughbreds, from 3,000 to fewer than 500.

The distribution of recovering and replenished livestock resources is concentrated in Ahmadi and Jhara Governorates, as indicated in Table 8. Sheep are still the most numerous ruminant species, followed by goats, cattle and camels.

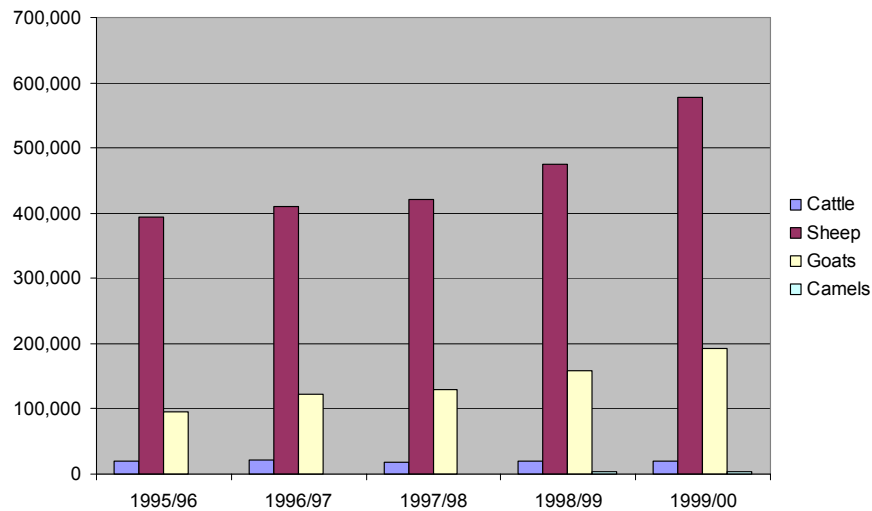
Table 8: Kuwait's Livestock Populations: 1999/2000

Governorate	Cattle	Sheep	Goats	Camels	Poultry
Hawalli	13	126	203	0	539,300
Ahmadi	1,981	234,984	77,962	2,563	10,031,379
Jhara	18,561	342,270	113,763	899	15,744,184
Farwaniya	0	0	0	0	0
Total	20,555	577,380	191,928	3,462	26,314,863

Source: <http://www.mop.gov.kw/mopwebsite/statpdf2001/Chapter07.pdf>

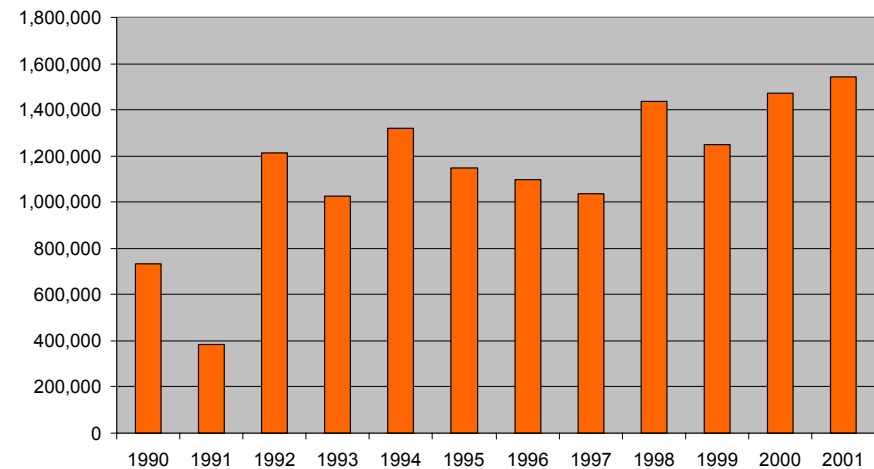
As is evident from Figure 14, small ruminant populations have increased progressively over the period from 1995 to 2000, to well in excess of pre-war levels, as has the cattle population, but camels have yet to recover to their former abundance.

Figure 14: Kuwait's Livestock Populations 1995-2000



Source: <http://www.mop.gov.kw/mopwebsite/statpdf2001/Chapter07.pdf>

Figure 15 : Kuwait's Imports of Australian Live Sheep



Source: http://www.livecorp.com.au/Statistics_sheep_Dest.asp

3.4.4 Livestock Imports

Given the size and wealth of its human population and limited livestock resources, it is not surprising that Kuwait depends heavily on food imports, including live animals. Following the Gulf War, Kuwait's imports of live sheep from Australia have steadily increased over the past decade to exceed 1.5 million in 2001 (Figure 15), surpassed only by Saudi imports of 2.1 million (Figure 10).

Kuwait thus appears to import 2.5 times as many sheep from Australia than graze its arid plains. It is not clear, how many Australian sheep are consumed locally or are sold on and exported to neighbouring countries, or indeed how many indigenous animals from those countries are imported into Kuwait.

3.5 Oman

3.5.1 Geography and People

The Sultanate of Oman is an arid, oil rich state occupying a total area of 312,500 km² in the south-eastern corner of the Arabian Peninsula. The country has a varied topography with extensive plains, deserts, mountain ranges and wadis. Mean annual rainfall is generally very low, varying from less than 20mm in the interior deserts to over 300mm in the highlands.

Northern Oman is dominated by three physiographic zones. The long, narrow coastal plain of Al-Batinah stretches along the Gulf of Oman. The high, rugged Al-Hajar Mountains extend south-eastward, parallel to the gulf coast, from the Musandam Peninsula to a point near Ra's

Al-Hadd at the easternmost tip of the Arabian Peninsula. The great central divide of Wadi Sama'il separates the Al-Hajar into a western and an eastern range. An inland plateau falls away to the southwest of the Al-Hajar Mountains into the great Rub' al-Khali (Empty Quarter) desert, which the sultanate shares with Saudi Arabia and Yemen.

The southern region of Dhofar (Zufar) is separated from the rest of Oman by several hundred miles of open desert. Dhofar's coastal plain is fertile alluvial soil, well watered by the southwest monsoon. Wooded mountain ranges, rising to about 1,500m, form a crescent in Dhofar behind a long, narrow coastal plain, on which the provincial capital of Salalah is located. Behind the mountains, gravel plains gradually merge northward into the Rub' al-Khali (Anon., 2001).

With the exception of the mountains of the Southern Region, which have a tropical monsoon climate, Oman is a sub-tropical desert. Rainfall is low and irregular. Mean annual rainfall is below 50mm in the interior, the major part of the country, and about 100mm in coastal areas. The Hajar mountains receive 100-300mm and the Dhofar mountains, influenced by the monsoon, receive 200-260mm (<http://www.fao.org/WAICENT/FAOINFO/AGRICULT/AGP/AGPS/Pgrfa/pdf/oman.pdf>).

The Sultanate is divided into eight administrative regions: A'Dakhliyah; A'Dhahira; Al Batinah; Dhofar; Al Wusta; Muscat; Musandam; Al Sharqiya.

In 2001, Oman had some 2.5 million inhabitants, with a mean density of 12 people per square kilometre, increasing at 2.0% per annum. The rural population accounted for 23.5% of the total, and Gross National Income (GNI) per capita was US\$7,600. (<http://lnweb18.worldbank.org/mna/mena.nsf>).

3.5.2 Arable Land

The cultivable area is estimated at 2.2 million hectares, or 7% of the country. In 1993, the cultivated area was 61,550ha, consisting of 18,550ha of annual crops and 43,000ha of permanent crops. More than half the agricultural area is in the northern Batinah Plain.

<http://www.fao.org/ag/agl/aglw/aquastat/countries/oman/index.stm>

3.5.3 Livestock Resources

The Sultanate is a leading livestock producer in the Gulf region. Goats are most numerous livestock species, followed by sheep, cattle and camels (Table 9). Government's policy is to increase local production and reduce dependence on imports (<http://www.nizwa.net/agr/agriculture.html>).

Table 9: Oman's Livestock Populations

Administrative Region	Area km ²	Cattle	Sheep	Goats	Camels	Chickens
Al Batinah	14,751	na	na	na	na	na
Ad Dakhiliyah	33,293	na	na	na	na	na
Al Wusta	77,244	na	na	na	na	na
Az Zahirah	44,387	na	na	na	na	na
Musandam	1,611	na	na	na	na	na
Masqat	4,648	na	na	na	na	na
Ash Sharqiyah	34,383	na	na	na	na	na
Zufar	99,366	na	na	na	na	na
Total 1999	309,683	285,000	327,000	959,000	117,000	na
Total 2000	309,683	298,900	343,900	978,500	118,900	na
Total 2001	309,683	313,500	354,200	998,400	120,800	na

Source: http://www.moneoman.gov.om/stb_web/tables/agriculture.htm

No information available for regions.

Model sheep production units have been set up, and the latest technology is being applied to improve fertility, lower death rates and increase growth rates. The Ministry of Agriculture and Fisheries is

supplying livestock breeders with concentrated feed, as well as fertilisers and seed for improved fodder production. Dairy development initiatives include providing dairy farmers with equipment and marketing assistance and demonstration of modern herd management techniques. An artificial insemination scheme has been introduced. Beef production and marketing is also being promoted in traditional cattle-breeding areas of the Jabali tribesmen on the coast-facing mountain slopes behind the coastal plain to meet increasing demand in northern Oman. It is hoped that increased off-take will relieve the mounting pressure on grazing lands.

Table 10: Oman's Vaccination Returns

Disease	1999	2000	2001
Cattle Plague	74,372	18,016	1,073
Goats & Sheep Pox	242,523	326,299	261,226
Enterotoxaemia	403,641	622,011	571,179
Rabies	—	5,960	41,421
Botulism	62,691	30,721	71,334
PPR	438,550	411,030	308,214

Source: http://www.moneoman.gov.om/stb_web/tables/agriculture.htm

A nationwide programme to immunise all livestock against common animal diseases has been introduced, with veterinary clinics at Haima, Wadi Bani Khalid, Al Oqbah, Madha and at Sint in the Wilayat of Bahla, and a veterinary quarantine station has been established in the Wadi Jizzi on the overland trade route with neighbouring countries.

3.5.4 Changing Patterns of Rural Trade

Marketing systems link producers to consumers and are important indicators of economic interdependence and change. In the Wahiba Sands and their margins in Oman, traditional exchange relationships involving the region's three main productive activities, namely

pastoralism, agriculture and fishing, are changing dramatically (Christie, 1988).

Although some of this change is due to the natural growth of the rural economy, the most rapid and recent developments are a regional response to growth in the national economy resulting from the discovery of oil. Marketing strategies differ widely between local products. All, however, are influenced by newly established trade relationships between this and other regions in Oman and between Oman and other nations, particularly the United Arab Emirates and Saudi Arabia.

Food imports, flooding the markets, have made a particularly significant impact on the viability of the rural economy, although a much wider range of imported consumer goods are also now to be found in markets throughout Oman. The competition from imported food products, notably fresh fruit and vegetables, hampers the development of the rural economy, while access to other imports has greatly altered life-styles and material expectations to the extent that cash is now a more highly desirable commodity than ever before.

Market centres are expanding and transport networks are being improved to accommodate the growth in the commercial economy. Without assistance, neither the local producer, nor the regional economy as a whole can adapt at sufficient speed to keep pace with new and growing consumer demands. Marketing assistance from the Government to the producer has taken a variety of forms and met with various degrees of success. Contradictions between consumer and producer interests and between traditional production strategies and new market opportunities pose particular difficulties.

3.6 Qatar

3.6.1 Geography and People

Qatar is an independent oil-rich, emirate on a peninsula on the west coast of the Gulf, occupying a land area of some 11,437km². Most of the 160km long and 80km wide peninsula is a flat, stony, barren, low-lying desert, rising from the east to a central limestone plateau; with low hills along the western and northern coasts. Sand dunes and salt flats, or sabkhahs, are the chief topographical features of the southern and south-eastern sectors.

Vegetation is found only in the north, where the country's irrigated farming areas are located and where desert plants blossom briefly during the spring rains; fauna is limited. Rainfall is scarce and erratic, with less 75mm falling annually (Anon., 2001).

In 2001, Qatar had some 600,000 inhabitants, with a mean density of 55 people per square kilometre, increasing at 3.0% per annum. (<http://lnweb18.worldbank.org/mna/mena.nsf>).

3.6.2 Arable Land

Qatar's cultivable land is estimated at 28,000ha, or 2.5% of the total area. In 1994, 8,312 ha were estimated to be cultivated, of which 5,987ha were annual crops (mainly green fodder, vegetables and cereals) and 2,325ha were permanent crops (mainly dates).

<http://www.fao.org/ag/agl/aglw/aquastat/countries/qatar/index.stm>

3.6.3 Livestock Resources

Qatar relies on imports for most of food requirements, although it does have some livestock resources of its own, mainly sheep and goats, as indicate Table 11.

Table 11: Qatar's Livestock Populations

Administrative Region	Area km2	Cattle	Sheep	Goats	Camels	Chickens	Horses
Ad Dawhah	102	na	na	na	na	na	na
Al Ghuwayriyah	587	na	na	na	na	na	na
Al Jumayliyah	2,422	na	na	na	na	na	na
Al Khawr	1,063	na	na	na	na	na	na
Ar Rayyan	850	na	na	na	na	na	na
Ash Shamal	1,094	na	na	na	na	na	na
Al Wakrah	1,007	na	na	na	na	na	na
Jarayan al Batnah	3,603	na	na	na	na	na	na
Umm Salal	404	na	na	na	na	na	na
Total 1995	11,132	13,635	191,851	167,925	48,483	na	1,436
Total 1996	11,132	13,651	199,682	172,071	49,388	na	1,451
Total 1997	11,132	13,849	202,826	173,670	49,809	na	3,608

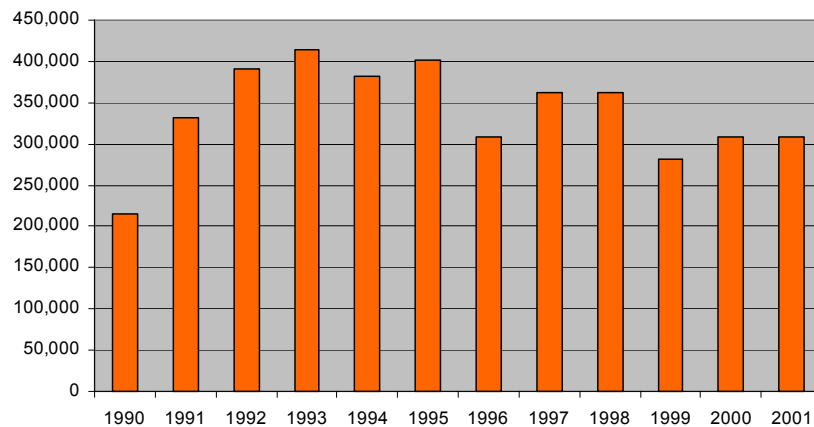
Gulf Co-operation Council: <http://www.gcc-sg.org/agr56.htm>

No information available for regions.

3.6.4 Livestock Imports

Qatar imports livestock from a variety of sources, including 300-400,000 live sheep annually from Australia, as indicated in Figure 16.

Figure 16: Qatar's Imports of Live Sheep from Australia



Source: http://www.livecorp.com.au/Statistics_sheep_Dest.asp

3.7 Saudi Arabia

3.7.1 Geography and People

The Kingdom of Saudi Arabia, with a total area of about 2.15 million km², is by far the largest country in the Arabian Peninsula and is dominated by a plateau that rises abruptly from the Red Sea and dips gently toward the Gulf. An imposing escarpment runs parallel to the Red Sea. The north-western highlands rise to 1,500m, decreasing slightly to around 1,250m near Medina and increasing to more than 3,000m to the south-east. The watershed is 40km from the Red Sea in the north, receding to 120km near the Yemen border. The coastal plain, known as the Tihamah, is virtually non-existent in the north, except for occasional wadi deltas, and widens slightly towards the south.

Inland, the surface gradually descends into the broad plateau area of the Najd, covered with lava flows and volcanic debris as well as with occasional sand accumulations; it slopes down from an elevation of about 1,500m in the west to about 800m in the east.

The interior of the Arabian Peninsula contains extensive sand surfaces. Among them is the world's largest sand area, the Rub' al-Khali (the Empty Quarter), which dominates the southern part of the country and covers more than 650,000km². Eastward, as the plateau surface slopes very gradually down to the gulf, there are numerous salt flats (sabkhas) and marshes (Anon., 2001).

In 2001, Saudi Arabia had some 21.4 million inhabitants, with a mean density of 10/km², increasing at 2.6% per annum. The rural population accounted for 13.4% of the total, and Gross National Income (GNI) per capita was US\$8,480 (<http://lnweb18.worldbank.org/mna/mena.nsf>).

3.7.2 Traditional Agriculture and Pastoral Nomadism

In the past, the bulk of agricultural production in Saudi Arabia was concentrated in a few small areas. Produce was largely retained by local communities, although some surplus was sold to the cities. Nomads played a crucial role in this regard, shipping foods and other goods between the widely dispersed agricultural areas. Livestock rearing was shared between the sedentary communities and nomads, who also used it to supplement their livelihoods.

Lack of water has always been the major constraint on agriculture and determine where cultivation occurred. There are no lakes or rivers, and rainfall is slight and irregular over most of the country. Only in the south-west, in the mountains of Asir, close to the Yemen border was rainfall sufficient to support regular cropping. This

region, plus the southern Tihamah coastal plains, sustained subsistence farming. Cropping in the rest of the country was scattered and dependent on irrigation. Along the western coast and in the western highlands, groundwater from wells and springs provided adequate water for self-supporting farms and, to some extent, for commercial production. Moving east, in the central and northern parts of the interior, Najd and An Nafud, some groundwater allowed limited farming. The Eastern Province supported the most extensive plantation economy, with major oases centred around Al Qatif and Al-Hasa, which enjoy high water tables, natural springs, and relatively good soils.

Historically, the limited arable land and the near absence of grassland required livestock keepers to adopt a nomadic existence and take advantage of what forage was available. Only in summer, the year's driest time, did the nomad keep his animals around an oasis or well for water and forage. The Bedouin developed special skills knowing where rain had fallen and forage was available to feed their animals and where they could find water en route to various forage areas.

Traditionally, Bedouin were not self-sufficient but needed some food and materials from agricultural settlements. The near constant movement required to feed their animals limited other activities, such as weaving. Settled farmers and traders needed the nomads to tend to their camels. Nomads would graze and breed animals belonging to sedentary farmers in return for portions of the farmers' produce. Bedouin groups contracted to provide protection to the agricultural and market areas they frequented in return for such provisions as dates, cloth and equipment. Bedouin supplemented their income by taxing caravans for passage and protection through their territory (United States Library of Congress: <http://memory.loc.gov/frd/cs/satoc.html>).

3.7.3 Agricultural Development³

Since the 1970s, the Government has undertaken a massive restructuring of the agricultural sector to enhance food security through self-sufficiency and improve rural incomes. There has been a 25-fold increase in cultivation over the past three decades, from 150,000ha in the early seventies to 3.7 million hectares at the turn of the century - an impressive achievement given the environmental conditions, - although arable land still amounts to less than 2% of the total. Agriculture's share of gross domestic product (GDP) has risen from 1.3% in 1970 to 9.4% in 1998, and 16% of the population are employed in the agricultural sector.

Sufficient surpluses are produced for export of some commodities, notably grain, poultry and milk. This increased production, however, has been very much dependant on exploitation of non-renewable water resources and extensive use of chemical fertilisers. Two distinct agricultural sub-sectors have emerged; one, based on modern, large-scale, high-input production units; and the other, derived from traditional, farming and pastoral systems.

³ This and subsequent sections are synthesised from a variety of sources including:

Government of Canada's International Development Agency: Bi-Weekly Bulletin: <http://www.agr.gc.ca/mad-dam/e/bulletine/v14e/v14n11e.htm>

Government of the Kingdom of Saudi Arabia: <http://www.saudiembassy.org.uk/index2.htm>

Government of the United Kingdom: http://www.tradepartners.gov.uk/agriculture/saudi_arabia/profile/overview.shtml

Overseas Development Institute: <http://www.odi.org.uk/pdn/drought/>

United States Library of Congress: <http://memory.loc.gov/frd/cs/satoc.html>

Trade and Environment Database: <http://www.american.edu/projects/mandala/TED/saudi.htm>

3.7.4 Transformation of Pastoral Livestock Production

Profound changes in pastoral livestock production have taken place in Saudi Arabia over the past half-century, as documented by Ahmad (1998); Finan and Al Haratani (1998); Al-Eisa (1998); and Abdulla *et al.* (1998). Traditional nomadism as a production system no longer exists in Saudi Arabia. Dependency on range forage as a basic feed resource has declined from 100% to less than 20%. Nomadic movements have been mechanised and operations commercialised.

A major shift has taken place from traditional camel-rearing to commercialised sheep-raising. Herd sizes have increased manifold to suit the new economic conditions. Expansion in the sizes of production operations, in addition to other social changes, have resulted in a growing demand for foreign labour.

The new system of mechanized nomadism, with vehicles and water tankers, requires high levels of capital investments and cash to run livestock enterprises. Production levels are generally low. The availability of cheap barley feed, machinery and labour expenses are the most important factors determining production expenses. These factors tend to favour large-sized operations for economies of scale (Abdalla *et al.*, 1998).

3.7.5 Livestock Resources

The numerical distribution of Saudi Arabia's livestock resources by administrative region in 1998 is indicated in Table 12, and some of the major changes in livestock production that have occurred over the past few decades are considered in subsequent sections.

Table 12: Saudi Arabia's Livestock Populations by Region in 1998

Administrative Region	Area km ²	Cattle	Sheep	Goats	Camels	Chickens
Al Bahah	10,350	32,385	500,754	711,427	17,797	2,257,095
Al Jawf	117,168	54,059	513,694	26,915	1,916	1,244,607
Al Madinah	144,400	7,024	295,446	252,890	6,318	9,598,433
Eastern	568,617	2,410	122,235	77,537	5,930	22,918,497
Al Qasim	54,545	17,056	956,173	785,701	81,225	91,621,221
Ar Riyad	378,599	120,948	1,085,404	412,915	131,543	56,858,923
'Asir	77,587	890	238,356	331,245	31,453	27,937,022
Ha'il	121,497	23,679	1,617,100	1,199,237	29,525	10,257,255
Makkah	138,714	19,228	813,455	189,337	67,247	95,981,825
Northern	125,860	6,709	134,523	75,655	8,630	586,380
Najran	107,287	22	15,684	2,600	233	3,425,342
Jizan	15,194	3,239	494,575	255,511	26,570	2,881,884
Tabuk	99,306	3,479	634,507	29,190	6,854	3,179,882
Total	1,959,124	291,128	7,421,906	4,350,160	415,241	328,748,366

Source: Pers. Com. Pius Chilonda. AGA, FAO, Rome.

3.7.6 Modern Poultry Production

Poultry consumption has steadily risen since 1975. The total 2001-2002 poultry production forecast was 410,000t, which was about 55% of domestic consumption. Of this total, about 400,000t were broiler meat. Per capita poultry consumption increased slightly from 32.5kg in 1998-1999 to a forecast of 33.4kg in 2001-2002.

Saudi Arabia is the largest importer of frozen poultry meat in West Asia. Expansion projects at two of Saudi Arabia's largest poultry producers in 1996, resulted in a 30% increase in poultry output, accompanied by a 26% increase in corn and soymeal exports to Saudi Arabia between 1996/97 and 2000/01. A continued increase in per capita demand and population growth is likely to result in a growing poultry sector and larger imports of corn and soymeal.

3.7.7 Modern Dairy Production

Modern dairy operations in Saudi Arabia are efficient and productive. The largest vertically integrated dairy production operation in Saudi Arabia is run by Almarai Company Limited, accounting for 40% of the dairy products market. Almarai has over 19,000 lactating cows and approximately 19,000 dry and replacement cows on four farms. The company's dairy processing plant processes and packages approximately 500 million litres annually. Milk production has reached an annual rate of 8,100 litres per cow, one of the highest in the world, and significant quantities are exported to Gulf countries.

3.7.8 Beef and Veal Production

Beef and veal production was estimated at 17,000t for 2000/01, which was the same as the previous several years, but down from the all time high of 30,000t in 1994/95. Consumption has been variable in the last 10 years, ranging from 62,000t in 1990/91 to 98,000t in 1993/94, but has been trending upwards. Consumption in 2000/01 was expected to surpass 83,000t. Imports have also been variable but have trended upwards. In the past the European Union (EU) has provided more than half of Saudi meat imports, but import of EU beef and veal was banned following the outbreak of Foot and Mouth Disease in 2001.

3.7.9 Demand for Sheep

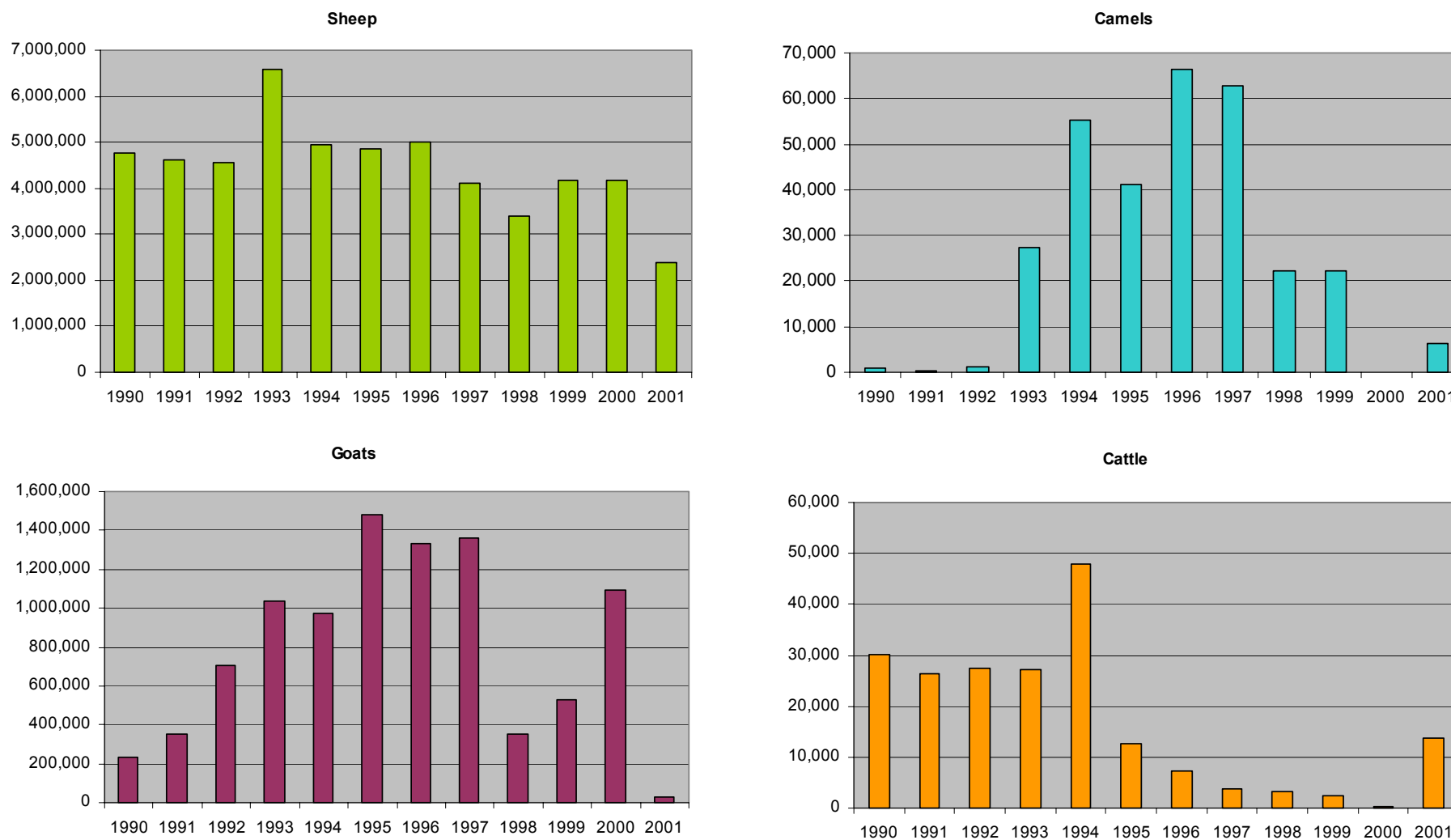
Saudi Arabia receives an annual influx of some 2 million pilgrims going on the Haj to Mecca, which generates considerable extra demand for sheep, over and above baseline levels.

About 11.5 million sheep are slaughtered annually in Saudi Arabia (<http://www.agr.gc.ca/mad-dam/e/bulletine/v14e/v14n11e.htm>).

Consumption is very high during the Eid Al Adha (The Feast of Sacrifice), which commemorates Abraham's intention to sacrifice his son in fulfilment of God's order. During this very important Islamic

holiday, business usually stops for five days and some 3 million rams are slaughtered. This major celebration begins on the twelfth month of the Muslim lunar calendar and in 2001, took place in late February.

Figure 17: Saudi Live Animal Imports: 1990-2001



Source: FAO's Statistical Database: <http://apps.fao.org/>

3.7.10 Livestock Imports

Saudi Arabia is by far the largest importer of live animals in the region and has regularly imported 3-5 million sheep and a million or so goats annually over the past decade (Figure 17). Far fewer, but nevertheless many tens of thousands of camels and cattle were also imported annually during the nineties, but numbers declined sharply towards the end of the decade. Recorded live animal imports were especially low in 2001, which probably reflects the ban on imports imposed after the outbreak of Rift valley Fever (see next section).

It has not been possible to obtain a complete picture of the origin of Saudi Arabia's livestock imports. Historically, Somalia and Sudan have been major suppliers of sheep, goats and camels. Iraq, Jordan and Syria have also been important suppliers from the north, as have Oman and Yemen from the south. More recently, Australia has also become a major supplier of live sheep, either directly, or through neighbouring countries, as indicted in Figure 10. In 2001, more than 2.1 million live sheep were exported from Australia to Saudi Arabia.

3.8 Syria

3.8.1 Geography and People

The Syrian Arab Republic is located at the western edge of Asia on the east coast of the Mediterranean Sea. The country has a relatively short coastline of 180km between Turkey and Lebanon and an area of 185,180km², including the Golan Heights. Inland, the Jabal an-Nusayriyah range borders the coastal plain, with an extensive, stony, inhospitable, semi-desert further to the east (Anon, 2001).

The country is divided into 14 Governorates, including the capital, Damascus, and has four physiographic regions:

- Coastal region between the mountains and the sea;
- Mountains and highlands, parallel to the Mediterranean coast;
- Interior plains, east of the highlands, including the plains of Damascus, Homs, Hama, Aleppo, Al-Hassakeh and Dara'a;
- South-eastern Badiyah and desert, bordering Jordan and Iraq.

In 2001, Syria had some 16.6 million inhabitants, with a mean density of 90/km², increasing at 2.5% per annum. The rural population accounted for 48% of the total, and Gross National Income (GNI) per capita was US\$1,010 (<http://lnweb18.worldbank.org/mna/mena.nsf>).

3.8.2 Arable Land

In 1993, Syria had an estimated 5.94 million hectares of cultivable land, 83% of which was cultivated, with 4.27 million hectares of annual crops and 0.67 million hectares of permanent crops. Almost two-thirds of the cultivated area was located in the three northern Governorates of Aleppo, Al-Reqqa and Al-Hassakeh (<http://www.fao.org/ag/agl/aglw/aquastat/countries/syria/index.stm>).

3.8.3 Livestock Resources

Livestock production is an important component of the agricultural sector and national economy, providing employment to approximately 20% of the workforce and is the main source of income and livelihood for Bedouin herders. The indigenous livestock breeds of Syria are well adapted to the arid conditions in the degraded steppes, the semi-arid rain-fed cultivated areas, such as Al-Djezera in the north-east, and the irrigated Euphrates and Al-Ghab valleys and the Ghoota area near Damascus (Bahhady *et al.*, 1998). Total livestock population estimates are given in Table 13, but it has not been possible to find sub-national figures by Governorate.

Table 13: Syria's Livestock Populations 2001

Administrative Region	Area km2	Cattle	Buffalo	Sheep	Goats	Camels	Equines	Chickens
Al Hasakah	22,629	na	na	na	na	na	na	na
Al Ladhqiyyah	2,377	na	na	na	na	na	na	na
Al Qunaytirah	1,644	na	na	na	na	na	na	na
Ar Raqqah	18,243	na	na	na	na	na	na	na
As Suwayda'	6,595	na	na	na	na	na	na	na
Dar'a	3,799	na	na	na	na	na	na	na
Dayr az Zawr	27,230	na	na	na	na	na	na	na
Halab	19,153	na	na	na	na	na	na	na
Hamah	10,099	na	na	na	na	na	na	na
Hims	50,508	na	na	na	na	na	na	na
Idlib	5,567	na	na	na	na	na	na	na
Dimashq	18,262	na	na	na	na	na	na	na
Tartus	1,879	na	na	na	na	na	na	na
Total	187,985	836,868	2,477	12,361,800	979,325	13,500	256,417	21,009

Sources: Pers. Com. Pius Chilonda. AGA, FAO, Rome, and
FAO's Statistical Database: <http://apps.fao.org/>

3.8.3.1 Sheep

Sheep are the most important livestock resource, being found across most regions of the country. The fat-tailed Awassi is the main breed. It is famous for its meat and milk products and is known for its ability to tolerate heat, drought, cold and long treks. The level of production is substantial considering the harsh conditions, but the population also has a large amount of unexploited genetic potential. Awassi lambs grow fast and can reach 20kg live weight at two months of age. If they are fed on concentrates, they can reach 40kg five months after birth. Ewes produce about 60kg of milk after lambs have been weaned at 2-3 months old (Bahhady *et al.*, 1998).

3.8.3.2 Goats

Goats are still found in most parts of Syria, apart from the steppe where their numbers are low. There are two breeds, the mountain and the Shami (Damascus) goat. Mountain goats are found in the mountainous west, and in the rainfed and irrigated-cropped areas. They are dual-purpose animals, raised primarily for milk, and account for 83% of the goat population. The Shami goat, on the other hand, is distributed in the Ghoota area of Damascus and other irrigated regions. It is raised for milk and used as a milk-improver breed for crossing with the mountain goat (Bahhady *et al.*, 1998).

3.8.3.3 Cattle

There are several breeds of cattle in Syria, the most important being the Aksi that accounts for about half of the total. It is found along the Euphrates and Khaboor rivers and in the high-rainfall zone, and is raised for meat. Cattle of the exotic Friesian breed account for 29% of the total population. They are raised primarily for milk production. Shami (Damascus) cattle represent about 6% of the total. They are kept mainly for milk production and are found in the Ghoota area near Damascus. The rest of the cattle are a mixture of imported and local breeds (Bahhady *et al.*, 1998).

3.8.4 Livestock Distribution

Sheep, goat and cattle populations in Syria are concentrated in different parts of the country. Numbers fluctuate, particularly after a season with low rainfall. In winter and spring, sheep are mostly concentrated in areas with an annual rainfall of less than 250-300mm, including the steppe, covering some 65% of the country. In many areas, the steppe's condition has deteriorated sharply because of excessive grazing pressure and cultivation for barley production.

Between December and March, sheep are heavily dependent on hand-fed concentrates, agro-industrial by-products and cereal and legume

straws, with natural grazing making only a modest contribution. In summer and autumn, sheep are found grazing cereal stubble and irrigated residues in cropped areas covering 6.1 million hectares. Of this area, 4.8 million hectares are used for rain-fed crops, 0.7 million hectares for irrigated crops, with the remainder being fallow. Goats tend to be found in areas receiving more than 250mm a year; whilst cattle are mainly confined to higher rainfall areas, where adequate moisture allows sufficient production of feed (Bahhady *et al.*, 1998).

Syria's domestic buffalo population has been in decline for many years and is now concentrated in two localities in central and north-east parts of the country (Swaid, 1995).

3.8.5 Hima System of Range Use

Hima is a communal property system developed by the nomadic pastoralists of West Asia and North Africa, but was also widely adopted by non-pastoralists. It restricted and regulated the use of lands for grazing, provided areas for use during droughts, and maintained the productivity of the rangelands. Hima remained an important aspect of pastoral techniques across West Asia and North Africa until widespread national land reforms in the 1950s and 1960s.

Following a decade of unsatisfactory pastoral development and land reform in Syria, the hima system was revived as official rangeland policy in 1968 in the form of community cooperatives. Four types of cooperative were established: tribal cooperatives called tahsin; government-owned cooperatives, or hukumiyah; and cooperatives for villagers and urban flock owners, called tarbiyah, or livestock production cooperatives. All hima cooperatives are linked to tasmin, or fattening cooperatives through marketing channels (Shoup, 1990).

3.8.6 Changing Modes of Production

Until the end of the 1940s, most of the Bedouin occupying the Syrian steppe were fully nomadic, relying on natural grazing as feed for their sheep flocks. Sedentarisation and the extension of cultivation was quite slow, and found only in the western part of the country, up to the line of the Damascus-Aleppo road.

Following the introduction of mechanization at the end of the 1940s, cultivation extended rapidly eastward, particularly in the Jezireh Plains and in the north of Syria. By the end of the 1950s, most of the land down to the 200mm isohyet had been brought into cultivation, which made more cereal stubble available for grazing in summer months and altered former patterns of seasonal livestock movement.

After a prolonged period of drought from 1958 to 1961, which halved Syria's sheep population, the Government introduced a system of supplementary feeding that radically changed flock movements and feeding patterns in the rangelands.

More recent and continuing expansion of irrigation in the Aleppo and Raqqa areas of northern Syria has also encouraged greater use of irrigated crop residues as grazing (Leybourne *et al.*, 1993).

3.8.7 Institutional Change

Over the past forty years, Syrian rangelands have been the focal point of various government interventions. These had four major components: assertion of state ownership over rangelands; settlement and transformation of herders into farmers; formal reorganisation of the Bedouin population into range improvement and sheep husbandry cooperatives; and development of rangeland reserves. Each of these interventions has had many implications for livestock production, on

rangeland management as well as on the livelihood strategies of herding households and communities.

In 1994, the Syrian government took a major decision by banning cultivation on rangelands and committed itself to enhancing livestock production through better conservation, improvement and management of rangeland resources.

The ban on cultivation, which is transforming sheep production systems and livelihood strategies of herding communities, is forcing herding communities to devise new strategies for overcoming their production constraints. Under present range conditions, it is clear that herding communities cannot stay there all year round and have, necessarily, to seek alternative feed resources (Ngaido *et al.* (2001).

3.8.8 Livestock Marketing

The main sheep producers are the Bedouin and around two-thirds of all the sheep in Syria are considered to be based in the steppe. They raise and herd sheep for meat, milk and wool production. Most of their animals are sold in city markets. Sheep, along with cattle and goats, are also raised by farmers in cropped areas, and are sold through local markets. Although there is no supporting statistical information, the highest percentage of sheep is said to pass through the fattening cooperatives before going back to the market to be sold for export, or slaughter. The remainder are either taken directly to slaughterhouses, or exported.

Market prices play an important role in the decision-making process of farmers. They fluctuate from year to year due to rainfall variations, but also within seasons. Thus, farmers try to sell their stock at times of the year when prices are favourable, such as before the main religious festivals of Eid Al Fitr and Eid Al Adha, or before the new

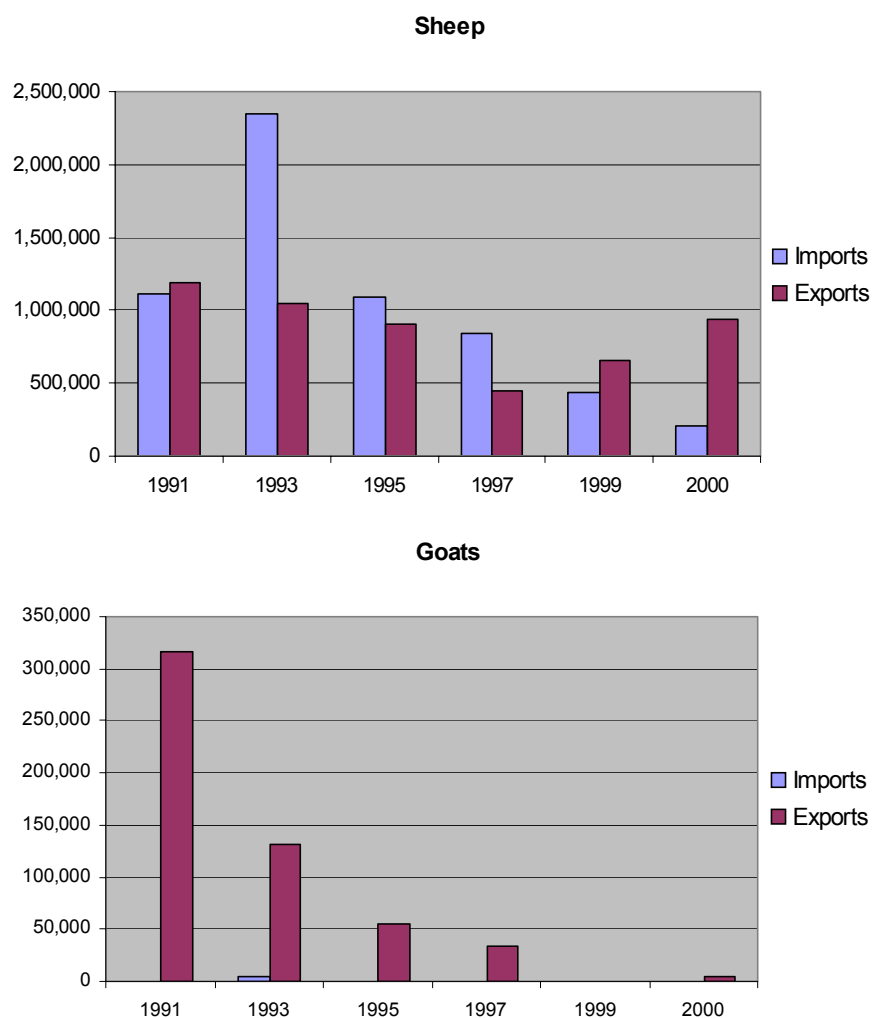
lamb crop begins to reach the markets in spring. However, their decision is often determined by the need for immediate cash, particularly in the winter when flocks are hand-fed with feed that is normally purchased at markets once farmers' own stocks are used up.

Barley grain is considered the most important and useful feed that determines trends in the prices of sheep and feed. Seasonal rainfall also affects market prices. For example, in a year of low rainfall, barley yields are reduced, thus decreasing availability, and high demand from farmers pushes up prices. At the same time, low rainfall results in farmers selling stock, which lowers the price of meat (Bahhady *et al.*, 1998).

3.8.9 Livestock Trade

The Awassi breed is famous for its high-quality products, specially the quality and taste of its meat. For many years, Syria has supplied the Arabian Peninsula, Lebanon and Jordan with Awassi lambs and fattened kids because prices in these countries are higher due to the better incomes of many of their inhabitants. To compensate for the large numbers exported, Syria imported sheep from Turkey until 1993, but these have since been replaced by imports of sheep from Eastern Europe.

Figure 18: Syria's Live Sheep and Goat Trade



Most of the imported and exported live animals are sheep, with exports fluctuating between 500,000-1,000,000 a year, whilst imports have declined over the past decade (Figure 18). Exports and imports are supervised either by the General Meat Company, or by allowing traders to export a limited number of sheep after obtaining a license from the Ministry of Economics. Traders are supposed to abide by certain rules, such as importing twice as many sheep as they export. Export policy is also dependent on the climatic conditions, with more exports being permitted in years of drought.

Goats are not imported for two reasons. First, there are sufficient animals to meet the limited demand, and second, their meat, at least from adults, is not popular with consumers. As a result, goats are exported to neighbouring countries, but numbers have declined dramatically over the past decade. Some cattle, mostly pregnant Friesian heifers, are imported to be raised mainly for milk production. Cattle are not exported because their numbers are few. Sheep account for the major part of live animal export earnings (Bahhady *et al.*, 1998).

3.9 United Arab Emirates

3.9.1 Geography and People

The United Arab Emirates (UAE) is a federation of seven Emirates on the Gulf coast adjoining Saudi Arabia and Oman, with an area of some 83,600km². Vegetation is sparse and the general landscape is a flat sandy desert extending over 90% of the country, except for the Hajar mountains to the north. Scant rain is brought by erratic winter storms. Mean annual rainfall is less than 65mm, with more than half in December and January.

Popular accounts from such explorers as British writer, Sir Wilfred Thesiger, who crossed the Empty Quarter by camel to arrive in the Emirates some 50 years ago, have created an impression to the outside world of an indigenous population of nomadic herdsmen, the Bedu, moving across the desert with their camels and goats from one pasture to another. There is some truth in this, but it is far from the whole picture.

In reality, very few of the indigenous ethnic groups were ever wholly nomadic. Most of them were settled, at least for much of the year, engaged in small-scale agriculture, or in the age-old practice of harvesting the pearl banks and fish stocks of the Gulf. The real desert, with its great sand dunes, is confined to the south and southwest of the country, bordering the Empty Quarter, or Rub al-Khali (<http://www.uae.gov.ae/>).

In 2001, the UAE had some 3 million inhabitants, with a mean density of 36/km², increasing at 3.1% per annum. The rural population accounted for 12.9% of the total, and Gross National Income (GNI) per capita was US\$18,060 (<http://lnweb18.worldbank.org/mna/mena.nsf>).

3.9.2 Agriculture

Farming in the region dates back to antiquity, but until recently was confined to smallholdings in scattered oases and mountain valleys. Over the past forty years, the UAE has developed more than 100,000 hectares of irrigated cultivation, with water from deep aquifers and large scale desalination, and now has a thriving agricultural sector producing a range of crops, including salad vegetables, potatoes, fruit and fodder, as well as flowers, grown mainly for export to Europe.

The total cultivatable area in 1994 was estimated to be 72,374ha, of which in 1993, the total cultivated area was estimated at 54,512ha, with 21,683ha of annual crops and 32,829ha of permanent crops (http://www.fao.org/ag/agl/aglw/aquastat/countries/unt_d_arab_em/index.stm).

3.9.3 Livestock Resources

Dairy and poultry production has also increased progressively and in 2001 there were a total of 28 commercial dairy farms with some 16,000 cattle and 37 poultry farms, producing some 91,473 tons of milk, 310 million eggs and 28,124 tons of chicken meat. In the more traditionally managed, non-commercial sector, goats are the most numerous species of livestock, followed by sheep, camels and cattle, as indicated in Table 14 and Figure 19 (pers. com. Mr. E.A. Mustafa, Animal Wealth Department, Ministry of Agriculture and Fisheries).

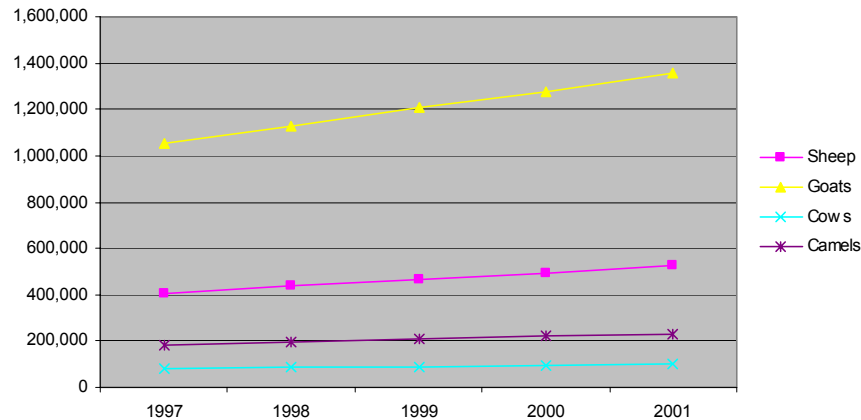
Table 14: UAE'S Livestock Populations by Region in 2001

	Cattle*	Sheep	Goats	Camels
Abu Dhabi	13,854	109,610	295,827	150,094
Central	67,274	305,349	498,281	70,133
Northern	13,553	87,502	346,633	12,091
Eastern	7,114	22,049	214,253	530
Total	101,795	524,510	1,354,994	232,848

* Excluding: 16,112 cattle in milking herds on commercial farms.

Source: UAE Ministry of Agriculture and Fisheries

Figure 19: UAE Livestock Populations 1997-2001



Despite suspiciously regular incremental increases in livestock populations (Figure 19) and production estimates within the UAE, the country still imports substantial numbers of live animals from abroad, including Australia, whose sheep imports have declined markedly from their peak of more than 1.7 million in 1996 and 1997, to 681,000 in 2001 (Figure 10).

Camels have long been a characteristic feature of the region but are no longer as common as they used to be. Before the discovery of oil, large caravans of camels regularly crossed the desert to Abu Dhabi, Al Ain and Dubai, carrying firewood, charcoal, agricultural products and livestock, returning with much-needed supplies to desert camps or small villages. Camels also transported whole families and their belongings from the humid coast to summer activities in the cooler oases. Camels were the main means of transport for pilgrims visiting Mecca.

Much has changed since then and today modern transport is available to everyone and well-stocked, readily accessible supermarkets provide the necessities of life. Many local families, however, still own a few camels for meat and for milk and are encouraged to do so by the offer of generous government subsidies

3.10 Yemen

3.10.1 Geography and People

The Republic of Yemen, located at the southern extremity of the Arabian Peninsula, has an estimated total area of 527,970km². The country may be divided into five major geographic regions: a coastal plain (known as the Tihamah in northern Yemen); the western highlands; the central mountains; the eastern highlands; and finally, the eastern and north-eastern desert regions.

The coastal plain ranges from 8-64km in width. Low mountains rising to 1,070m lie between the plain and the great central massif, with many peaks in excess of 3,000m. Toward the northeast the mountains subside rapidly into the eastern highlands (1,000m), which descend steeply to the sandy hills of the Rub' al-Khali (Anon., 2001).

In 2001, Yemen had some 18 million inhabitants, with a mean density of 34/km², increasing at 2.7% per annum. The rural population accounted for 75% of the total, and Gross National Income (GNI) per capita was US\$450, by far the lowest of the ten countries under consideration in this report (<http://lnweb18.worldbank.org/mna/mena.nsf>).

3.10.2 Arable Land

Cultivable land is estimated at about 3.62 million hectares, or 7% of the total area. In 1994, an estimated 1.05 million hectares were

cultivated (29% of the cultivable area) consisting of 0.85 million hectares of annual crops and 0.20 million of permanent crops.
<http://www.fao.org/ag/agl/aglw/aquastat/countries/yemen/index.stm>).

Table 15: Yemen's Livestock Population by Region in 2000

Administrative Region	Cattle	Sheep	Goats	Camels	Chickens
Abyan	15,321	389,912	433,405	13,105	na
Aden	3,615	46,118	104,506	1,813	na
Al-Beida	31,613	350,618	166,115	3,737	na
Al-Jawf	7,106	188,916	167,503	11,713	na
Al-Mahara	1,129	94,816	253,673	35,681	na
Al-Mahwit	40,178	38,617	28,967	816	na
Dhamar	142,616	363,316	133,143	5,306	na
Hadhramout	45,703	260,321	578,008	45,006	na
Hajjah	107,881	223,798	195,813	6,996	na
Hodeidah	195,336	348,728	308,556	17,399	na
Ibb	221,607	338,678	197,515	4,233	na
Lahj	70,139	310,918	391,702	10,215	na
Marib	16,063	257,114	223,036	8,008	na
Sadah	60,263	183,008	84,139	1,095	na
Sana'a	214,689	997,117	492,896	5,700	na
Shabwa	2,156	275,616	284,667	13,378	na
Taiz	163,364	136,166	208,778	5,672	na
Total	1,338,779	4,803,777	4,252,422	189,873	na

Source: Pers. Com. Pius Chilonda. AGA, FAO, Rome.

3.10.3 Livestock Resources

According to World Bank estimates, livestock's contribution to agricultural GDP in 1999 was around US\$300 million, or 20% of agricultural GDP. Animal husbandry's contribution to employment, however, was considerably higher, with close to 80% of the rural population being involved in some form of animal production

([http://lnweb18.worldbank.org/mna/mena.nsf/Attachments/Agriculture-full/\\$File/BB-17.pdf](http://lnweb18.worldbank.org/mna/mena.nsf/Attachments/Agriculture-full/$File/BB-17.pdf))

Livestock population estimates by Governorate are given in Table 14. Ten breeds of sheep and five breeds of goat are recognised. Cattle are mostly of the local Zebu type. Camels are used for milking, transport and ploughing, and are found mainly in coastal areas and in the eastern desert. Donkeys are also extensively used for transport and draught purposes, but no record of their abundance and distribution could be found (<http://www.fao.org/ag/agp/agpc/doc/counprof/yemen.htm>).

3.10.4 Livestock Production Systems

The principal livestock production systems in Yemen are:

1. Smallholder Systems

- Confined livestock systems mainly found in the highlands. Almost all cattle and 20% of sheep in the highlands are raised in this system;
- Guarded grazing in agricultural areas. This applies mainly to small ruminants that are grazing (often as combined village flocks) under supervision in daytime and confined at night;
- Animal traction use of livestock (mainly oxen and camels) for tilling (especially in the highlands, where animal traction is the only method, apart from manual labour, to till the small terraces) or for transport (mainly donkeys and camels).

2. Transhumant and Nomadic Systems

- Mainly found in the drier areas where "Bedu" producers migrate their sizeable flocks (mainly sheep, goats and camels).

3. Intensive "Modern" Production System.

- These are mainly poultry farms, 3 large sheep farms (>3000 head), 6 large intensive dairy farms (>100cows), as well as some 60 urban dairies (each with approx. 20-50 cows) in, mainly, Hodeidah and Aden city.

Most animals are raised in mixed arable/animal systems, where the linkages between crop production, feed, traction and manure are strong. Fifty-nine per cent of Yemen's farmers are mixed arable/livestock farmers; 21% are arable farmers; and 20% are livestock farmers.

Table 16: Livestock Distribution by Mode of Production

	Farms	Sheep/Goats	Cattle	Camels
Nomadic Livestock Farmers	15,000	100,000	60,000	
Transhumant Livestock Farmers	20,000	800,000	100,000	
Highland Mixed Farmers	300,000	2,700,000	550,000	
Lowland Mixed Farmers	350,000	2,500,000	450,000	115,000

Source: [http://lnweb18.worldbank.org/mna/mena.nsf/Attachments/Agriculture-full/\\$File/BB-17.pdf](http://lnweb18.worldbank.org/mna/mena.nsf/Attachments/Agriculture-full/$File/BB-17.pdf)

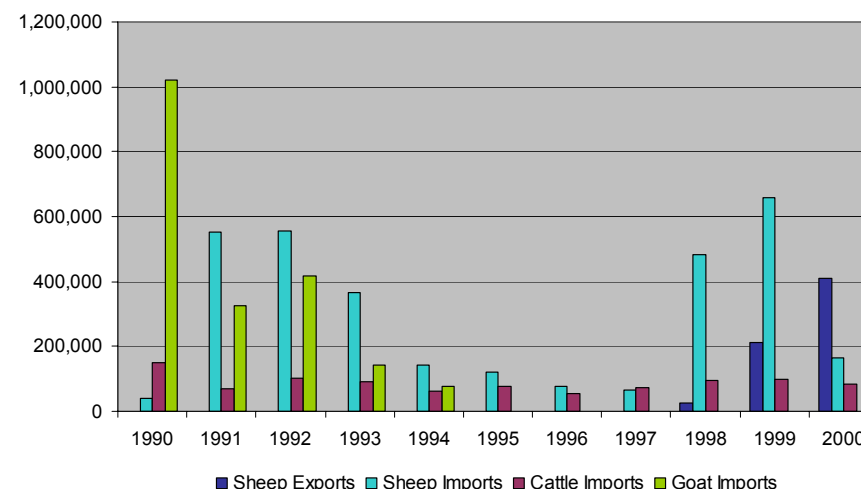
3.10.5 Livestock Trade

FAO records indicate considerable variation in Yemen's livestock trade over the past decade (Figure 20). Just over a million goats were imported in 1990, but numbers declined sharply thereafter, with no imports after 1994. There are no records of goat exports from Yemen. Sheep imports have also ranged rather erratically from a low of 41,000 in 1990 to a high of 657,000 in 1999. Sheep exports appear to have commenced in 1998 and rose to more than 400,000 in 2000. Annual cattle imports have been more consistent, ranging between

50,000-150,000 a year. It would appear that no cattle are exported from Yemen.

The origins and destinations of imported and exported livestock could not be ascertained from the available records.

Figure 20: Yemen's Livestock Imports and Exports 1990-2000



Source: FAO's Statistical Database: <http://apps.fao.org/>

An outbreak of Rift Valley Fever occurred in Yemen in August-October 2000, involving 1,087 cases and 121 deaths (Nasher *et al.*, 2000). Yemen was one of six Gulf states to ban imports of live cattle, camels and goats and their meat from Kenya, Somalia, Uganda, Tanzania, Eritrea, Ethiopia, Sudan, Nigeria and Djibouti (http://www.agjournal.com/story.cfm?story_id=997). See also: <http://www.fao.org/DOCREP/003/Y0482E/y0482e04.htm>

4. CONCLUSIONS AND RECOMMENDATIONS

The purpose of this study has been to review information on the distribution and movement of livestock relevant to the potential spread of trans-boundary diseases in the Arabian Peninsula and neighbouring countries to the north. Trans-boundary diseases are “those that are of significant economic, trade and/or food security importance for a considerable number of countries; which can easily spread to other countries and reach epidemic proportions; and where control/management, including exclusion, requires co-operation between several countries.”

Large-scale trans-boundary epidemics have occurred with increasing frequency in recent years due to the growth in international livestock movements, the breakdown of sanitary control systems, e.g. border controls, and the expansion of civil disturbances. Diseases of particular concern include Rinderpest, Foot and Mouth Disease, Contagious Bovine Pleuropneumonia, Peste des Petits Ruminants, Rift Valley Fever, Lumpy Skin Disease (FAO, 1997).

The synthesis presented in this report provides a review of available information obtained from a miscellany of scientific papers, publications, reports, internet sources and various statistical databases, compiled by national and international authorities. References and abstracts are included in an annotated bibliography, but because of linguistic and time constraints, most citations are from English language sources, although some Arabic documents, with English and or French, summaries are included.

4.1.1 Changing Modes of Livestock Production

There have been profound changes in livestock production in the Arabian Peninsula over the past half century, driven by the pervasive influence of oil wealth, which has fuelled demand for meat and milk, and the importation of livestock and animal feeds. These changes have perhaps been most pronounced in Saudi Arabia, but their effects have been felt throughout the region.

Completely new methods of production have been introduced and traditional forms of livestock production have adapted to changing circumstances. The relative importance of modern as opposed transitional modes of production is difficult to assess from the aggregate data available to this review, but modern methods are confined to relatively small areas, whilst transitional animal husbandry and pastoral production occurs over extensive rangelands.

4.1.2 Intensification and Modernisation

Poultry, dairy and feedlot production has been expanding in the WANA region for decades and there has been increasing use of imported animal feed concentrates (Nordblom and Shomo, 1993).

Modern, “high-tech” poultry and dairy production units with high-yielding breeds have been established in countries such as Jordan, Kuwait, Saudi Arabia and UAE, but their maintenance is dependant on many imported inputs and the domestic production of others, such as irrigated forage production for dairy cows (Delgado *et al.*, 2000).

Government subventions in various forms across the region, including widespread subsidies of grain imports (animal feeds), have encouraged the processes of intensification and modernisation, the long-term sustainability of which is questionable.

4.1.3 Transitional Pastoral Production

Pastoral livestock production mainly involves sheep and, to a lesser extent, goats and cattle. The importance of camels as a means of transport and source of animal protein has declined generally; and only a few thousand domesticated buffalo remain in Iraq and Syria.

Sheep production in the rangelands has intensified through utilisation of crop residues from expanding cultivation and increasing use of supplementary feeds. Vehicles are widely used to move animals and transport feed and water supplies. Modern telecommunications provide access to information on rainfall, rangeland condition, pasture availability and market prices.

4.1.4 Livestock Movement

Historically, traditional livestock movements in the Arabian Peninsula were related to one of three primary activities: trade and the passage of caravans between markets; stock for sale or slaughter at markets near permanent settlements; and seasonal transhumance/nomadism in response to rainfall and fodder availability.

There is much evidence to suggest that seasonal and tribal movement patterns of traditional nomadism and transhumance have been transformed by oil wealth and the various changes in livestock production referred to in the previous section, especially in such countries as Iraq, Jordan, Saudi Arabia and Syria, although the impact of sanctions on livestock production in Iraq over the past decade is most uncertain.

With transport to supply animal feeds and tank trailers to provide water, pastoral livestock production is no longer as dependent on rainfall and range condition as it used to be. Traditional seasonal patterns of movement to and from specific areas are no longer

followed, and have been replaced by more erratic and opportunistic transportation to areas with pasture and/or where water and supplementary feed can be supplied.

From the limited information available for review, however, it is unclear to what extent traditional modes of production and seasonal movement have changed in Oman, UAE and Yemen. Nevertheless, it is arguable that with further development of their oil resources, it is only a question time before similar changes occur.

4.2 Livestock Trade

Livestock trade in the region is driven by demand from the Gulf States (Bahrain, Kuwait, Oman, Qatar, Saudi Arabia and UAE), which collectively imported 71% of the recorded 11.3 million live sheep, goats and cattle imported into the region in 2000. Imports are drawn in from as far a field as Australia and New Zealand, but also from Yemen, Pakistan, Sudan and the Horn of Africa, as well as Jordan and Syria, and almost certainly Iraq, Turkey and Iran.

There are, however, grounds for concern about the reliability of available livestock statistics, as exemplified by the minimal recorded sheep exports from Iraq. With their extended common frontiers across generally inhospitable terrain, it is considered likely that many animals pass unrecorded from one country to another.

4.2.1 External Trade Records

With the exception of information made available on the Internet by the Jordanian Authorities, live animal trade statistics obtained during the course of this review did not indicate the origin of imports or the destination of exports. This is a serious failing in terms of assessing the risks of animal diseases spreading from one country to another.

4.2.2 Internal Movement Records

If it is important to monitor animals entering a country, it is equally important to maintain records of internal livestock movements. This may be easier said than done over the immense and sparsely populated Arabian Peninsula, but it should be possible to monitor the movement of animals at markets and slaughter-houses, and those being transported on major roads.

It may be that this information is already collected by government agents, but the epidemiological significance of such data in terms of determining the likely spread of a disease outbreak and establishing appropriate control strategies is not always appreciated (e.g. the FMD outbreak in Britain in 2001). Such information may be considered confidential, and so access may need to be restricted.

4.2.3 Main Markets

As mentioned above, the main market for live animals in the Arabian Peninsula is in the Gulf States, especially Saudi Arabia and Kuwait, where the main demand is for sheep. Records indicate that in 2000 Saudi Arabia imported 4.2 million sheep, 1.1 million goats and 336 cattle; and that Kuwait imported 1.8 million sheep, 3,240 cattle and 180 goats. It is estimated that some 11.5 million head of sheep are slaughtered annually in Saudi Arabia.

The main recorded sources of sheep exports to the region in 2000 were: Australia (4.9 million); Syria (937,000); Yemen (410,000); and Jordan (277,000).

4.2.4 Variation in Demand (and Trade Movements)

A characteristic feature of the livestock trade in countries of the Arabian Peninsula is that demand for live sheep exceeds local national supply during religious festivals, especially Eid ul Fitr and Eid ul Adha.

Saudi Arabia receives an annual influx of some 2 million pilgrims going on the Haj to Mecca, which generates considerable extra demand. Consequently, there are substantial variations in market prices and the number of animals traded. Indeed, it can be argued that much of the animal husbandry and sheep trade in the region is premised on the high prices commanded immediately before and during festival periods.

4.3 Epidemiological Significance of Findings

The likelihood of an animal disease spreading from one area to another is a function of the proportion of animals infected at source and the number transferred. Others things being equal, the risk of disease transmission depends on the number of animals moved. Nutritional status, breed sensitivities, animal husbandry practices and stress tolerance are other obvious considerations.

It is important, therefore, to have reliable and up to date information about the incidence of diseases in source areas and the number of animals traded/imported from those areas to new destinations, as well as a more general appreciation and understanding of the distribution and movement of animals in source areas.

The general trends over the past half century throughout much of the region have been for pastoralists to become more sedentary, and for people in general to become more urbanised and concentrated in towns and cities. These urban centres generate the main demand for animal protein, which traders and producers endeavour to supply, from local production and/or by importation from further a field.

A dichotomy in livestock production has emerged, with “high-tech,” capital-intensive poultry and dairy units at one extreme, and

transitional, relatively small-scale, “low-tech” dairy and sheep producers at the other. Levels of capital investment in the two systems are obviously very different, as are abilities to afford and implement disease control measures. Differential disease control strategies are therefore required.

These trends seem set to continue for the foreseeable future, so in terms of assessing the risks of trans-boundary disease transmission, it is important to consider options for strengthening existing, or establishing new, systems of monitoring the trade and marketing of live animals, both nationally and internationally.

Poultry and sheep are by far the most numerous species traded in the region, and should thus be the primary focus of attention, followed by goats, cattle and camels.

4.4 Critical Information Gaps

If the risks of animal diseases spreading from one country to another are to be assessed properly and appropriate means of control established, it is important to have reliable and up to date information about the distribution and abundance of livestock resources, and the scale and direction of livestock movements.

Disaggregated data is required to show: sub-national distributions of resources and diseases, seasonal movements/transhumance; relative importance of markets and trade routes; geographical variations; and temporal trends.

Detailed information about livestock movements within the region is not easy to find from conventional English language sources. Such information may exist in Arabic texts and/or departmental records,

but this needs to be investigated to ensure that adequate records are kept, and compiled centrally on a regular basis.

Some aggregate data about Jordan’s live animal trade with its neighbours, and Australia’s live animal exports to West Asia were found on the internet, but did not provide individual consignment details of animal numbers, date and points of departure and arrival, required for trans-boundary disease monitoring.

It is believed that a substantial proportion of livestock trade within the region is likely to avoid/evade detection at conventional checkpoints on main roads, border crossings and at ports and airports, by clandestine movement across unmarked borders in remote areas, which are difficult, if not impossible, to monitor.

There is a general lack of reliable, up-to-date information about livestock numbers, distribution, seasonal movements and trade, especially for Iraq, Oman, Syria and Yemen.

There is a general lack of detailed information about species, origin, entry points and destinations of livestock imports, especially by the Gulf States, where demand is greatest and imports are highest.

Whilst information on aggregate livestock imports is available for most countries, more detailed data on the date, origin and entry point of individual consignments has not been found. For any objective assessment of risk and tracing the source of disease, it is essential that this information be collected, compiled centrally and disseminated.

No information could be found on the month-to-month variation in market prices or the number of animals traded. Such time series data

would provide a useful indication of the ebb and flow of livestock trade and the risks of trans-boundary disease transmission.

National authorities should be encouraged to release sub-national data to international bodies. For example, Jordan provides livestock distribution data for both April and October; and Saudi Arabia differentiates modern and traditional cattle production; both of which are useful indicators of production status.

4.5 Suggested Remedies

4.5.1 Strengthen Regional Networking

Various national and international bodies exist with mandates that cover animal health and livestock production in the region, including: Ministries of Agriculture; FAO's Emergency Prevention System (EMPRES) for Trans-boundary Animal and Plant Pests and Diseases; the Regional Animal Disease Surveillance and Control Network for North Africa, the Middle East and the Arab Peninsula (RADISCON); the World Organisation for Animal Health's (Office International des Epizooties – OIE) Regional Commission for the Middle East; the Arab Centre for the Studies of Arid Zones and Dry Lands; and the International Livestock Research Institute (ILRI). Networking and information exchange between these organisations should be encouraged.

4.5.2 Obtain Better Understanding of Livestock Trade

The structure and dynamics of livestock trade and marketing in the region needs to be better understood and documented, including identification and description of all major livestock markets, slaughterhouses, transit routes, entry and departure points, number of animals involved and seasonal variation in demand/supply. A study should be commissioned to obtain standardised information about livestock trade and marketing from each country in the region.

4.5.3 Enhance Monitoring

An effective means of monitoring livestock imports and exports, and internal movements, including: date, species, number, origin and destination, should be established. This information should be compiled nationally, updated regularly and made available in a standard and accessible form, preferably on the internet.

The magnitude and extent of clandestine livestock movements in the region is not known, at least to the author. It is important that some assessment of any potentially unreported, parallel trade be undertaken to provide an indication of its scale, direction and timing. Such information may well be available informally from local sources, but because of obvious sensitivities needs to be handled with care.

4.5.4 Strengthen GIS and Database Management Capacity

- Improve and standardise livestock information collection, analysis, reporting and dissemination. This would involve close collaboration with national and regional authorities to unearth and digitise records not available electronically;
- Obtain information and create layers of major trade routes (air, land and sea), including: main markets; species and numbers involved; watering points; border crossing points; ports of entry and departure;
- Develop standard procedures and formats for collecting, storing, analysing and reporting livestock trade movements;
- Create and/or update layers for known incidence and potential occurrence of major trans-boundary diseases;
- Monitor resources used by livestock that may change from year to year, e.g. grazing, crop residues, water (remote sensing?), imported grains, animal feeds, veterinary drugs;
- Assist national departments to develop their GIS capability, and share results at regional level.

5. REFERENCES AND ANNOTATED BIBLIOGRAPHY

1. **Abdalla, S.H., A. Hajooj, and A. Simir, (1998).** "Economic analysis of nomadic livestock operations in northern Saudi Arabia", in V.R. Squires and A.E. Sidahmed (eds): *Drylands: sustainable use of rangelands into the twenty-first century. IFAD Series: Technical Reports*. Rome: International Fund for Agricultural Development. 375-383.

Abstract: The economic consequences of changes to the pastoral system in Saudi Arabia are the subject of this study. It presents economic analyses, including investment, production rates, off-take, income and expenditures and the returns to nomadic pastoralists. The key points made are:

1. Traditional nomadism as a production system no longer exists in Saudi Arabia. Dependency on range forage as a basic feed resource has declined from 100 to less than 20%. Nomadic movements have been mechanized and operations commercialized.
2. A great shift from traditional camel-rearing to sheep-raising took place. Herd sizes increased manifold to suit the new economic conditions. Expansion in the sizes of production operations, in addition to other social changes, resulted in a growing demand for foreign labour.
3. The new system of mechanized nomadism requires high levels of capital investments and cash to run livestock enterprises. Production levels are generally low. The availability of cheap barley feed, machinery and labour expenses will be the most important factors determining production expenses. These factors tend to favour large-size operations for economy of scale. In determining the size of a viable unit that can support a nomadic family, the social traditions must be considered.

URL: <http://www.odi.org.uk/pdn/drought/abdalla.html>

2. **ACSAD, (1982).** *Preliminary survey of range resources of Arab peninsula and Gulf States*. Damascus, Syria: Arab Centre for the Studies of Arid Zones and Dry Lands, Publication 25. 97.

Abstract: This is the second report in a series describing the range resources of the Arab peninsula and the Gulf States. This report is devoted to a description of the vegetation of the state of Bahrain. 3 range types occur:

mangrove and saline depressions; hills and hilly plateau; interior rocky desert, sandy plains and wadis. The vegetation cover of the area is described, with lists of the common plant spp. and spp. associations occurring. The forage and animal resources are indicated by lists of the grassland and tree spp. present.

3. **Ahmad, Y., (1998).** "The socio-economics of pastoralism: a commentary on changing techniques and strategies for livestock management", in V.R. Squires and A.E. Sidahmed (eds): *Drylands: sustainable use of rangelands into the twenty-first century. IFAD Series: Technical Reports*. Rome: International Fund for Agricultural Development. 329-344.

Abstract: This wide-ranging essay deals with nomadic pastoralism in the past and present. The author argues the case for programme and policy interventions that are multi-disciplinary, process-driven and focused on a minimum threshold of critical objectives. The key point made are:

1. A clearer understanding of the socio-economics of nomadic pastoralism is needed if the application of recent technological advances in rangeland monitoring is to yield maximum potential benefits to nomads and their home countries. To understand and consider viable nomadic pastoralism in the context of a healthy support environment, several distinct features need to be understood, which requires going beyond the more traditional control of livestock numbers in terms of a hypothetical concept of rangeland carrying capacity.
2. Stock numbers can continue to be governed by the pastoralists' traditional strategy of enhanced mobility and accessible communications that optimise advantages and opportunities offered by changing climatic and episodic conditions. Grazing systems could remain essentially event-driven. Attention should however be paid to understanding the special needs of pastoral nomads, particularly in terms of cultural values and the need to involve them in the processes of change and development with a potential to affect them.
3. One conclusion, which has emerged generally from development activities that impact on the environment, is that economy-wide policies, such as policy and programme interventions for the sustainable use of rangelands or for desertification control, help enhance social stability. This, in turn, will yield environmental benefits. Instability, combined with land-use pressures, undermines the sustainable use of natural resources.

4. While the mechanics of information-gathering and enhancing mobility have changed with time, the basic strategies for livestock management and production have remained the same. In recent years, however, a number of complex concerns have emerged that render effective livestock production more difficult and burdensome for pastoral nomads. These concerns include: a rapid increase in human population in pastoral communities; a more sedentary way of life; an increasing need for technology to deal with pressing problems of management; and rapidly changing political, economic and social conditions. As a result, policy and programme interventions are required that are multi-disciplinary, process-driven, and focused on a minimum threshold of critical objectives.

5. Man and nature are always in search of a liveable balance, but mishaps are more likely to happen because of the "discontinuous" nature of the relationship between the pressures generated by human activities and the tolerance levels of ecosystems. It is unlikely that damage inflicted on dry rangelands by overgrazing will be irreversible, because even a minor change in rainfall or other climatic conditions will often bring about a rapid response in terms of vegetation and alter expectations. It is, nevertheless, worthwhile when faced with risk and uncertainty with such critical consequences, to follow the precautionary principle and take action on a broad front to ensure that unexpected surprises do not occur.

URL: <http://www.odi.org.uk/pdn/drought/ahmad.pdf>

4. **Al-Eisa, A., (1998).** "Changes in factors affecting Bedouin movement for grazing", in V.R. Squires and A.E. Sidahmed (eds): *Drylands: sustainable use of rangelands into the twenty-first century. IFAD Series: Technical Reports.* Rome: International Fund for Agricultural Development. 369-373.

Abstract: This paper presents an overview of recent changes in the life-style, economy and prospects for Saudi Arabian traditional pastoralists, the Bedouin. Changes are reflected in grazing strategies, labour arrangements, consumption patterns and dependence on motorized transport. The use and importance of barley to the Bedouin culture is reviewed. The key points made are:

1. Although most of the rangelands in Saudi Arabia are located in remote areas and are known for their harsh environment and scarce resources, the rangelands play an important part in the national economy.

2. Many of the traditional Bedouin have now settled, but a large number pursue a nomadic or semi-nomadic lifestyle. This latter group is the largest user of rangelands and the people are best adapted to live there.

3. Changes in lifestyle, mobility and dependence on motorized transport have affected the way people use the rangelands. In the past, every tribe had its own territory for grazing. In dry times, that particular tribe could move to the territory of another tribe provided that certain conditions were met. Some of these traditional "rules" have been abandoned as pastoralists have come to depend on cheap barley as an alternative to long-distance movements in times of drought.

4. Barley supplements have become an important factor in Bedouin society, because grazing on Saudi Arabian rangelands, with the exception of some mountainous areas, is limited to the short rainy seasons.

URL: <http://www.odi.org.uk/pdn/drought/al-eisa.html>

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6. **Anon, (2001).** *Encyclopaedia Britannica.* Encyclopaedia Britannica Inc.
URL: <http://www.Britannica.co.uk>
7. **Bahhady, F., E.F. Thomson, and M. Boulad, (1998).** "Red meat production, marketing and trade in Syria." in *Conference Proceedings: Filière des viandes rouges dans les pays méditerranéens = Red meat industry in the Mediterranean countries.* Tunis (Tunisia), 20-23 Apr 1997. CIHEAM-IAMZ. 89-102.

Abstract: Red meat production is an important activity of the agricultural sector in Syria, where both the human and sheep population have grown at annual rates of over 3.5% and 3.3%, respectively, in the last two decades. Cattle numbers have grown at a more modest annual rate of 1.6% and goat numbers by only 0.6%. Red meat prices are affected by feed availability and climatic conditions, with a shortage of feed increasing meat prices and low rainfall reducing them. Prices also depend on consumers' preferences, with

lamb having the highest price, followed by beef and then goat meat. The quantity of red meat produced annually is based on calculations made by the Ministry of Agriculture and Agrarian Reform, whereas the quality and dressing percentages of the various categories are based on information from the Ministry of Supply. Red meat production has increased during the last two decades, but this is due to the larger numbers of animals rather than to better efficiency. Per-capita annual consumption of red and white meat has also increased from 8 kg and 2 kg, respectively, in 1976 to 12 kg and 7 kg, respectively, in 1995. Sheep heads the list of imported and exported livestock, Awassi lambs are in high demand from neighbouring countries. Self-sufficiency in red meat reached 95% in the late 1980s but it has probably decreased since then as the growth in domestic production has failed to keep pace with the rapid increase in the human population and in the demand for meat.

URL: <http://ressources.ciheam.org/om/pdf/a35/98606220.pdf>

8. **Belhadj, T., J.-P. Boutonnet, and A. Di Giulio, (eds) (1998).** *Conference Proceedings: Filière des viandes rouges dans les pays méditerranéens = Red meat industry in the Mediterranean countries, 20-23 Apr 1997, Tunis (Tunisia)*. Zaragoza: CIHEAM-IAMZ. 253pp.
9. **Birks, J.S., (1985).** "Traditional and modern patterns of circulation of pastoral nomads: the Duru' of south-east Arabia", in R.S. Prothero and M. Chapman (eds): *Circulation in Third World countries*: Routledge and Kegan Paul, London, UK. 145-159.
Abstract: The Duru' of the interior of Oman, who are traditionally involved in camel-trading with subsidiary but complementary economic activities, have been greatly affected by the impact of external factors. Traditional patterns of circulatory transhumance were controlled by seasonal variations in the harshest of physical environments. Response to these conditions produced a delicately balanced accommodation between men and animals. Recently, while there have been no major changes in the physical environment, the Duru' have effected major changes in their life-style through their response to alternative economic opportunities stemming from the oil wealth of Oman and adjacent Gulf States. Traditional circulatory movements have been adapted to accommodate these opportunities but the Duru' have exercised choice and have

not been forced into making these adaptations. The paper discusses the progressive disintegration which is occurring in Duru' society and economy, showing that in the not-too-distant future, when the oil-based opportunities may come to an end, the intractable physical environment will remain but the ways of coping with it built up over many generations of experience will have been lost.

10. **Blench, R.M.B., (1998).** "Rangeland degradation and socio-economic changes among the Bedu of Jordan: results of the 1995 IFAD survey", in V.R. Squires and A.E. Sidahmed (eds): *Drylands: sustainable use of rangelands into the twenty-first century. IFAD Series: Technical Reports*. Rome: International Fund for Agricultural Development. 397-423.

Abstract: The paper describes the pastoral system of the Bedu of Jordan as it existed in 1995, and summarizes the reasons for the changes that have occurred over recent years. The likely course of future development is outlined. The key points made are:

1. The classic literature on the Bedu in Jordan and neighbouring countries has shown regular patterns of transhumance, following traditional routes and associated with particular tribal and subtribal groupings. This situation has been shown as if it still existed in quite recent reports. However, in reality, it has all but broken down in favour of a more opportunistic system using trucks and telecommunications to exploit remote pastures.
2. The main reasons for the changes in the Bedu behaviour are: availability of trucks to move animals and water; telecommunications to assess the availability of pasture; closing of national the frontiers to the pastoralist movement; breakdown of traditional authority systems; and a relatively liberal political climate.

URL: <http://www.odi.org.uk/pdn/drought/blench.html>

11. **Blench, R.M.B., (2001).** "Pastoralism in the new millennium". *FAO Animal Production and Health Paper 150*, : pp93.

Abstract: 1. Extensive pastoral production takes up some 25% of the world's land area and produces some 10% of the meat used for human consumption, while supporting some 20 million pastoral households. Pastoral production is split between the extensive enclosed systems typical of North

America, Australia and parts of South America and the open-access systems in Africa, the Andes, Asia and Siberia which are still largely the province of "traditional" producers. The breakdown of the command economies of Central Asia has probably increased the numbers of households depending on pastoral production in the last decade of the twentieth century. Although pastoralists, along with foragers with whom they have much in common, represent an almost archetypically vulnerable social group, donor interest in the sector is minimal.

2. The rangelands exploited by pastoralists often cannot be used by conventional agriculture, although as technical advances spread cultivation into remoter regions, pastoralists are forced into increasingly inhospitable terrain. Although spontaneous settlement is quite common on the fringes of the pastoral domain, national governments are often hostile to pastoralists. Many countries have policies of sedentarisation that derive as much from political considerations as a concern for the welfare of those they wish to settle. However, compelling pastoral nomads to settle has a very unsatisfactory history and is unlikely to meet with long-term success.

3. Pastoralists make substantial contributions to the economy of developing countries, both in terms of supporting their own households and in supplying protein, both meat and milk, to villages and towns. The governments of those countries rarely recognise these contributions by a corresponding investment in the pastoral sector. The pastoral economic system is under increasing threat from the globalisation of the trade in livestock products and unpredictable import policies in many countries. Broadly speaking, the trend during the twentieth century has been for the terms of trade to increasingly turn against pastoralists.

4. The marginal lands that have previously been the province of pastoralists are increasingly coming into focus as reserves of biodiversity. Their very inaccessibility has permitted the survival of species eliminated in high-density agricultural areas. Consequently, there is pressure on governments to declare large regions protected areas, both because of pressure from the conservation lobby and the potential income from tourism. Uncertainties about pastoral tenure have made it difficult for pastoralists to lodge effective land claims.

5. The future of pastoralism will depend heavily on political decisions made by national governments in countries with extensive grasslands. Enclosed pastures are unlikely to see any significant extension, but conditions for existing pastoralists will become more difficult as both farmers and the

conservation lobby expropriates land. Work with pastoralists, and a more sympathetic understanding of their production systems, could act both to protect their lifeways and enhance their capacity to produce protein on otherwise marginal land.

6. Experience to date suggests that technical inputs will only have a very limited impact on overall output. Only a major policy re-orientation will protect and support pastoralism during the next millennium. Elements likely to become important are:

- a. Production of niche products, either unusual species or breeds, and meat and milk free from contaminants;
- b. Crop-livestock integration, the effective use of pastoral outputs in mixed farming, particularly the extension of work animals;
- c. Co-conservation, the development of interlocking strategies to link conservation of wild fauna and flora with pastoral production;
- d. The expansion of ecologically-sensitive low-volume tourism, using pastoralists to provide services, particularly in the area of indigenous knowledge.

12. **Bocco, R., R. Jaubert, and F. Metral, (eds) (1993).** *The steppes of Arabia. States, pastoralists, farmers and businessmen: the future of the dry regions.* Paris: Cahiers de l'Institut Universitaire d'Etudes du Developpement, FS 32, Presses Universitaires de France, Paris, France. 401pp.

Abstract: The concept of the 'steppes of Arabia' evokes images of mystery, richness and beauty which have little basis in reality. In fact, the control of resources and land degradation in the desert regions of the Arab world constitutes a major factor in the future development of the area. Over the last 40 years, agricultural policies have been concentrated on the development of the irrigated desert perimeters, to the detriment of the steppes, which are traditionally devoted to livestock and forage production. The increasing economic marginalization of these regions is accompanied by an increasing socio-political marginalization of their population. This book, which results from a conference on 'The future of the Arab steppes and Bilad ash-Sham' held at the Institut de Monde Arabe, Paris, April 10-13, 1991, comprises the following reports: The decline of the nomads from importance to confusion: a view of the history of the steppes (O. Aurenche); The emergence of

agriculture, livestock production and pastoral nomadism in the Middle East (J. Cauvin); Population and development of the Syrian steppes (1800-1920) (N. Lewis); The French mandate policy in relation to tribes and the steppe region in Syria; Djezireh as an example (C. Velud); Peasants, nomads and the State in East Jordan: rural development policies (1920-1989) (T. Tell); Nomadic tribe territories and frontiers in the Arab world (J. Wilkinson); State policies and Bedouin adaptation: northern Arab countries (1900-80) (U. Fabietti); Bedouin sedentarization and the construction of the State in Kuwait (N. Gavrielides); The evolution of agro-pastoral systems and development policies in arid regions of Syria (Jaubert); Sheiks, peasants and members of the Ba'th Party: political changes in northern Syria (S. Khalaf); Livestock and agriculture in the Sukhne oasis (Syria): risk management by business entrepreneurs (Metral); Drought and economic reconversion strategies among the Bedouin in Jordan (W. Lancaster and F. Lancaster); Commerce and production in the north-central Arab countries: change and development in Unayzah (D. P. Cole and S. Altorki); Development policies and the role of researchers, D. Nygaard; Agricultural economic research and development strategies for cultivated regions in Syria (M. Jones); Livestock systems management in Syria (T. Treacher); Socioeconomic change and its effects on the Dhofar nomads, Oman (1970-90) (J. Janzen); From political security to food autonomy in the steppe (Bocco); Development and environment (P. Sanlaville); Durable development and applied research (Jaubert); Economy and societies (J. Metral); Development policies and the underdevelopment of socio-political analysis (Bocco).

13. **Boyazoglu, J. and J.C. Flamant, (1990).** "Mediterranean systems of animal production", in J.G. Galaty and D.L. Johnson (eds): *The world of pastoralism: herding systems in comparative perspective*: Belhaven Press, London, UK. 353-393.

Abstract: The Mediterranean basin is one of the most ancient and flourishing cradles of agriculture in the world. Rural prosperity and decline have been linked through the centuries to the economic growth or stagnation of the region's culture and societies, the major determining factors being the human population and associated socioeconomic dynamics. The chapter considers the 17 sea-front states and Portugal as constituting the 'Mediterranean' area and adds a number of neighbouring Near East and Balkan states. The two main traits of animal production that have been conditioned by the physical and human environment of the Mediterranean are that: the animal factor is often

associated with cereal production; and livestock management is generally linked to systems of natural resources available in different locales of more or less large regions. Livestock numbers have changed considerably over recent centuries. In the northern part of the basin, sheep and goat populations that tended to decrease until the late 1970s are now again on the increase, and cattle numbers that were increasing have now stabilized. The chapter traces the evolution of animal production and of small ruminant populations. Patterns of food consumption, closely linked with existing systems of production and food availability, are described. Milk sheep farming forms an integral part of the traditional Mediterranean agricultural production system and is discussed. The dramatic evolution of traditional systems of land use in the Mediterranean over the last several decades is examined and the prevailing production system, based on the relationship between the flock, the herd and its milieu is analysed.

14. **Braverman, Y. and F. Chechik, (1993).** "Air streams and their possible potential for the introduction of Culicoides (Diptera, Ceratopogonidae) borne animal diseases to Israel." *Israel Journal of Veterinary Medicine*, **48**(1): 1-9.

Abstract: The role of air streams and climatological conditions in the transport of Culicoides vectors of livestock diseases (bluetongue and Akabane viruses) is discussed. Data from Israel on temperature, relative humidity, wind speed and direction were analysed for the years 1964, 1966, 1969 and 1988 at heights of 0.5, 1.0 and 1.5 km. The relationships of these parameters with outbreaks of Akabane and bluetongue viruses was examined. Results showed that disease outbreaks and most seroconversions did not occur before the season of the Persian trough air stream system (mid-June to mid-September), despite the fact that *C. imicola* is present locally during March-April. Circumstantial evidence for the introduction of infected Culicoides by wind is stronger than the evidence against. Moreover, the amount of spring rainfall in the years 1968-86 was not positively correlated with the number of bluetongue outbreaks. It is suggested that cooperation between the countries in the region of the Persian trough air system could lead to the establishment of an early warning system.

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16. **Campbell, D. and A. Roe, (1998).** "Results of a preliminary survey of livestock owners", in R.W. Dutton, J.I. Clarke, and A. Battikhi (eds): *Arid land resources and their management: Jordan's desert margin*: Kegan Paul International, London, UK. 189-196.
- Abstract:** The paper provides data on a sample group of pastoralists in the Jordan Badia Programme for long term flock monitoring. Data are presented on 105 livestock (sheep and goat) owners [no year given] who represent 4.2% of all Programme Area households, and 19.3% of households whose main source of income is drawn from livestock production. Data were gathered, through a questionnaire, on the following topics: background information on the respondent or owner; how the flock was being managed and structured; its importance within the household economy; attitudes to milk production; lamb take-off from the flock; cooperation and organization with other livestock owners; and use of supplementary feed concentrates.
17. **Chatty, D., M. Zaroug, and A. Osman, (1991).** *Pastoralists in Oman*. Rome: Food and Agriculture Organisation of the United Nations. 69pp.
- Abstract:** This study has three objectives: (1) to describe the traditional arid land management system of Oman and its evolution to date; (2) to describe its present interpretation by traditional pastoral leaders and government; (3) to analyse traditional arid land management in Oman with emphasis on land tenure, herd size and composition, access to resources and employment by different social groups and income distribution. The data are derived from fieldwork during the period 1981-89. The basic research tools used are participant observation, in- depth interview schedules, open-ended interviews, sample surveys and socio-demographic questionnaires. Following an introduction which deals with objectives, methodology, geographical background, social make-up and overlapping systems of land use, the second section deals with traditional arid land use, providing a brief description of the main pastoral tribes of Oman and the socioeconomic features common to them. The third section presents an analysis of traditional arid land management. The penultimate section contrasts traditional and modern practices as conflicting means to a common goal. The paper concludes with a summary of findings and recommendations.
18. **Chatty, D., (1996).** *Mobile pastoralists: development planning and social change in Oman*: Columbia University Press, New York, USA. xiv + 230pp.
- Abstract:** The book begins by describing the formation of a development project, targeting a pastoral community in Oman, from conception and design through to implementation and completion. The aim is to extend basic social services to a highly mobile pastoral population without destroying their traditional way of life. It then assess the impact of the project on the Omani nomads. The study is divided into eight chapters. Following an introduction, chapter 2 discusses the relationship between anthropology and development. Chapter 3 describes the plan of action negotiated between the international agency and the project leader, and discusses its implementation through a series of practical activities. Chapter 4 is a description of how the Harasiis tribe has come to terms with the radical changes in their environment. Chapter 5 examines the present Harasiis household focusing on the traditional cultural patterns and the new adaptations, and contrasts the families of a full time husbandryman with one who is locally fully employed. Chapter 6 focuses on the relationship between pastoralism and full time employment opportunities. Chapter 7 looks at the nature of gender relations among the Harasiis tribe and re-examines the perceived notion that women tend to be the conservative element in society. Chapter 8 considers the future of the Harasiis tribe living amongst extensive petroleum exploitation on a UNESCO World Heritage Site. It reviews the trends in herd management and subsistence patterns and the ways in which tribal identity can accommodate national identity.
19. **Christie, A.J., (1988).** "Markets and marketing: interdependence and change in the local economy." *Journal of Oman Studies*, (Special): 523-538.
- Abstract:** The marketing system links producer to consumer and is an important indicator of economic interdependence and change. In the Wahiba Sands and their margins, Oman, traditional exchange relationships involving the region's three main productive activities, namely pastoralism, agriculture and fishing, are changing dramatically. Although some of this change is due to the natural growth of the rural economy, the most rapid and recent

developments are a regional response to growth in the national economy resulting from the discovery of oil. Marketing strategies differ widely between local products. All, however, are influenced by newly established trade relationships between this and other regions in Oman and between Oman and other nations, particularly the United Arab Emirates and Saudi Arabia. Food imports, flooding the markets, have made a particularly significant impact on the viability of the rural economy, although a much wider range of imported consumer goods are also now to be found in markets throughout Oman. The competition from imported food products, notably fresh fruit and vegetables, hampers the development of the rural economy, while access to other imports has greatly altered life-styles and material expectations to the extent that cash is now a more highly desirable commodity than ever before. Market centres are expanding and transport networks are being improved to accommodate the growth in the commercial economy. Without assistance, neither the local producer, nor the regional economy as a whole can adapt at sufficient speed to keep pace with new and growing consumer demands. Marketing assistance from the Government to the producer has taken a variety of forms and met with various degrees of success. Contradictions between consumer and producer interests and between traditional production strategies and new market opportunities pose particular difficulties.

20. **Cooper, P.J.M. and E. Bailey, (1991).** "Livestock in Mediterranean farming systems: a traditional buffer against uncertainty is now a threat to the agricultural resource base." in *Risk in agriculture: proceedings of the Tenth Agriculture Sector Symposium*, . World Bank, Washington, D.C., USA. 18-21.
- Abstract:** Rainfed farming in West Asia and North Africa has evolved against a background of highly variable rainfall and temperature conditions. Traditional systems developed strategies to buffer against climatically induced uncertainty of production, a prime example being the close integration of crop and livestock enterprises. In this paper, climate, as the basis of uncertainty and risk, is discussed, and a broad overview of the evolution of farming systems in the region is presented. The integration and role of livestock, principally sheep, in these systems is highlighted together with an assessment of regional trends in livestock numbers and feed supplies. Syria is then taken as an example to illustrate in detail the problems faced by the region. Rising demand for livestock products has resulted in a dramatic increase in the national sheep flock size (3.1 to 13.3 million) in the last 35 years. The derived demand for barley, grain and straw has caused an equally dramatic increase in

the area sown to barley. The data indicate that the rapid expanse of the area under barley has been achieved by expanding cultivation into more and more marginal environments, and through the adoption of barley monoculture. National average yields have not increased, but clear indications of increased yield variability are present. The implications for sustainable production and resource conservation are discussed. Other possible strategies are examined. Reducing the area of barley in the marginal areas of Zones 4 and 5 and improving production on the remaining area through the introduction of simple, improved practices (such as seed dressing, drill sowing, the use of N and P fertilizer and the maintenance of the barley/fallow rotation) has the potential to meet national flock requirements in 75% of years, and at the same time, will increase the stability of production over time. The introduction of forage legumes would further enhance the national feed supply in all but the driest years.

21. **Delgado, C., M. Rosengrant, H. Steinfeld, S. Ehui, and C. Courbois, (1999).** *Livestock to 2020. The next food revolution*. Washington D.C.: International Food Policy Research Institute. pp72.
22. **Dixon, J., A. Gulliver, and D. Gibbon, (2001).** *Global farming systems study: Challenges and priorities to 2030. Synthesis and global overview*. Rome: Food and Agriculture Organisation of the United Nations. 1-35.
23. **Dutton, R.W., J.I. Clarke, and A. Battikhi, (eds) (1998).** *Arid land resources and their management: Jordan's desert margin*. London: Kegan Paul International Limited. xvii + 332pp.
- Abstract:** It is noted that there have been many changes to the population, the resource base and the management of the Badia's natural resources, which are the subject of the Jordan Badia Research and Development Programme. The book presents the main research findings from the first phase of the Programme, which established a baseline for the natural and human resources of the area. The Programme, long-term, is also deeply concerned with questions of economic and social productivity. The first two overview chapters define the changing relationship between the people and their environment and describe the natural resources upon which the people in the Badia depend. Subsequent chapters divide into groups. Chapters 1-10 cover

aspects of the hydrological cycle from precipitation to water demand. Chapters 11-13 look at aspects of the relationship between rainfall and irrigation and geomorphological processes. Chapter 14 contains a checklist of the flora including rain-dependent grazing plants. Chapter 15 deals with the changing pastoral system for the management of sheep and goats. A final group of papers describes demographic change and aspects of social structure, and discusses the provision of health and education services.

24. **Dutton, R. and M. Shahbaz, (1999).** "The Badia programme: defining and overcoming constraints on sustainable development." *Applied Geography*, **19**(4): 275-281.
- Abstract:** Since 1992 research on the Badia Programme, in north-east Jordan, has begun the process of identifying constraints on development and is suggesting where developmental potential still exists. Still, there are no proven development options to set alongside the traditional pastoralism. Perhaps in the future, service industries will provide the main additional employment opportunities, especially those serving the needs of international trade to and from Iraq and further east.
25. **Economides, S., (1983).** "Intensive sheep production in the Near East." *FAO Animal Production and Health Paper*, (40): 67pp.
- Abstract:** The Near East region, i.e. from Morocco and Mauritania to Pakistan, raises some 240 million sheep which is more than 20% of the total world sheep population. This report discusses the possibilities of increasing production to meet the growing demand for sheep meat and milk in this region. The following aspects are considered: semi-intensive and intensive production systems, early weaning and suckling regimes and fattening, with notes on farm construction and equipment, management of the breeding flock (including a discussion on milking) and management of fattening.
26. **ERGO, (1995).** *Formulation report for the pastoral resource assessment and monitoring component of the range rehabilitation and development programme.* Oxford and Rome: Report to the Ministry of Agriculture, Hashemite Kingdom of Jordan, by Environmental Research Group Oxford

Limited on behalf of the International Fund for Agricultural Development, Rome. .

URL: <http://ergodd.zoo.ox.ac.uk/ifadjordansum.htm>

27. **Esmail, S.H.M., (1991).** "Animal production from rangelands in Yemen." *Rangelands*, **13**(4): 196-198.
- Abstract:** Range ecology and management, factors affecting animal production from rangelands including changes in vegetation structure, plant toxicity and aphosphorosis, and range and livestock improvement strategies in Yemen are discussed.
28. **FAO, (1979).** *Strategy for livestock development in the Gulf States and Arabian Peninsula.* Beirut, Lebanon: Food and Agriculture Organization of the United Nations, Joint ECWA/FAO Agriculture Division. 73pp.
- Abstract:** The report deals with the role of the livestock sector in agricultural development. It discusses the long-term perspectives of supply and demand for livestock products. An analysis is made of important supporting policy measures.
29. **FAO, (1991).** *Report of the workshop on: Pastoral communities in the Near East: traditional systems in evolution.* Amman, Jordan: Food and Agriculture Organisation of the United Nations. 57pp.
- Abstract:** This paper presents a report of a workshop, organized by FAO and CARDNE (the Regional Centre for Agrarian Reform and Rural Development in the Near East), on pastoral communities in the region, held in Amman, Jordan, 1-5 December 1991. The workshop provided a venue for the exchange of ideas on the traditional range management systems of the region and their recent evolution with a view to studying the current social and economic changes and their long-term implications and to identify a common policy platform. The specific objectives of the workshop were to hold technical discussions on the major issues of concern for the development of pastoral populations in the region, to assess the problems, changes and trends and to make recommendations on policies and programmes that would reflect the aspirations of the populations in a participatory manner. Case studies were provided from Jordan, the Syria- Iraq-Turkey border, Iraq, Turkey, Saudi Arabia, Oman, Yemen, Lebanon and Iran. Major issues were identified:

rangeland degradation; rangeland speculation; pastoralists' loss of political power; non-acceptance of the legal framework; carrying capacity; underutilization of peripheral areas; range versus forage crops; cost-effectiveness of range investment; focus on development programmes; pastoralist- farmer relations; pastoralist mobility; planning. Major conclusions and recommendations fell under five headings: the need for a policy platform for pastoral people; land tenure; participation; identification of economically viable and ecologically sustainable pastoral systems; the need for research. As well as a list of participants and an agenda, this publication also includes as appendices two papers delivered at the workshop. The first is a keynote address, entitled 'The revival of traditional pastoral systems in the Near East' (J. Janzen). It maintains that the destruction of pasture land is not primarily a natural phenomenon but rather a socioeconomic and political- legal problem. Praising the hima, the traditional range management system of the region, it calls for two main measures: drastic reduction of livestock numbers; the re-introduction of traditional management systems. The second paper (A. W. Qureshi) 'Biological limits to animal production from pastoralism in the Near East' points out the limits to increasing livestock production from rangelands in the region and describes the major factors determining these limits, as well as discussing development issues which are relevant to the sustainable management of natural resources in the pastoral systems of production. The report concludes with appendices containing the recommendations of the three working groups. Group 1 deals with land tenure, water resources and the identification of range users. Group 2 deals with land tenure, participation and income generation. Group 3 deals with land tenure, identification of range users and identification of economically viable and ecologically sustainable pastoral systems and recommends further studies.

30. **FAO, (1995).** *Evaluation of food and nutrition situation in Iraq.* Rome: Technical Cooperation Programme, Food and Agriculture Organization of the United Nations. .

URL: <http://www.iacenter.org/fao.htm>

31. **FAO, (1997).** *Prevention and control of transboundary animal diseases.* Rome: Food and Agriculture Organisation, Animal Production and Health Paper 133. .
URL: <http://www.fao.org/DOCREP/004/W3737E/W3737E00.htm#TOC>
32. **FAO, (2000).** *World meat situation in 1999 and outlook for 2000.* Rome: Food and Agriculture Organisation. 33pp.
URL: Global trends in meat production and trade are reviewed in FAO (2000) (<http://www.fao.org/es/ESC/esce/escb/meat/pdf/Outlooke.pdf>)
33. **Farid, M.F.A., (1980).** "The Camel in Arab Nations." *Arab Center for the Studies of Arid Zones and Dry Lands*, (Publication 5): 76pp.
Abstract: This publication shows the economic importance of camels in relation to other traditional animals in dry lands and Arab nations. It enumerates the types of camels and discusses their distribution, daily food and water needs, mating seasons, foaling, and the physiology of growth and acclimatization. It compares camel grazing patterns with those of cattle, and illustrates the importance of the camel in milk, meat, wool, and hide production. In Arab nations, the camel produces 8.2% of all animal hides, 8.8% of all meat, 23.6% of the milk, and 9.1% of the wool. In Somalia, Sudan, and Mauritania, camel products account for about 85% of all animal products. This study is part of a larger program designed to promote the use of the camel at a time when Bedouins are settling and turning to other animals.
34. **Finan, T.J. and E.R. Al Haratani, (1998).** "Modern Bedouins: the transformation of traditional nomad society in the Al-Taysiyah region of Saudi Arabia", in V.R. Squires and A.E. Sidahmed (eds): *Drylands: sustainable use of rangelands into the twenty-first century. IFAD Series: Technical Reports.* Rome: International Fund for Agricultural Development. .
Abstract: This paper traces the history of the nomadic Bedouin pastoralists and the impact of modernization and is based on a large empirical study in central Saudi Arabia, including several months of participant observation among the Harb tribesmen. It examines the impact of modernization upon changes in rangeland management strategies is examined and, in turn, upon the livelihood of local Bedouin groups. It further enquires into the

environmental consequences and suggests several options that seek to reconcile the persistence of the Bedouin as a social category in Saudi Arabia with environmental sustainability. The key points made are:

1. Since the unification of the Kingdom of Saudi Arabia, traditional strategies of rangeland management have been significantly altered. Tribal boundaries and local control over water sources have disappeared, creating a situation of open ranges accessible to all groups and eliminating local management strategies.

2. At the same time, economic growth in Saudi Arabia has introduced capital-intensive forms of herding and more intense market integration of Bedouin groups into a wider economic system. Moreover, the government subsidies on feed grains have expanded economic opportunities and reduced the traditional risks of nomadic pastoralism. The Bedouin have experienced a major transformation from an essentially nomadic existence to one that resembles a market-orientated ranching strategy.

3. The environmental consequences are significant, with land degradation being a common feature.

35. **Ghandour, A.M., (1988).** "Health hazards in humans and animals caused by imported livestock diseases in Saudi Arabia." *Fauna of Saudi Arabia*, **9**: 468-477.

Abstract: A survey conducted at the Jeddah abattoir every month from 1983-1984 demonstrated higher incidences of parasitic diseases in imported as opposed to indigenous livestock (sheep, cattle and camels). Helminthic infections were fascioliasis, echinococcosis, cysticercosis, onchocerciasis (caused by *Onchocerca fasciata* in cattle), schistosomiasis (*Schistosoma bovis*) and coenurosis (*Coenurus cerebralis*). The distribution of these diseases is shown on a map. Naso-pharyngeal myiasis caused by *Cephalopina titillator* (in imported camels) was also detected. Diseases and ectoparasites reported in earlier studies are briefly discussed. 31 species of ixodid ticks have been recorded in Saudi Arabia, as have dermal myiases caused by *Chrysomya megacephala*, *C. albiceps*, *Wohlfhartia* spp., *Oestrus ovis* and *Hypoderma lineatum* in goats, camels and sheep. Viral (rinderpest, sheep-pox, foot and mouth disease) and bacterial diseases (brucellosis, contagious bovine pleuropneumonia, contagious caprine pleuropneumonia, pseudotuberculosis)

have also been reported by other workers and their incidence is briefly discussed and their distribution shown on maps.

36. **Gibbon, D., (2001).** *Global farming systems study: Challenges and priorities to 2030. Regional analysis of the Middle East and North Africa*. Rome: Food and Agriculture Organisation of the United Nations. 1-35.

37. **Gurdon, C., (1985).** "Livestock in the Middle East", in P. Beaumont and K. McLachlan (eds): *Agricultural development in the Middle East*. Chichester, UK: John Wiley & Sons. 85-106.

Abstract: This review examines trends which have occurred in the Middle East in the past 20 years. They include the dramatic rise in the level of production of dairy and poultry products, particularly in the richer oil-exporting countries of the Arabian Gulf. At the same time, the production of beef and mutton has not kept pace with demand. This has led to a substantial rise in the level of imports of both live animals and frozen meat to all but a few countries. Since countries such as Iran and Syria, which used to be major regional exporters, today have to import a large proportion of their livestock, only Turkey and Sudan are net exporters. The chapter also examines the way in which both net importers and exporters are now seeking to develop their livestock sector and to what extent they have been successful. **ADDITIONAL ABSTRACT:** Traditional systems of livestock production in the Middle East, livestock development projects in Saudi Arabia, Sudan and Turkey, and patterns of livestock production and trade in the region are reviewed. It is concluded that livestock production over the past 20 yr has been disappointing. Most governments of the region have ignored the importance of the livestock sector and its potential for increased production, and have increased imports of live animals and meat. The only sectors that have received sufficient investment and attention are the dairy and poultry industries.

38. **Hasnain, H.U., A.A. Al Hokhief, and A.R.F. Al Iryani, (1991).** "Goats in Yemen." *Animal Genetic Resources Information*, (8): 38-45.

Abstract: The distribution, phenotypic characters, performance and management systems of the major goat breeds in Yemen are described.

39. **Hedger, R.S., I.T.R. Barnett, and D.F. Gray, (1980).** "Some virus diseases of domestic animals in the Sultanate of Oman." *Tropical Animal Health and Production*, **12**(2): 107-114.

Abstract: A total of 415 cattle, sheep, goats, camels, horses and donkeys was sampled in 23 localities distributed throughout the 2 fertile regions of Oman. Foot-and-mouth disease virus type O, previously identified in Oman in 1976, was isolated from clinically affected animals. In addition, virus types A and Asia 1 were isolated from unaffected animals. Serological studies indicated that infection with all 3 types had been widespread. The presence of infectious bovine rhinotracheitis was confirmed by virus isolations and sheep and goat pox, long recognised in Oman, was confirmed by the demonstration of pox particles in dried lesion material. In serological studies antibodies were found to pest of small ruminants virus, bovine herpesvirus, bovine diarrhoea virus, bovine parainfluenza virus, bluetongue virus and african horse sickness virus. There were no significant antibody levels to rinderpest virus in unvaccinated animals and no antibody to equine infectious anaemia or vesicular stomatitis viruses.

40. **Horowitz, M.M. and F. Jowkar, (1992).** *Pastoral women and change in Africa, the Middle East and Central Asia*. New York: Institute for Development Anthropology. xiii + 79pp.

Abstract: This paper examines pastoral and agropastoral peoples in Africa, the Middle East and Central Asia, where production systems are concentrated in regions of low natural biological productivity, low and erratic rainfall patterns, and, especially in Central Asia, extremes of temperature and altitude. The gender division of property ownership is reflected ideologically in the allocation of labour, where men claim responsibility for herding and management of larger animals. Women's under-representation in formal political processes is in part balanced by their domestic responsibilities which legitimize a good deal of informal power, and their control over the processing, distribution, and often marketing of dairy products grants them a measure of economic autonomy. Pastoral and agropastoral production systems, in general, and pastoral women in particular, are experiencing rapid and profound changes resulting from the effects on these systems of larger economic and political events, including development actions imposed from outside. An erosion of land rights and encroachment of non-herding peoples is associated with growing internal differentiation of herding communities and

their marginalization both in space and in power. The commoditization of pastoral produce (meat, milk, hides, wool, etc), has had variable effects on women's roles and economic status. In general, a shift from subsistence dairying to commercial meat production has affected women adversely, diminishing both their revenue from milk and milk product sales and their status derived from decision making authority over household hospitality and food distribution. Pastoral/agropastoral production systems are in flux, and the position of women in these systems is changing. Many of the changes adversely affect women's status. Traditional mechanisms that once gave women a degree of autonomy within male-dominated pastoral communities are eroding, and new lines of gender discrimination have emerged as modern states firm up their economic and political grip. Any changes that weaken the viability of the production system in general, particularly the abrogation of pastoral land rights, also negatively affect women.

41. **Huss, D.L., (1977).** "Importance of range development in dryland systems of farming for integration of crops and livestock husbandries in the Near East." in *Technology for Increasing Food Production. Proceedings of the second FAO/SIDA seminar on Field Food Crops in Africa and the Near East.*, Lahore, Pakistan, 18 September to 5 October, 1977. Rome: Food and Agriculture Organisation of the United Nations. 188-192.

Abstract: In higher-rainfall areas of the Near East the introduction of a grain legume to replace the fallow period in the traditional rotation increased crop and animal production. In Libya, wheat yield increased from 0.4 t grain/ha using traditional methods to 1.6 t/ha with medic [*Medicago spp.*]/wheat rotation and grazing capacity was 3 sheep/ha. Common vetch, lucerne or sainfoin have also increased forage yields in areas with cold winters and av. rainfall of >350 mm. In Turkey, wheat, sainfoin and fallow rotations yielded 0.5 t/ha more wheat and gave an additional 5 t/ha of herbage. Phaseolus aconitifolus [*Vigna aconitifolia*] has been successful in the Sudan, and Dolichos lablab [*Lablab purpureus*] may also be suitable as a grain legume in the Near East. Rangeland was improved by controlled grazing in Jordan, Tunisia and Libya from 7-10 ha/ewe annually to 2-3 ha/ewe after a few yr. A 4-pasture rotation system in Tunisia increased grazing capacity from 7 ha/ewe to 2 ha/ewe annually in a 175-mm rainfall area, and in a higher-rainfall area yielded 3 t more lamb from 200 ewes than under traditional methods. Deferred grazing is recommended where pastoralists receive food incentives to grow their own forages during periods of low rangeland production.

42. **Ionesco, T., (1981).** "Ecological management of arid and semi-arid rangelands (EMASAR): Concept, objectives and present activities." in *Expert Meeting on Management, Conservation and Development of Agricultural Resources in the ECWA Region*. Damascus, Syrian Arab Republic, 9-15 May 1981. New York: United Nations Economic and Social Council, 33pp.
- Abstract:** The EMASAR program is sponsored by WHO and UNEP for the purpose of improving and maintaining balanced livestock and forage production. The overall design and goals of this program are reviewed. Detailed information on the many aspects of forage production, grazing, and stock management is presented. Regional cooperation is necessary for success in stabilizing productivity of semi-arid grazing lands. A calendar for the management of sheep is presented with information on available fodder species, animal diets, nutritional supplementation, and grazing rotation.
43. **Istanbulluoglu, E., (1993).** "Foot and mouth disease: surveillance and control in the Middle East", : *Rapports de synthese sur les themes techniques presentes au Comite international ou aux Commissions regionales*. Paris: Office International des Epizooties. 137-142.
- Abstract:** The report is based on information provided by the FAO Animal Health and Production division, the World Reference Laboratory for Foot and Mouth disease in the UK, and by the following countries: Cyprus, Egypt, Iran, Jordan, Kuwait, Lebanon, Oman, Saudi Arabia, Sudan, Turkey, and United Arab Emirates. No information was received from the following countries: Afghanistan, Iraq, Libya and Somalia. Topics discussed include the present status of animal production, animal health in the region, the FMD position and prevention and control.
44. **Jaubert, R. and R. Bocco, (1994).** "Traditional dryland resource management systems in Syria: construction or reality?" in *Population and environment in arid regions. Papers from a conference on population and environment in arid regions*. Amman, Jordan, 24-27 October 1994. Parthenon Publishing Group, Carnforth, UK. .
- Abstract:** Focusing on Syria, the paper presents a study of the rehabilitation of traditional management systems. The country was the first in the region to initiate a large sheep and range management programme based on the revival of the ancient Arab pastoral management system known as Hema. Although participation was remarkably high, over 90% of families utilizing the range joined the programme, the range management component of the project was the least successful. The paper discusses several biases which affected the design and implementation of the project, focusing in particular on the effects of state interventions on traditional systems and the apparent consensus between experts, government institutions and agro-pastoralists. A new strategy based on the Hema system has been proposed which stresses the need for active participation and the potential of communal range management in order to reverse the alarming degradation of steppe areas, and the paper considers whether these conclusions relate to reality despite being appealing. Issues discussed are: settlement, agrarian capitalism and land reform; the Sheep and Range programme, from resource conservation to increasing production; and whether range management is a key issue.
45. **Juma, K.H., (1997).** "Present status in buffalo production in Iraq." *Buffalo Journal*, **13**(2): 103-113.
- Abstract:** After a brief description of buffalo production on government and private farms in Iraq, the paper reviews the body measurements, and reproduction, milk production and growth traits of indigenous buffaloes in Iraq. The h2 and repeatability estimates for some of the traits are also tabulated.
46. **Kessler, J.J., (1995).** "Mahjur areas: traditional rangeland reserves in the Dhamar Montane Plains (Yemen Arab Republic)." *Journal of Arid Environments*, **29**(3): 395-401.
- Abstract:** Mahjur areas (traditional, privately owned rangeland reserves) are commonly found in the rangelands of the Dhamar Montane Plains. In various ways their use is integrated in the local agro-pastoral land-use system. They are most importantly used as a forage reserve in the dry season for feeding sheep. Local variation of their role, in that respect, is related to variation in ecological factors and is one measure aimed at optimizing rangeland utilization. It is recommended that their traditional utilization by village communities, of decreasing importance under the current socio-economic conditions, should be reconsidered. The re-introduction of an adapted system to improve livestock production in the dry season and to enhance ecological stability is proposed.

47. **Khouri, F., (1997).** *The encyclopaedia of goat breeds in the Arab countries.* Damascus, Syrian Arab Republic: The Arab Centre for the Studies of Arid Zones and Dry Lands (ACSAD/AS/P 158/1996). .

Abstract: Goats are known for their productive efficiency; adaptability; and tolerance of a wide range of environmental and climatic conditions; but are neglected on most research and development agenda, despite their utility and important role in the livelihoods of millions of poor farmers. This encyclopaedia of Arabian goat breeds is presented in three sections. The first describes where goats are found, in terms of geography, topography and climate. The second considers the productivity of different breeds and the production systems they inhabit. The third section describes the characteristics of three main breed types recognised: Syrian; Egyptian-Libyan; Nubian; Atlas; Yemeni-Sudanese; Southern Sudanese; White; and Sahelian

48. **Lancaster, W. and F. Lancaster, (1990).** "Desert devices: the pastoral system of the Rwala Bedu", in J.G. Galaty and D.L. Johnson (eds): *The world of pastoralism: herding systems in comparative perspective.* London: Belhaven Press. 177-194.

Abstract: The chapter traces the origins of the Rwala Bedu tribe whose way of life has been associated with camel pastoralism in north Arabia. The Rwala of Syria, like most Bedu, have always interacted with the outside world, and as the outside world changes, so too have the practice and occupations of the Rwala. The chapter emphasizes that the pastoral system of the Middle East has been in constant and close touch with the settled segment of the population. Pastoralism has never been a subsistence economy. It has always interacted with the agriculturalists and traders and, from the Bedu point of view, offered one resource in a multi-resource economy. One of the features of this multi-resource economy is that options are usually dictated by factors beyond the control of the pastoralists. They have to be able to adapt to ecological variation and react to the rise and fall of trade centres, the development of new trade routes, and the political actions of urban based states. As the chapter shows in its analysis of the camel pastoral economy, the Rwala are highly adaptive and quick to exploit change. They are able to do this because the ideology of autonomy and personal equality is closely linked to an extraordinary flexible social system.

49. **Leybourne, M., R. Jaubert, and R.N. Tutwiler, (1993).** "Changes in migration and feeding patterns among semi-nomadic pastoralists in northern Syria." *Paper Pastoral Development Network*, (34a): 20pp.

Abstract: This paper looks at the changes in migration and feeding patterns among semi-nomadic pastoralists in northern Syria in the light of the introduction of modern technologies and the increasing amount of land being given over to cultivation. The paper considers the following: current feeding patterns; a historical overview of the Bedouin occupation of the Syrian steppe, over two periods, 1860 to 1958 and 1958 to 1980; the evolution of three villages, Mouhaseneh, Bir Amaleh and Hzir Alsurr, used as case studies; the changes in the production system since 1980; the changes in the type of supplementary feed offered in all three villages; and, lastly, possible future trends. The paper highlights the link between cultivation and feed, and also notes that the populations of the steppe have become increasingly transient in recent years, and that this form of behaviour is likely to become commonplace unless other sources of income can be found. Questions are also raised in relation to the ability of cultivation on the steppe to support the numbers of sheep currently grazing there.

50. **Leybourne, M., (1997).** "The adaptability of Syrian Bedouin production systems." in *Population and environment in arid regions. Papers from a conference on population and environment in arid regions.* Amman, Jordan, 24-27 October 1994. 193-207.

Abstract: Focusing on the Syrian Bedouin, who are based in the steppe and are mostly semi-nomadic agro-pastoralists, the paper discusses the changes in the Bedouin production systems and the consequences these changes have had on both the environment and on the population. Data from a survey are presented: original data are drawn from a survey undertaken from 1978-81 undertaken by ICARDA in three villages (Mouhaseneh, outside the steppe, and Hazm Alsurr and Bir Amaleh inside the borders of the steppe). The villages were revisited in 1991/92 to study changes that had occurred in their production systems in the ten year period between the two surveys. Issues considered are: how sustainable the production systems are; what the future is of such systems; and whether despite the dynamism of the systems and adverse changes there may now be an increasing inability to adapt to change

despite similar situations in the past when the Bedouin have continued to herd sheep.

51. **Leybourne, M., (1999).** "The pastoral population and rangelands in Syria: change and adaptation." in *People and rangelands: building the future. Proceedings of the VI International Rangeland Congress*. Queensland, Australia., 19-23 July, 1999. International Rangeland Congress, Inc, Aitkenvale, Australia. 45-46.

Abstract: Factors of change and production systems of the pastoralists of the Syrian rangelands are investigated with particular reference to the issue of sustainability. Whilst to date these people have been able to sustain and maintain their production systems, there is some doubt surrounding their ability to do so in the future. Data were collected from 11 families during 1991 and 1998. The Bedouin have had to constantly adopt their migratory cycles to change. Whilst the dynamic nature of the production system helps with the process of adaptation, it also makes it difficult to plan for any change in the production systems.

52. **Loretz, J., (1991).** "The animal victims of the Gulf War." *The PSR Quarterly*, : 221-225.
URL: <http://home.ecn.ab.ca/~puppydog/gulfwar.htm>
53. **Magid, S.W., (1996).** *Buffalo population and production in Iraq*. : National Co-ordinator for Iraq, State Board for Agricultural Research, Baghdad. .
URL: <http://ww2.netnitco.net/users/djligda/wbiraq.htm>
54. **McCartan, B.M., A.G. Hunter, R.G. Pegram, and A.S. Bourne, (1987).** "Tick infestations on livestock in the Yemen Arab Republic and their potential as vectors of livestock diseases." *Tropical Animal Health and Production*, **19**(1): 21-31.

Abstract: A survey of ticks on cattle, camels, sheep, goats and donkeys was carried out in 1978-79 in 4 areas of the Yemen Arab Republic in order to provide more information on the possible risks to imported livestock of endemic tick-borne diseases. The ticks collected included *Amblyomma*

variegatum, *Boophilus annulatus*, *B. kohlsi*, *Hyalomma anatolicum excavatum*, *H. anatolicum anatolicum*, *H. erythraeum*, *H. impeltatum*, *H. dromedarii*, *H. arabica*, *H. marginatum rufipes*, *Haemaphysalis sulcata*, *Rhipicephalus evertsi*, *R. simus* and *R. sanguineus* s.l. Most abundant were species of *Hyalomma*, particularly on camels. Ticks recovered from cattle included species of *Rhipicephalus* and *Hyalomma*, and *A. variegatum* and *B. annulatus*. With the exception of camels, tick burdens were very low on livestock, too low for significant disease transmission. Serum samples (298) taken randomly from cattle throughout the country were negative for antibodies to *Anaplasma marginale*. Information on seasonality, distribution, ecology, host burden, distribution on the host and host preference are provided, and the implications of these findings are discussed.

55. **MoI, (1995).** *Oman' 95*. : Ministry of Information, Oman. .
URL: <http://www.nizwa.net/agr/agriculture.html>
56. **Nasher, A.A.W., A.K. Shibani, M. Al Eriyani, A. Aly Bourgy, A.H. Al Kohlani, et al., (2000).** "Outbreak of Rift Valley fever - Yemen, August-October 2000." *Morbidity and Mortality Weekly Report*, **49**(47): 1065-1066.
Abstract: During 7 August-7 November 2000, a total of 1087 suspected Rift Valley fever (RVF) case patients were identified in Yemen, including 121 (11%) who died. The mean age of suspected case patients was 32.2 years. The clinical spectrum of the disease was typical of that associated with RVF and included patients with haemorrhagic disease, encephalitis, retinitis and uncomplicated RVF. 815 of the 1087 (75%) case patients reported exposure to sick animals, handling an abortus or slaughtering animals in the week before onset of illness. Cross-sectional surveys were conducted in late September in diverse areas throughout Yemen to assess the extent of transmission in animals.
57. **Ngaido, T., F. Shomo, and G. Arab, (2001).** "Institutional change in the Syrian rangelands." *IDS Bulletin*, **32**(4): 64-70.

Abstract: Over the past forty years, the Syrian rangelands have been the focal point of government interventions. These had four major components: assertion of state ownership over rangelands, settlement and transformation of

herders into farmers, formal reorganisation of the Bedouin population into range improvement and sheep husbandry cooperatives, and development of rangeland reserves. Each of these interventions has had many implications for livestock production, on rangeland management as well as on the livelihood strategies of herding households and communities. In 1994, the Syrian government took a major decision by banning cultivation on rangelands and committed itself to enhancing livestock production through better conservation, improvement and management of rangeland resources.

The ban on cultivation, which is transforming sheep production systems and livelihood strategies of herding communities, is forcing herding communities to devise new strategies for overcoming their production constraints. Under present range conditions, it is clear that herding communities cannot stay there all year round and have, necessarily, to seek alternative feed resources. This article asks the questions: are herding communities likely to revert to old Bedouin livestock production systems based on trans-humance and reciprocity or will they opt to use more individualistic and market-based feed resources? Are feed access strategies differentiated by livestock ownership? How will these changes affect their production systems and livelihood strategies?

58. **Nishikawa, N., L. Gruner, M. Giangaspero, and D. Tabbaa, (1995).** "Parasite nematode infections in Awassi adult sheep: distribution through Syrian farm flocks." *Veterinary Research*, **26**(3): 162-167.
- Abstract:** 1474 adult sheep from 73 flocks distributed in the 13 provinces of Syria were examined for faecal egg and larval nematode outputs. *Marshallagia marshalli* and *Nematodirus* spp. infections were higher in the driest areas; infections by *Dictyocaulus filaria* and small lungworms (*Cystocaulus ocreatus* and *Muellerius capillaris*) were higher in the more rainy areas. A long transhumance distance limited small lungworm infections, which were higher in flocks using wet night shelters.
59. **Nordblom, T.L. and F. Shomo, (1993).** "Livestock and feed trends in West Asia and North Africa: past, present and future." *Cahiers Options Méditerranéennes*, vol. 1, n° 5, **1**(5): 15-30.
- Abstract:** This paper describes trends in populations of four major classes of livestock and in quantities of feeds in three classes² for fifteen countries of West Asia and North Africa (WANA) over a recent twenty-year period (1967-

71 to 1987-91). This addresses a gap in understanding the places and roles of the various livestock and feed classes and of the growing importance of concentrate feeds for poultry, dairy and feedlot production in particular. Using population projections to the years 2000 and 2025, and assumed expansions in production of crop residues, the authors project strong declines in the per capita numbers of livestock units supported by domestic sources of feedstuffs and grazing. Very large national deficits in livestock and/or feeds are projected and implications for research planning by ICARDA and national agricultural research systems (NARS) of WANA are explored

URL: <http://ressources.ciheam.org/om/pdf/c01-5/93400044.pdf>

60. **Pratt, D.J., F.I. Gall, and C.d. Haan, (1997).** "Investing in pastoralism: sustainable natural resource use in arid Africa and the Middle East." *World Bank Technical Paper Number 365*, : x + 159pp.
- Abstract:** This document offers guidelines for development in arid lands where pastoralism is practiced. The focus is on natural resource management (NRM), which is a prime consideration in pastoral development. An introductory chapter on the nature of NRM is followed by advice on preparing for project intervention (Part One), and guidelines for specific project components (Part Two). A concluding chapter considers the broader implications for international agencies such as the World Bank. Eight annexes provide additional background information and advice, and a user guide is offered for the practitioner.
61. **Reynolds, S., C. Batello, and S. Baas, (1999).** "Perspectives on rangeland development - the Food and Agriculture Organization of the United Nations." in *People and rangelands: building the future. Proceedings of the VI International Rangeland Congress*. Townsville, Queensland, Australia, 19-23 July, 1999. Aitkenvale, Australia: International Rangeland Congress, Inc., 160-165.
- Abstract:** Following an introduction to FAO approaches to rangeland development, four illustrative studies are presented: range rehabilitation, wildlife reintroduction and a participatory approach to range management in the Syrian steppe; Kazak herders, winter feed and transhumant systems in Altai Prefecture, Xinjiang, China; pastoral risk management in Mongolia; and rural development at N'Nguigmi in Niger.

62. **Rowe, A.G., (1999).** "The exploitation of an arid landscape by a pastoral society: the contemporary eastern Badia of Jordan." *Applied Geography*, **19**(4): 345-361.

Abstract: The paper reconsiders the use of arid landscapes as a resource by pastoral societies in the light of recent socioeconomic developments, using Bedouin livestock herding in the Jordanian Badia as a case study of a pastoral system in transition. The paper argues that in the contemporary Badia context, landscape is exploited by users in a wide variety of ways, and for the acquisition of both tangible and non-tangible resources. The study concludes that the modernization and commercialization of livestock production in the Badia does not necessarily imply a diminishing of ties between herder and land resources, and suggests instead that the process of modernization in livestock production may in fact generate a wider spectrum of options for its exploitation. Data were gathered from 105 pastoral households during 1994, and then more detailed data were gathered from 25 households during 1995-98.

63. **Rweyemamu, M., R. Paskin, A. Benkirane, V. Martin, P. Roeder, et al., (2000).** "Emerging diseases of Africa and the Middle East." *Annals of the New York Academy of Sciences*, **916**: 61-70.

Abstract: The term "emerging diseases" has been used recently to refer to different scenarios, all of which indicate changes in the dynamics of disease in the population. Of the OIE List A diseases, major changes have been experienced with rinderpest, peste des petit ruminants (PPR), contagious bovine pleuropneumonia (CBPP), foot-and-mouth disease, African swine fever, lumpy skin disease, and Rift Valley fever. Rinderpest represents a success story of the 1990s, thanks to the programs of the Pan African Rinderpest Campaign (PARC). The situation has changed from that of the 1980s when rinderpest was widespread throughout most of Tropical Africa and the Middle East. PPR is a disease that has become of increasing importance throughout Tropical Africa and the Middle East. CBPP, which had previously been reduced to sporadic incidence within endemic areas, invaded new areas, causing heavy mortality. African swine fever has extended to West Africa and to Madagascar, in both regions resulting in heavy losses. Climatic changes in both East and West Africa were associated with an upsurge of Rift Valley fever. Deficiencies in national veterinary services have contributed to

failures in early detection and response; in many regions investigation and diagnosis services have deteriorated. The continuing structural adjustment program for national veterinary services will need to take into account their transformation from providers of services (e.g., vaccinations, medicines) to inspection and quality assurance services. Surveillance, early warning, and disease emergency preparedness will need to be pursued more vigorously in Africa and the Middle East as vital components of national veterinary services.

64. **Sere, C. and H. Steinfeld, (1966).** *World livestock production systems: current status, issues and trends*. Rome: Food and Agriculture Organisation of the United Nations. pp89.

65. **Shalash, M.R., (1990).** "Prospects of buffalo development in the Arab world." *Egyptian Journal of Veterinary Science*, **27**: 1-8.

Abstract: This review deals with buffalo breeds and their distribution and the use of buffaloes in the Middle East for meat and milk production and traction.

66. **Shanawany, M.M. and J. Dingle, (1999).** "Ostrich production systems." *FAO Animal Production and Health Paper Number 144*, : 1-256.

Abstract: The 1st part of this publication on the ostrich is a review of (1) its origin and evolution, (2) basic anatomy and physiology, (3) farming systems, (4) breeding, (5) incubation and hatching, (6) management of chicks, (7) nutrition, (8) ostrich products, (9) diseases and their medical management, and (10) the economics of ostrich farming. The 2nd part is an account of ostriches and ostrich farming in South Africa, Namibia, Zimbabwe, Kenya, Ethiopia, the United Arab Emirates and Australia.

67. **Shelton, M. and R. Lewis, (1985).** "Breeding sheep for arid environments." in *International Conference on Animal Production in Arid Zones (ICAPZ)*. Damascus, Syria, 7-12 September 1985. Damascus, Syria: Arab Center for the Studies of Arid Zones and Dry Lands. 665-674.

Abstract: A discussion of economic values of sheep meat and wool, breed type population numbers, necessary traits for arid regions, methods of improving fat-tailed sheep, selection and crossbreeding.

68. **Shimshony, A., (1999).** "Disease prevention and preparedness in cases of animal health emergencies in the Middle East", in G. Murray and P.M. Thornber (eds): *Revue Scientifique et Technique Office International des Epizooties*: 66-75.

Abstract: Au Moyen-Orient, la situation de la santé animale est très défavorable, la région étant fortement exposée à nombre de maladies animales majeures. Pour illustrer les facteurs déterminants qui contribuent à cette situation, l'auteur prend pour exemple une épidémie de fièvre de la Vallée du Rift survenue en Égypte entre 1977 et 1980. Le Moyen-Orient est mal préparé à la mise en place de mesures de prévention et de contrôle des maladies en raison de carences tant au niveau national que régional. La détection précoce, le diagnostic et la déclaration de maladies doivent devenir une priorité pour chaque pays mais également entre pays. L'auteur décrit plusieurs programmes régionaux de santé animale, soutenus par des organismes internationaux, et montre leur importance respective.

69. **Shoup, J., (1990).** "Middle Eastern sheep pastoralism and the Hima system", in J.G. Galaty and D.L. Johnson (eds): *The world of pastoralism: herding systems in comparative perspective*: London: Belhaven Press. 195-215.

Abstract: Hima is a communal property system developed by the nomadic pastoralists in the Middle East and North Africa but it enjoyed widespread use by non-pastoralists as well. It restricted and regulated the use of lands for grazing, provided areas for use during droughts, and maintained the productivity of the rangelands. Hima remained an important aspect of pastoral techniques in the Middle East and North Africa until the institution of national land reform policies in the 1950s and 1960s. In 1968, hima was revived as the official rangeland policy in Syria, following a decade of failed land reform and pastoral programmes. The Syrian programme revived traditional tribal hima in the form of cooperatives. By 1983 over 90% of the total Bedu population had joined cooperatives. During 1981- 83, 80 new cooperatives were registered, to give a total of 231, with over four million head of sheep. Three types of cooperatives have been organized since the inception of the

programme: tribal cooperatives called tahsin; government-owned cooperatives or hukumiyah; and cooperatives for villagers and urban flock owners called tarbiyah, or livestock production cooperatives. All the hima cooperatives are linked to the tasmin or fattening cooperatives through marketing channels. Several other agricultural support programmes operate in Syria. They are of two types: agricultural production programmes in the higher rainfall areas; and plant banks and restocking programmes to improve the productivity of the desert. The chapter discusses the important changes that have occurred among the Syrian Bedu as a result of the implementation of revived hima.

70. **Sidahmed, A.E., (1990).** "Analysis of animal production systems in marginal lands (with a case study of the United Arab Emirates and experiences from eastern Africa)." in *Advances in range management in arid lands. Proceedings of the First International Conference on Range Management in the Arabian Gulf*, . London: Kegan Paul International Limited. .

Abstract: The human support capacity of marginal arid and semi-arid lands is considered briefly. Pastoral production systems in these areas and the distribution of ruminants in these areas are outlined with particular reference to E. Africa. Constraints to pastoral animal production systems are listed and include administrative and socio-economic constraints, aridity, desertification, and decreased range productivity (as a result of overgrazing, extended drought, cultivation of grazing lands, fires, over supply of water points, abolition of local administration and poor animal performance). Range improvement measures are also listed. A case study of animal production systems in the United Arab Emirates is presented in which livestock species and breeds, and land use are reviewed.

71. **Skarkova, L. and R.F.A. Sawan, (1988).** "Some aspects of sheep breeding in the United Arab Emirates." *Agricultura Tropica et Subtropica*, (21): 177-183.

Abstract: A discussion on sheep production, with particular emphasis on improving productivity through improvements in the environment, and selection within the indigenous adapted breeds. Production characters of the Awassi and Chios breeds are tabulated.

72. **Slingenberg, J., G. Hendrickx, and W. Wint, (2002).** "Will the livestock revolution in the developing world succeed?" *AgriWorld Vision*, 2(4): 31-33.
- Abstract:** Patterns of food consumption are becoming increasingly similar throughout the world, incorporating higher-quality and more expensive, safer meat and dairy products. This trend is associated with the increased international trade in foods, the global spread of fast food chains, and the exposure to North American and European dietary habits. Dietary convergence is particularly high among the high income OECD countries. Clearly, dietary shifts have had global impacts on the demand for agricultural products and will continue to do so. Meat consumption in developing countries has risen from only 10 kilos per person per year in 1964/66 to 26 kilos in 1997/99 and is projected to rise further to 37 kilos in 2030. Milk and dairy products could rise from 45 kg now to 66 kg by 2030. The authors argue that imbalances in global livestock development must be redressed to halt the spread of animal diseases, food safety hazards and other veterinary public health risks.
73. **Squires, V.R. and A.E. Sidahmed, (eds) (1998).** *Drylands: sustainable use of rangelands into the twenty-first century*. Rome: International Fund for Agricultural Development. IFAD Series: Technical Reports. 470pp.
74. **Sriramaratnam, S., (1988).** "The New Zealand live sheep export quota: the potential impact and economic considerations." in *Australian Agricultural Economics Society, New Zealand Branch, Annual Conference*,. New Zealand: Blenheim, 8-9 July 1988. Discussion Paper Number 121, Agribusiness & Economics Research Unit, Lincoln College, University of Canterbury. 300-318.
- Abstract:** Live sheep exports from New Zealand recommenced in 1985 and have experienced only modest growth, due mainly to the annual quota in effect since 1986. The major determinants of demand for live sheep, especially in the Middle East market, are identified and discussed. The countries included are those surrounding the Persian Gulf (including Iran and Iraq) and north African countries such as Algeria, Libya and Egypt. The nature of demand for sheepmeat in the Middle East, both frozen and chilled lamb and mutton, is also considered. Alternative supplies of meat and suppliers of live sheep are surveyed. This market analysis provides the framework against which the effects of the live sheep exports on producer returns and hence on the New Zealand sheep industry are analysed. Following this, the impacts on the meat processing industries are examined. Animal welfare, transport considerations and recent market developments are analysed, leading up to a study of implications of the quota and of its administration. In the long term, the benefits to the economy of unrestricted trade are considered to outweigh any short-term losses to sector groups. The main effects of the live sheep trade on sheep farming are on current returns and future sheep numbers. The absence of a sound economic basis for determining the quota and its allocation has stifled natural growth in New Zealand's live sheep trade.
75. **Stafford, K., (1989).** "Animal health and production in the Tihama area of the Yemen Arab Republic." *Tropicultura*, 7(4): 172-174.
76. **Steinbach, J., (1985).** "Evaluation of goat genotypes for use in semi-arid environments." in *International Conference on Animal Production in Arid Zones (ICAPZ)*. Damascus, Syria, 7-12 September 1985. Damascus, Syria: Arab Center for the Studies of Arid Zones and Dry Lands. 665-674.
- Abstract:** A discussion on evaluation of goats for conformation, reproduction and fertility, growth and carcass traits, milk yield and composition, skin and fibre yield and quality, disease susceptibility, mortality, biometeorological and nutritional adaptations, genetic parameters and profitability.
77. **Sultan Ahmed Sultan Al, K., (1993).** *Problems associated with international trade and the movement of livestock in the region*. Paris: Office International des Epizooties. 153-158.
- Abstract:** The Middle East is an important market for the international livestock trade. The transportation of several millions of animals annually through the region carries hazards for both the animals and the countries concerned. This report deals with identification of the problems associated with livestock trade, an outline of the available recent scientific research, recommendations and references to significant reports published. In addition, it stresses the importance of international cooperation in adhering to guidelines and legislation which currently exist in order to allow this

important trade to continue whilst maintaining the highest standards of animal welfare. Contributions to this report have been received from Cyprus, Kuwait and Saudi Arabia.

78. **Swaid, A., (1995).** *Buffalo population and production in Syria.* : Buffalo Network National Co-ordinator, Syria. .

Abstract: There are two distinct types of buffalo in Syria: Mediterranean; and Indian They are found in the middle part of the country (Ghab Plain) and the north-eastern part of the country (Kamishly). The population had been in decline but as of 1995 had stabilised at around 4,500. Buffalo farmers in Syria are specialized farmers; and don't practice other agricultural activities. In the Ghab area, they live in close villages, while in Kamishly they are basically settled Bedouin.

URL: <http://ww2.netnitco.net/users/djligda/wbsyria.htm>

79. **Tawfik, M.A.A. and H.S. Al Sumry, (1991).** "Gastro-intestinal parasites of livestock in Oman." *World Animal Review*, (66): 64-67.

Abstract: A total of 1780 random faecal samples were collected from sheep, goats, cattle and camels in different regions of Oman, and examined for parasites. The most widespread parasite, *Eimeria* sp., found in 61.8% of the samples, caused wasting, debility and diarrhoea, especially in young livestock. Of the gastrointestinal nematodes, species belonging to the genera *Haemonchus*, *Ostertagia*, *Trichostrongylus* and *Nematodirus* were the commonest causes of problems in livestock. *Strongyloides papillosus* was seen in sheep, cattle and to a lesser extent camels in some regions, with diarrhoea, emaciation and a rough coat the most common symptoms. *Trichuris* was found to cause disease in a low percentage of goats and camels. *Skrjabinema ovis* was diagnosed among goats in the coastal region of the country. Although it was not associated with clinical disease, perianal pruritus resulted from the movement of the female worm and the presence of egg masses.

80. **Thomson, E.F., L. Gruner, F. Bahhady, G. Orita, A. Termanini, et al., (2000).** "Effects of gastro-intestinal and lungworm nematode infections on ewe productivity in farm flocks under variable rainfall conditions in Syria." *Livestock Production Science*, **63**(1): 65-75.

Abstract: 10 flocks of Awassi sheep in north-west Syria were monitored over 4 years from February 1987 to determine the effect of gastro-intestinal and lungworm nematode infections on ewe productivity. Rainfall varied considerably between the different years (below average rainfall in 2 years contributed to low levels of infection even in untreated ewes). A group of ewes in each flock served as controls, and the others were treated with a high dose of fenbendazole (625 mg, given twice, 14 days apart) in the autumn and again in the spring. The flocks were visited each month to start with, and every 3 months later in the trial, to collect faecal samples, and recordings were made of ewe and lamb live weight, ewe body condition score, changes in flock inventory and supplementary feeding practices. Treated ewes had generally lower numbers of eggs and larvae in their faeces. Treatment had no beneficial effect on ewe fertility, mortality or survival, but in spring treated ewes were heavier and generally had better body condition than untreated ewes ($P < 0.01$ in some years), and this was associated with heavier lambs at birth and at weaning ($P < 0.01$ in some years). Stepwise regression analysis suggested that better management, such as more rigorous culling, resulted in higher ewe fertility and survival. The overall effect of treatment on annual ewe productivity was small, equivalent to 0.5-1.0 kg additional lamb weaned per ewe exposed to rams, but this covered the cost of the treatment. The trial demonstrated that useful studies on nematode parasites can be conducted in farm flocks, and this gives the results added value for predicting the impact of treatment on other flocks in north-west Syria.

81. **Thornton, P.K., R.L. Kruska, N. Henninger, P.M. Kristjanson, R.S. Reid, et al., (2002).** *Mapping poverty and livestock in the developing world.* Nairobi, Kenya: International Livestock Research Institute.
82. **Tleimat, F.M., M.F.A. Farid, H.M.H. Abbas, M.B. Al-Mufarreh, O.A. Awa, et al., (1981).** *Encyclopaedia of animal resources in the Arab Countries.* Damascus, Syria: Arab Centre for the Studies of Arid Zones and Dry Lands.
- Abstract:** The eight volumes cover the following countries: Tunisia; Syria; Mauritania; Kuwait; Bahrain (all by F.M. Tleimat and M.F.A. Farid); Sudan (Tleimat and H.M.H. Abbas, M.B. Al-Mufarreh, O.A. Awa and M.F. Wardeh); Iraq (A. Al-Haj Taha and Tleimat); and Morocco (B. Abdel-Rahman and Tleimat). Each volume describes the livestock farming situation

and structure in the country concerned, with particular reference to traditional systems, and the current and future potential for camels and goats.

83. **Tleimat, F.M., R. Al-Khatib, I. Al-Herek, M. Safeih, and Z. Abdo, (2002).** *The economics of Awassi sheep production systems in Syria*. Damascus: The Arab Center for the Studies of Arid Zones and Dry Lands, ACSAD/AS/P 266/2002. .

Abstract: Sheep production in most Arab countries depends on the traditional extensive system where natural rangelands are the main feed sources. In Syria, there are about 13.5 m sheep which contribute 78%, 27% and 100% of the total red meat, milk and wool production, respectively. Most sheep feed on natural rangelands for over 6 months each year. The objectives of this study were to identify sheep production systems, economic evaluation of each production system, the main themes for improving such systems and means for alleviating drought impacts. The study was conducted on private sheep herds in Syria during the season 1997/1998, which was one of the best seasons, and 1999/2000, which was extremely dry. Three systems of sheep production were distinguished, namely the sedentary, semi sedentary and nomadic. Productivity and the net return of sheep herds were estimated.

84. **Webster, R., (1988).** "The Bedouin of the Wahiba Sands: pastoral economy and society." *Journal of Oman Studies*, (Special): 461-472.

Abstract: The Wahiba Sands (Ramlat Al Wahibah) are inhabited by 450-500 Bedouin families, or 2700-3000 people. The largest and most widespread tribe is the Al Wahibah. Each tribe is associated with a particular subregion of the Sands containing wells, summer and winter pastures. The tribes also look to particular settlements on the edges of the area as their administrative and market centres. They raise mainly goats and camels, with a few sheep and even a very small number of cattle. The herds provide milk, butter, meat and a small cash income from irregular sales. The cash income from an average herd of 40-50 goats may be as little as RO 250-350 per annum. Against this must be set the expenses of buying staple foods (rice, flour, dates, coffee and fish), obtaining and running a truck and the costs of providing supplementary feed for livestock for at least 6 months of the year. It appears that a small family with few children or dependents is able to subsist on the produce of its livestock for some months or perhaps a few years. As families grow, and as

occasional major costs are incurred, one or more members of the family goes to work, usually in the army or police of the United Arab Emirates. There are limited opportunities for seasonal harvesting work or casual trading within the region. At least half the families are dependent on remittances for their own livelihood and often to support their livestock. The Sharqiyah is known for its very fine racing camels, some of which are bred in the Sands. The breeding and sale of racing camels contributes significantly to the income of some families. The encouragement of greater commercial orientation among traditional semi-nomadic pastoralists is notoriously difficult.

85. **Webster, R., (1991).** "The Al Wahiba: Bedouin values in an oil economy." *Nomadic Peoples*, (28): 3-17.

Abstract: Oil production in Oman is of modest proportions, yet still accounts for around 50% of GDP and 80% of government income. As much as half of the population is rurally based and engaged in agriculture, fisheries and pastoralism, albeit often on a part time basis. These rural industries remain semi-traditional, characterized by a small scale of operations and low productivity. Bedouin life in Oman, which differs in many respects from the better known traditions of Central and Northern Arabia, is illustrated in reference to the Al Wahiba, a Bedouin tribe of north eastern Oman. The semi-nomadic herding life continues to be followed by many of these Bedouin, yet this apparent stability conceals a conflict whereby national prosperity derived from oil is undermining both the pastoral economy and the cultural goals and values associated with it.

86. **Wint, W., J. Slingenbergh, and D. Rogers, (2000).** *Livestock distribution, production and diseases: towards a global livestock atlas*. Oxford: Report by Environmental Research Group Oxford Limited and TALA Research Group, Department of Zoology, University of Oxford to the Animal Health Service of the Animal Production and Health Division of the Food and Agriculture Organisation of the United Nations, Rome, Italy.

6. SELECTED WEBSITES

The following links were working on 31 January 2003:

Arab Centre for the Studies of Arid Zones and Dry Lands (ACSAD): <http://www.acsad.org/index.html>

Bahrain: <http://www.bahrain.gov.bh/english/RunIndex.asp?count=21>

Environmental Research Group Oxford Limited (ERGO): <http://ergodd.zoo.ox.ac.uk/>

Environmental Systems Research Institute (ESRI): <http://www.esri.com/>

FAO Agricultural Statistics Information Links: <http://www.fao.org/WAICENT/FAOINFO/ECONOMIC/ESS/ASIL/links/new.htm>

FAO Animal Production and Health Division: http://www.fao.org/ag/aga/index_en.htm

FAO Land and Water Development Division: <http://www.fao.org/ag/agl/default.stm>

FAO Livestock Geography: <http://www.fao.org/ag/aga/Publication/CD-ROM/LAS/faolivat2/LIVATL2/index.htm>

FAO Livestock, Environment and Development Initiative (LEAD): <http://www.lead.virtualcentre.org/selector.htm>

FAO Statistical Databases: <http://apps.fao.org/default.htm>

Food and Agriculture Organisation (FAO): <http://www.fao.org/>

International Centre for Agricultural Research in the Dry Areas (ICARDA): <http://www.icarda.cgiar.org/Index.Htm>

International Fund for Agricultural Development (IFAD) Livestock and Rangeland Knowledgebase: <http://www.ifad.org/lrkm/about.htm>

Iraq: <http://www.iraqi-mission.org/>

Jordan, Department of Statistics: http://www.dos.gov.jo/agr/stat_f_1.htm

Kuwait: <http://www.mop.gov.kw/MopWebSite/english/default.asp>

National Geographic Society, Maps and Geography: <http://plasma.nationalgeographic.com/mapmachine/>

Oman: <http://www.moneoman.gov.om/>

Qatar: <http://english.mofa.gov.qa/>

Saudi Arabian Information Resource - Central Department of Statistics: <http://www.saudinf.com/main/c74.htm>

Statistical, Economic and Social Research and Training Centre for Islamic Countries: <http://www.sesrtcic.org/aboutus.shtml>

Sustainable Animal Production - Visions for the 21st Century: <http://agriculture.de/acms1/conf6/index.htm>

Syria Gate – Government Ministries and Establishments: http://www.syriagate.com/Syria/Government/Ministries_And_Establishments/

Syria, Ministry of Agriculture and Agrarian Reform: <http://www.syrianagriculture.org/frame.htm>

United Arab Emirates: <http://www.uae.gov.ae/maf/>

World Animal Health Organisation: <http://www.oie.int/>

Yemen National Information Centre: <http://www.nic.gov.ye/English%20site/index.htm>

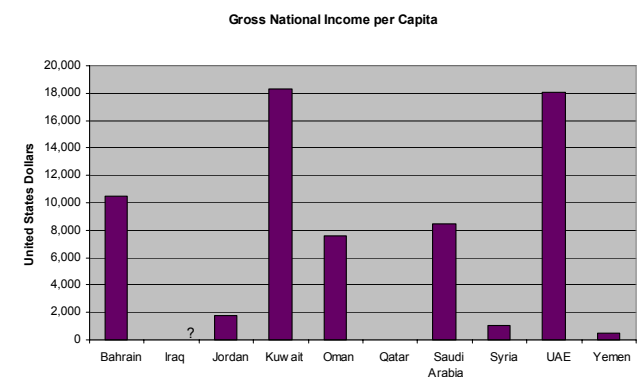
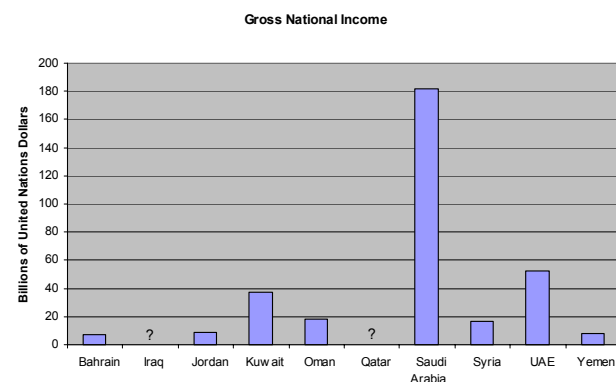
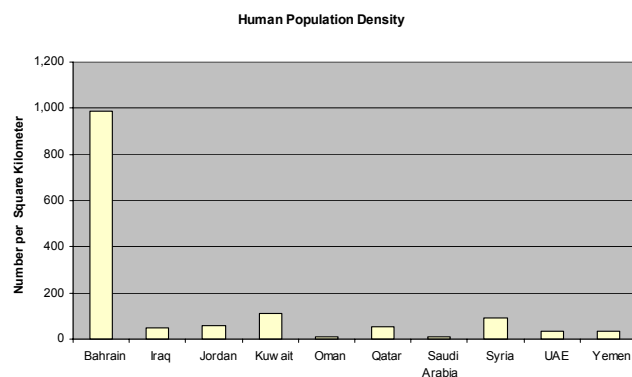
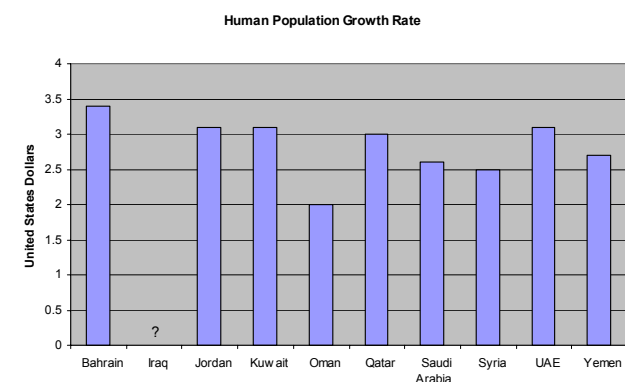
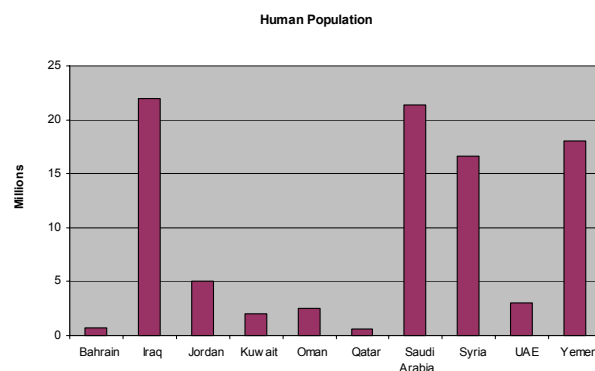
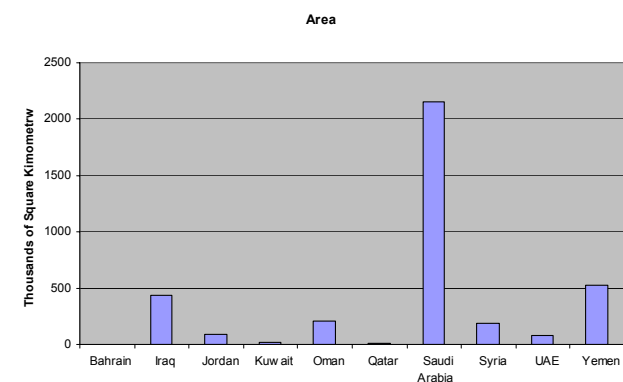
APPENDIX 1: TERMS OF REFERENCE

Under the overall guidance of the Chief, Animal Health Service, and in direct collaboration with colleagues of EMPRES and the Environmental Health Management Team, the contractor will produce a report on livestock distribution and movement as relevant to the understanding of livestock disease spread in the Arabian Peninsula. In particular, the incumbent will:

- collate and compile available livestock data for the whole of the Arabian Peninsula with incorporation also of the countries Jordan, Syria and Iraq, from Internet searches, FAO documents, literature and on the basis of records obtained through direct contact with livestock services in the countries concerned, and produce a comprehensive knowledge base on all the livestock data which are directly relevant to the epidemiological analysis of trans-boundary animal diseases in the area concerned;
- describe in further detail the spatial dimension of the annual husbandry cycles (mainly of sheep, goats, and cattle) placing emphasis on the movement of animals in response to the availability of forage/grazing/water, both seasonal and within season, and related to the lambing season, fattening in feedlots, markets, local and international trade, religious festivities, networks of on-foot livestock trade tracks, road transport, shipment by vessels and air, the supply pattern to provide the urban centres with meat and/or dairy;
- in addition to written text, compile all the above data in spreadsheets with time and location references;
- describe how this information may serve the epidemiological understanding of disease spread of infectious livestock diseases;
- identify critical information gaps and recommend how this problem may be overcome through further field collection of data; and
- provide a comprehensive report on all of the above, both in electronic format and two hard copies, in English.

APPENDIX 2: DEMOGRAPHIC AND ECONOMIC INDICATORS (2001)

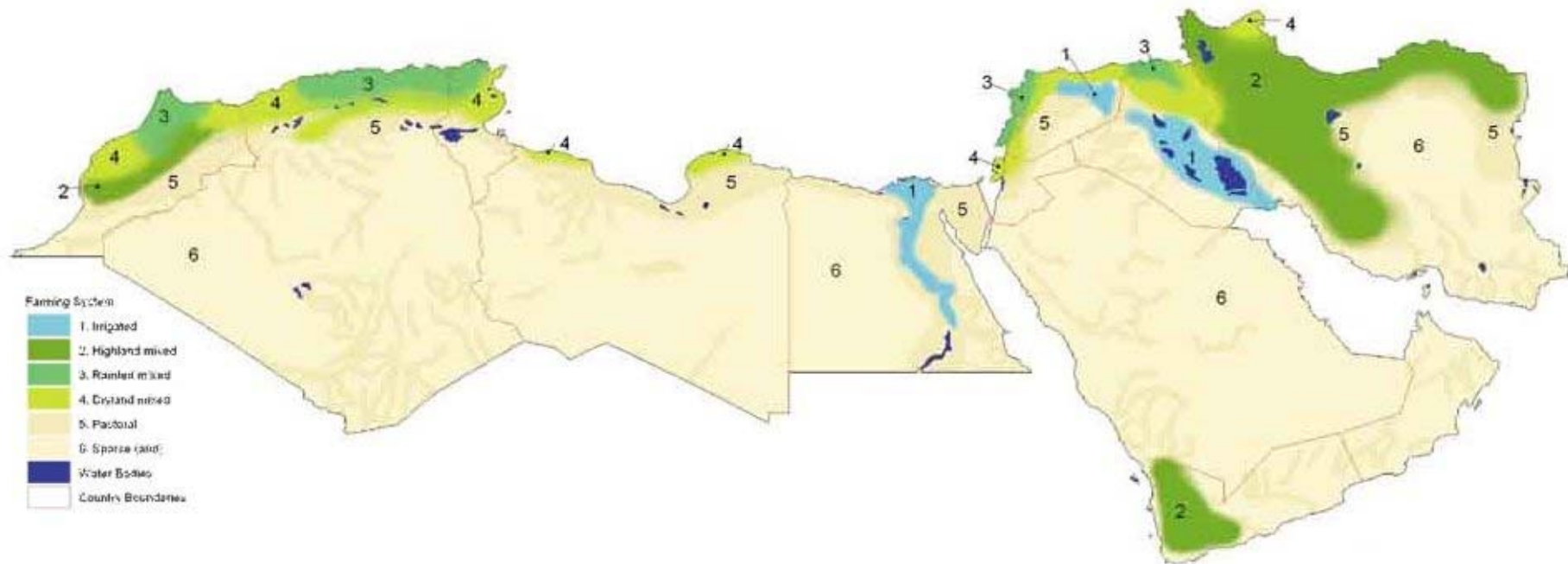
Country	Area km ²	People	Density /km ²	Growth %	Rural %	GNI/Capita US\$	GNI Billions US\$
Bahrain	710	700,000	986	3.4	7.5	10,470	7.5
Iraq	438,000	22,000,000	50	?	?	?	?
Jordan	89,200	5,000,000	56	3.1	21.2	1,750	8.8
Kuwait	17,800	2,000,000	112	3.1	3.9	18,270	37.4
Oman	212.5	2,500,000	12	2	23.5	7,600	18.6
Qatar	11,000	600,000	55	3	?	?	?
Saudi Arabia	2,150,000	21,400,000	10	2.6	13.4	8,480	181.6
Syria	185,200	16,600,000	90	2.5	48.2	1,010	16.7
UAE	83,600	3,000,000	36	3.1	12.9	18,060	52.5
Yemen	528,000	18,000,000	34	2.7	75.0	450	8.2



Source: <http://lnweb18.worldbank.org/mna/mena.nsf>

APPENDIX 3: FARMING SYSTEMS

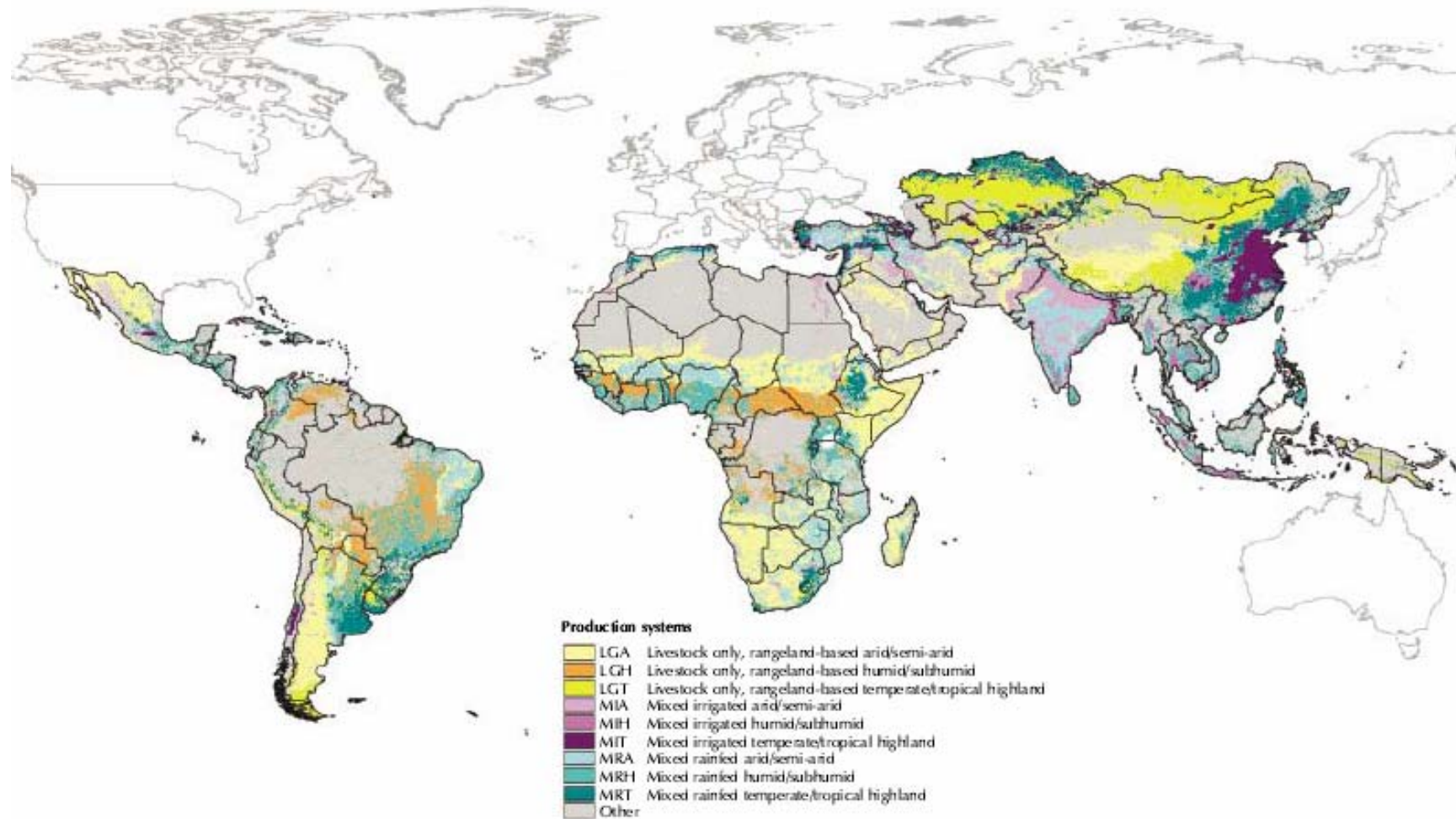
Figure 21: Major Farming Systems of West Asia and North Africa



Source: Gibbon (2001).

APPENDIX 4: GLOBAL LIVESTOCK PRODUCTIONS SYSTEMS

Figure 22: Global Livestock Production Systems



Source: Thornton *et al.* (2002).

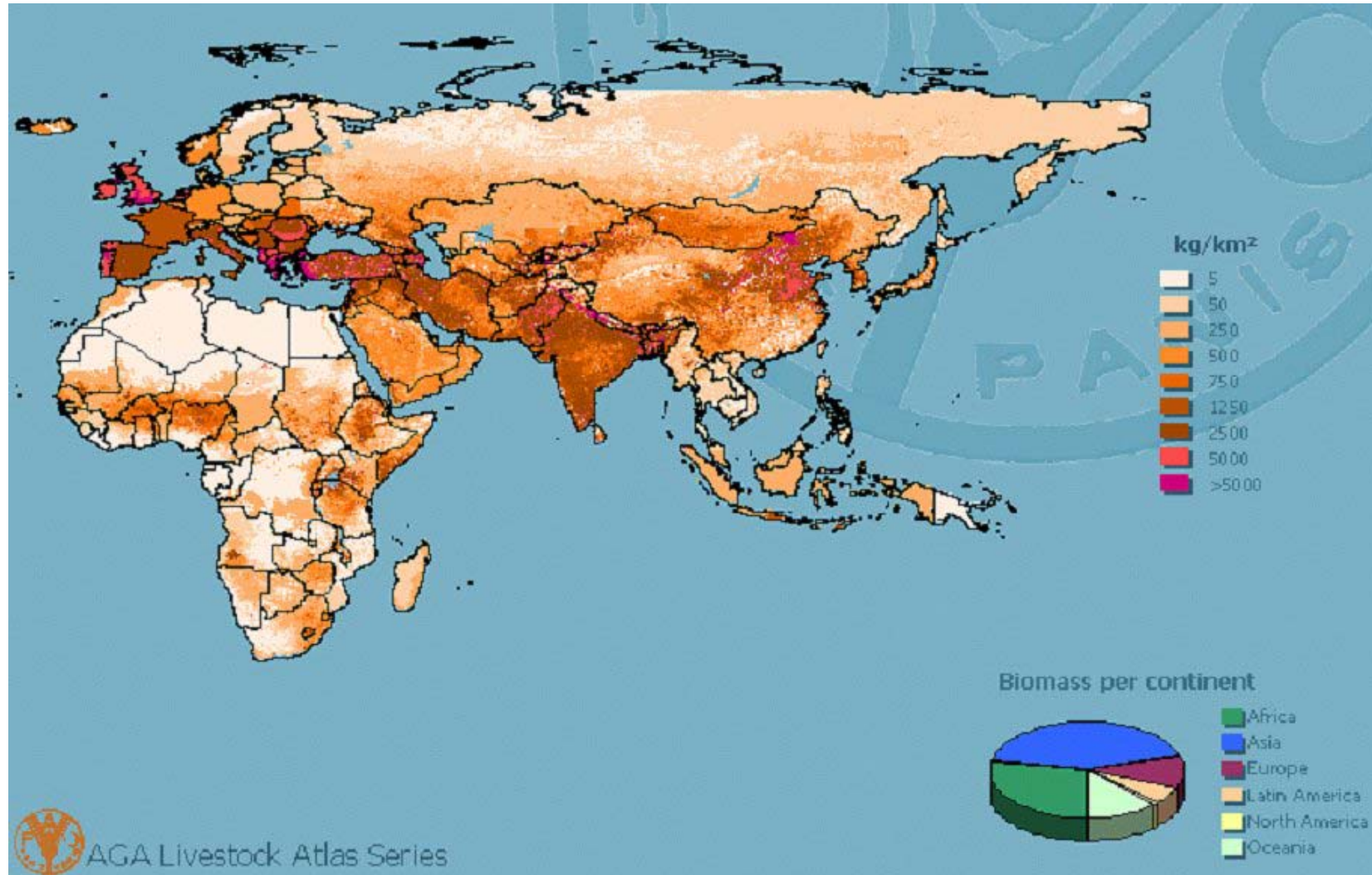
Table 17: Global Livestock Production Systems and Examples

Classification: First Level	Second Level	Third Level - 12 Livestock Production Systems	Examples (<i>West Asia Systems Highlighted</i>)		
Grassland-based systems (LG): >90% of dry matter fed to animals comes from rangelands, pastures, annual forages and purchased feeds and <10% of total value of comes from crops. Annual average stocking production rates are <10 livestock units (LU) ha agricultural land (i.e. high degree of importance of livestock in farm household economy, relatively high land/head of cattle)		1. Temperate and tropical highlands (LGT)	Mongolia's steppe system Dairy systems near Bogota, Colombia; Peru and Bolivia Altiplano camelid and sheep-grazing systems Chinese Merino wool sheep on communal grazing		
		2. Humid/sub-humid tropics and subtropics (LGH)	Extensive ranching South American lowlands Ranching systems in West and Central Africa Amazonian ranching		
		3. Arid/semi-arid tropics and subtropics (LGA)	Pastoralists in the Sahel West Asia and North Africa pastoralists Beef-milk systems on pastures in Mexico, Venezuela Southern Africa ranches		
		Mixed farming systems (M): >10% of the dry matter fed to animals comes from crop by-products and stubble or >10% of the total value of production comes from non-livestock farming activities (i.e. another source of income besides livestock, relatively low land/head of cattle)	Mixed rainfed systems (MR): >90% of the value of crops comes from rainfed land use	4. Temperate and tropical highlands (MRT)	Smallholder peasant farmers in northern China Smallholders in Ethiopian highlands where oxen for traction are important Mixed crop-livestock smallholders in highlands of Central and South America Small-scale peri-urban dairy farmers in East African highlands
				5. Humid/sub-humid tropics and subtropics (MRH)	Areas of South America where rainforests are being cleared Large areas of SSA (tsetse 'belt')
				6. Arid/semi-arid tropics and subtropics (MRA)	Dryland farming-sheep systems across the West Asia, North Africa and India Small ruminant-cassava systems in northeastern Brazil Mixed crop-livestock farms in Burkina Faso, Nigeria Dairy farms in Senegal and Mali
	Mixed irrigated (MI): 10% of the value of crops comes from irrigated land	7. Temperate and tropical highlands (MIT)	Mediterranean region Far-East Asian irrigated rice/dairy farms		
		8. Humid/sub-humid tropics and subtropics (MIH)	Irrigated rice-buffalo systems of The Philippines, Vietnam and India Irrigated rice, pig and poultry enterprises in Asia		
		9. Arid/semi-arid tropics and subtropics (MIA)	Small-scale buffalo milk production, Pakistan and India Animal-traction based cash-crop production in Afghanistan, Egypt, Iraq and Syria Intensive dairy systems in California, Israel, Mexico		
Landless (LL): <10% of the dry matter fed to animals is produced on the farm where the livestock are located, and where annual average stocking rates are above 10 LU/ha of agricultural land		10. Landless mono-gastric systems (LLM): where value of production of the pig/poultry enterprise is higher than that of the ruminant enterprises	Pig production in Asia Poultry production in Central and South America		
		11. Landless ruminant systems (LLR): where value of production of the ruminant enterprises is higher than that of the pig/poultry enterprises	Landless sheep production systems in West Asia and North Africa Sheep-fattening operations in Syria or Nigeria (peri-urban dairy systems are not included here because the manure is typically used on home gardens or used as fuel and feeds)		
Other: Residual category with very low human and livestock population densities		12. Very sparse, low density (hyper-arid) systems	Very arid rangelands where livestock are kept by nomadic pastoralists on annual grasslands across the West Asia, North Africa and the Sahel		

Source: Derived from Thornton *et al.* (2002) and Sere and Steinfeld (1966).

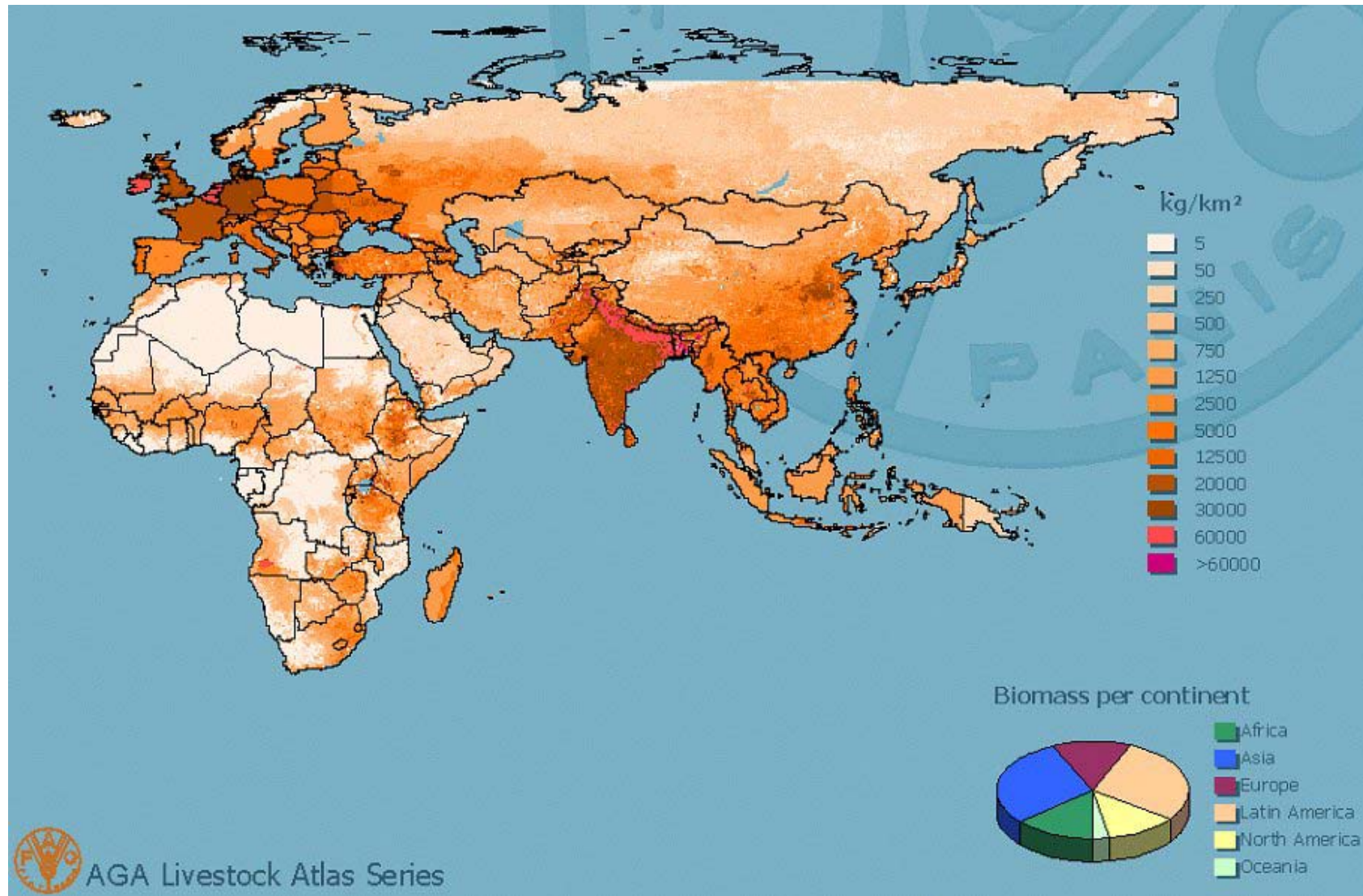
APPENDIX 5: TRANS-CONTINENTAL LIVESTOCK DISTRIBUTION MAPS

Figure 23: Small Ruminant (Sheep and Goats) Distribution



Source: <http://www.fao.org/ag/aga/Publication/CD-ROM/LAS/faoliv2/LIVATL2/index.htm>

Figure 24 Bovine (Cattle and Domesticated Buffalo) Distribution



Source: <http://www.fao.org/ag/aga/Publication/CD-ROM/LAS/faoliv2/LIVATL2/index.htm>

APPENDIX 6: ANIMAL HEALTH AND PRODUCTION ADDRESSES

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Livestock Dynamics in the Arabian Peninsula