

Small Ruminant Production: Challenges and Opportunities for Poverty Alleviation in West Asia and North Africa



Aden Aw-Hassan, Farouk Shomo, and Luis Iniguez



International Center for Agricultural Research in the Dry Areas

Copyright © 2008 International Center for Agricultural Research in the Dry Areas (ICARDA)

All rights reserved.

ICARDA encourages fair use of this material for non-commercial purposes, with proper citation.

Citation:

Aden Aw-Hassan, A., F. Shomo and L. Iniguez. 2008. Small ruminant production: challenges and opportunities for poverty alleviation in West Asia and North Africa. ICARDA, Aleppo, Syria. iv + 23 pp.

ISBN 92-9127-212-2

International Center for Agricultural Research in the Dry Areas (ICARDA)

P.O. Box 5466, Aleppo, Syria

Tel: + 963-21-2213433, 2213477, 2225012

Fax: + 963-21-2213490, 2225015, 5744622

E-mail: icarda@cgiar.org

Website: www.icarda.org

The views expressed are those of the authors, and not necessarily those of ICARDA. Where trade names are used it does not imply endorsement of, or discrimination against, any product by the Center. Maps have been used to support research data, and are not intended to show political boundaries.

Contents

1. Introduction	1
2. Trends in the Small Ruminant Sector	2
2.1. Population trends	2
2.2. Small ruminant meat production	3
2.3. Small ruminant meat consumption	4
3. Driving Forces in the Small Ruminants Sector	5
3.1 Supply side factors	5
3.2. Demand side factors	8
3.3. Growth of the poultry industry	11
3.4. Growth of beef consumption	12
4. Production and Consumption Projections for 2020	13
5. Market Shares and Implications for the Poor	16
6. Environmental Implications of Expanded Small Ruminant Production	18
6.1 Impact on the environment	18
6.2 Technological options	18
6.3 Institutional options	19
6.4. Policy options	20
7. Conclusions	21
References	22

Abstract

Small ruminant production is a major factor in national economies throughout West Asia and North Africa (WANA). This paper examines past trends in the region's small ruminant sector, the forces driving these trends, and the implications for the livelihoods of the poor. It identifies technological, institutional and policy issues that should be considered in order to improve the performance of the sector and reduce its environmental impact.

Production growth was driven by improved veterinary services, provision of feed subsidies and credit, increased utilization of alternative feed resources, and progressive intensification of production systems. Consumption growth was driven by (human) population growth, income growth and urbanization. Small ruminant populations in WANA have grown rapidly in the last three decades, but the gap between production and consumption is widening. There is a large and expanding meat trade in WANA, but the region's

exporters are struggling to maintain market share, because their competitiveness (relative to exporters from outside WANA) is limited by structural and technical constraints. A number of practical, tested technologies are available that can improve productivity; while competitiveness can be improved through government and regional policies.

While small ruminants provide many benefits, they are also a major contributor to rangeland degradation in WANA. This issue must be addressed. Simultaneously, technological improvements and policy changes are necessary to improve overall sector performance, and facilitate market participation by small-scale producers. Further research is needed on markets, institutions and policies to inform policy makers, and enable traders and producers to improve their decision-making.

1. Introduction

Production of small ruminants – sheep and goats – has considerable significant economic and social value in West Asia and North Africa (WANA).¹ Production in the region was worth US\$ 29 billion in 2003, representing about one-fourth of the value of total livestock (World Bank 2006).

Small ruminants are particularly important in the region's dry areas (annual rainfall below 300 mm), where they are the main agricultural output and the most important source of livelihoods for the poor. Small ruminants offer several advantages in smallholder production systems. They do not require large initial investments because animals are relatively low-cost. Permanent buildings are not needed. Maintenance costs are low because the animals can produce milk and meat from marginal land and crop residues. Sheep and goats are important for the family diet, providing proteins and minerals. They are also a key source of income, and a preferred

asset-building strategy (Delgado et al. 1999). But alongside these many advantages, small ruminant production can cause, or contribute to, damage to natural resources. Improper grazing management can cause severe depletion and eventual degradation of range resources.

This study examines the small ruminant sector in the WANA region: past trends in small ruminant populations; meat production, consumption and markets; the main forces driving these trends; and the implications for the livelihoods of the poor. It identifies technological, institutional and policy issues that should be considered in order to improve the performance of the sector and reduce its environmental impact. Small ruminants produce a range of outputs – milk, meat, fiber – but this study focuses on animal populations and meat production and consumption. Milk and wool are not dealt with because reliable data are lacking.

¹ Afghanistan, Algeria, Bahrain, Egypt, Ethiopia, Iran, Iraq, Jordan, Kuwait, Lebanon, Libya, Mauritania, Morocco, Oman, Pakistan, Qatar, Saudi Arabia, Somalia, Sudan, Syria, Tunisia, Turkey, United Arab Emirates, and Yemen.

² The least-squares growth rate, r , is estimated by fitting a linear regression trending to the logarithmic annual values of the variable in the relevant period. $\ln x_t = a + bt$, which is equivalent to the logarithmic transformation of the compound growth equation, $x_t = x_0 (1 + r)^t$. x is the variable, t is time, and $a = \ln x_0$ and $b = \ln (1 + r)$ are parameters to be estimated. If b^* is the least-squares estimate of b , the average annual growth rate, r , is obtained as $[\exp (b^*) - 1]$ and is multiplied by 100 to express it as a percentage (World Bank 1999).

2. Trends in the Small Ruminant Sector

Past trends in small ruminant population, meat production and consumption were analyzed by fitting a logarithmic equation² to time series data for the period 1961-2004. For this analysis we divided the 24 WANA countries into seven groups, based on a combination of two parameters (Table 1). One parameter was livestock holdings per capita as of 2004. Countries were classified as high, medium or low stockholdings, with >1.1, 0.6-1.1 and <0.6 animals per capita, respectively. High-stock countries, Afghanistan, Mauritania, Iran, Libya, Somalia, Sudan and Syria, accounted for 51% of the total WANA stocks. Medium-stock countries accounted for 23% and low-stock countries for 26%. The second parameter was per capita GNP. There were three groups: high, middle and low income, with annual per capita income of >US\$ 5000, US\$ 1000-4000, and <US\$ 500. The seven country groups (Table 1) formed by combining these two parameters will be used in the rest of the analysis.

2.1. Population trends

Fig. 1 shows trends in small ruminant population over four decades, from the 1960s. In 2004 there were 488 million

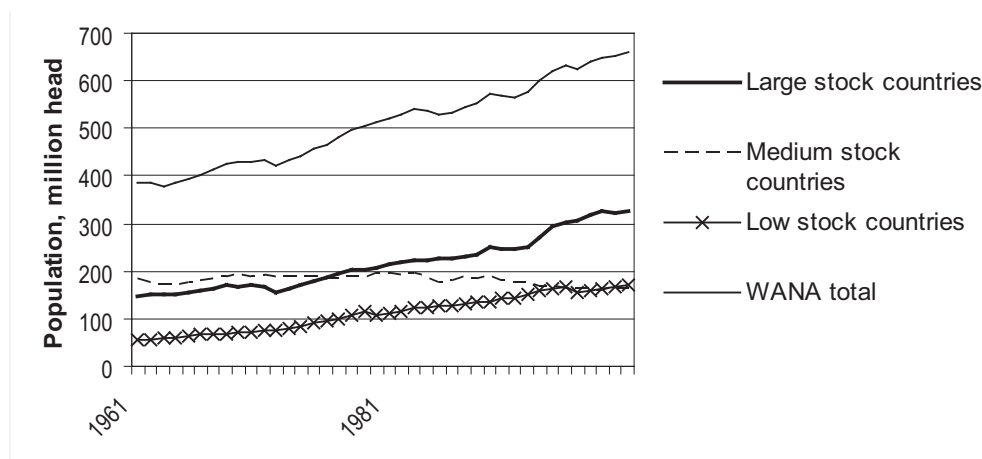
head in WANA, 49% more than in 1961. Populations grew by 1.2% per year during the period 1961-75, 1.4% during 1976-90 and 0.7% during 1991-2004. This growth is a result of multiple factors: improved animal health and nutrition, government policy support, and increased demand for meat due to population growth, urbanization and higher incomes. Where the small ruminant population has declined, for example in Turkey, this was due to industrialization and shift of labor from extensive sheep herding to higher-wage jobs. In several countries, political instability and wars have also affected these trends through their impact on services, feed systems and markets.

Population trends were highly variable between the seven country groups, and even within each group. However, some broad generalizations can be made. In general, population growth rates were highest during the second period, 1976-90, except in low-income low-stock countries, where population growth rate was highest in the 1961-75 period. This reflects the increasing demand for sheep meat in the Gulf States as a direct result of the oil boom. In the third period, 1991-2004, all growth rates declined – except in low-income high-stock countries, where export facilities improved significantly, boosting growth.

Table 1. Country groupings based on stockholdings and GNP.

High income	Low stock	Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, UAE
Middle income	High stock	Iran, Libya, Syria
	Medium stock	Algeria, Morocco, Tunisia, Turkey
	Low stock	Egypt, Iraq, Jordan, Lebanon
Low income	High stock	Afghanistan, Mauritania, Somalia, Sudan
	Medium stock	Ethiopia
	Low stock	Pakistan, Yemen

Figure 1. Small ruminant population trends in WANA, 1961-2000



Large-stock countries. Population increased from 127 million in 1961 to 250 million in 2004. Growth rates were highest (2.2% per year) during the 1990s, reflecting demand growth and improved export facilities, such as modern quarantines, infrastructure, and transport from production areas to ports. Populations increased in Sudan but declined during 1991-2004 in Afghanistan and Somalia because of political instability and drought.

Middle-stock countries. Population fell from 133 million in 1961 to 110 million in 2004. If Turkey, with its rapid decline, is excluded, there was a small increase, from 74 million to 79 million, i.e. growth of 1% per year during 1961-2004.

Low-stock countries. Population grew rapidly, 3.4% per year, from 46 million in 1961 to 127 million in 2004. High growth rates in the Gulf countries were due to the low base (1961). In contrast, Iraq had negative growth rates because of the political instability, economic reforms and removal of feed subsidies. Figure 1 shows the trend of aggregated small ruminant population for countries with large stock (> 1.1 animals per capita), medium stock (0.6-1.1 animals) and low stock (<0.6 animals per capita).

2.2. Small ruminant meat production

Table 2 shows growth rates in small ruminant meat production for two periods, 1970-90 and 1991-2004. In general, meat production growth rate was higher than that of small ruminant population, which indicates either improved carcass weight, or higher off take (in response to increasing demand).

Small ruminant meat production doubled from 1.2 million tons in 1970 to 2.7 million tons in 2004. Average annual growth rate was 2.9% during the period 1970-90 and 1% during 1991-2004 (Table 2). The growth rates of meat production were higher for all categories during 1970-90 comparing with 1991-04 period, the exception was low-income high-stock category when growth rate in.

Growth rates were highly variable across countries. Some Gulf States had very high growth rates, for two reasons: the low base, and government support for the sector. For example, small ruminant meat production in Saudi Arabia increased from 25 million tons in 1970 to 99 million tons in 2004, largely due to

the government's drive to boost domestic meat production. (The country also reached self sufficiency in poultry production; Aklilu et al. 2002.) Similarly, government policy support contributed to high growth rates in middle-income countries such as Syria, Algeria and Tunisia; and low-income countries such as Sudan (where infrastructure was expanded in the 1990s). Production growth was slowest in the low-income countries; and fluctuated dramatically in Afghanistan, Ethiopia, Iraq, Lebanon and Somalia as a result of political instability.

2.3. Small ruminant meat consumption

Consumption of small ruminant meat in WANA increased from 1.3 million tons per year in 1997 to 2.7 million tons in 2004, at an annual growth rate of 2.2%. Again, consumption was highly variable between countries. High-income countries had high consumption growth rates in the 1970s and 80s, although the increase is leveling off. Several middle-income countries (Algeria, Egypt, Iraq, Jordan, Morocco, and Turkey) had low

or even negative growth rates, at least for some periods. In Lebanon, reflects the effects of during the long civil war (1975-90), but recovered strongly after the war. Some (but not all) low-income countries had the lowest consumption growth rate, reflecting the effect of political instability on markets and disposable incomes. For example, consumption in Ethiopia declined rapidly (–3.7% per year) during the period 1991-2004 because of prolonged political instability, which affected domestic markets and general economic wellbeing.

However, low consumption growth in all countries is also a reflection of a shift to other meat sources like poultry. Due to relatively low poultry meat prices, poultry consumption rose significantly – particularly in the Gulf States, Iran, Lebanon, Libya and Jordan, where poultry accounts for over half of total meat consumption (FAOSTAT 2007). The price ratio of small ruminant to poultry meat increased from 1.3 in 1980 to 2.3 in 2004.

3. Driving Forces in the Small Ruminants Sector

The small ruminant sector in WANA has changed greatly during the last three decades. Production and consumption have soared, production systems have intensified, and trade has increased. This section discusses the major supply and demand factors driving these trends.

3.1 Supply side factors

Government policy support: A number of government measures and policies support production in different ways. These include improved veterinary services such as free vaccination, and wide availability – and acceptance by producers – of veterinary medicines (Umali et al. 1994); government interventions during frequent drought periods, e.g. distribution of subsidized animal feeds and rescheduling of loans; and government investments in water development and animal health (Hazell et al. 2001³, Chaherli et al. 1999).

Such assistance has led to increased small ruminant numbers and production. For example, in Tunisia, because of drought relief measures, sheep numbers rose consistently during the droughts of early 1990s (Boughanmi 1996), and again in the droughts of 1998-2000. In Morocco, the devastating drought of 1995 only slightly affected small ruminant numbers because of the government drought relief program (Laamari and El Mourid 1998, Oram 1998). In Syria, the government established protected shrub plantations in steppe areas to provide sheep owners with extra feed during drought years; these reserves were opened for grazing during three successive dry years, 1999-2001, minimizing the consequences of

the drought (Ngaido et al. 2001).

In recent years, feed subsidies have been largely eliminated in several countries, such that market feed prices are not different from government sources. But producers can still receive subsidized government loans to buy feed.

Cultivation of shrubs on private land has been less successful because farmers and herders are unwilling or unable to make the initial investment, or because of insecure land tenure. However, development projects are providing subsidies for the establishment of shrub plantations on private land and land considered as community property. These projects, which are either locally supported or donor funded, have been implemented in marginal areas in Algeria, Morocco, Syria and Tunisia, where livestock is the dominant economic activity.

Improved feed supply: The most important supply side factor appears to be the improvement in animal nutrition due to increased feed supplies. This in turn resulted from increased feed imports and increased supply and utilization of crop residues, mainly due to the expansion of cropped land - particularly irrigated areas, which increased from 27 million ha in 1961 to 48 million ha in 2000. Livestock owners developed the know-how to effectively collect and utilize crop residues. This reduced the impact of droughts, such as unwanted culling of animals. Markets for crop residues are developing (cereal and legume straws, sugar beet pulp, cotton seed hull) and now provide about 40% of all small ruminant feed, while feed grains and other concentrates provide

³This is true for the Middle East and North Africa, but there are no feed subsidies in the poorest WANA countries, such as Ethiopia, Mauritania, Somalia and Sudan.

about 40% of small ruminant diets (Nordblom and Shomo, 1995).

Livestock owners now rely less on natural grazing, and have increased utilization of crop residues and purchased feed. This has also led to the development of intensive and semi-intensive production systems such as lamb fattening, in response to market demand.

Table 2 shows small ruminants per capita in 2004 and the annual growth rates of small ruminant population in three equal time intervals, meat production and consumption growth rates in two periods 70-90 and 91-04.

Table 2. Consumption and production growth rates for WANA countries over 15 year intervals*

Income category	Stockholding category	Country	Animals per capita, 2004	Annual growth rates (%)						
				Population			Meat production		Meat consumption	
				61-75	76-90	91-04	70-90	91-04	70-90	91-04
High income	Low stock	Bahrain	0.05	4.0	5.8	4.3	13.8	0.5	13.8	0.5
		Kuwait	0.31	4.1	0.3	11.7	5.5	9.7	3.5	7.6
		Oman	0.53	6.4	5.5	2.7	10.6	3.4	12.7	1.0
		Qatar	0.60	2.5	8.2	3.1	8.9	-2.8	8.6	-0.6
		Saudi Arabia	0.60	4.2	5.3	-1.2	6.5	1.7	7.6	-0.1
		UAE	0.60	5.7	8.1	5.8	11.4	-4.3	11.1	-4.0
		Average	5.80	4.4	5.3	0.5	7.2	1.5	7.4	0.0
Middle income	High stock	Iran	1.16	-0.3	2.3	5.8	3.2	2.2	3.3	1.1
		Libya	1.74	5.7	-0.3	-0.9	0.3	0.7	0.4	1.2
		Syria	1.10	4.6	5.2	0.8	5.3	5.0	5.4	4.9
		Average	1.18	0.4	2.9	0.8	3.4	2.8	3.3	2.1
	Medium stock	Algeria	0.73	5.0	3.9	0.6	5.2	0.9	5.5	0.9
		Morocco	0.69	1.4	-0.5	2.3	2.3	0.5	2.3	0.5
		Tunisia	0.85	1.7	0.7	0.6	3.7	3.3	3.8	3.2
		Turkey	0.61	0.1	-0.7	-4.0	0.5	-1.2	0.5	-1.2
		Average	0.66	1.0	0.1	-1.1	1.6	0.0	1.7	-0.1
	Low stock	Egypt	0.12	2.5	4.7	3.0	3.1	-0.1	3.3	0.0
		Iraq	0.38	-0.2	-1.3	-1.2	-1.3	0.6	0.9	0.5
		Jordan	0.47	-0.2	4.2	-4.2	0.7	-9.1	6.1	-8.9
		Lebanon	0.24	-1.6	3.1	0.7	-2.5	2.7	-3.5	2.6
		Average	0.20	0.2	0.6	0.0	0.8	-0.5	2.1	-1.2
Low income	High stock	Afghanistan	1.10	-1.0	-2.5	-1.7	1.1	-0.2	1.2	5.4
		Mauritania	4.13	0.0	1.3	4.5	1.2	5.3	1.2	5.3
		Somalia	3.22	2.1	2.0	-3.0	2.9	2.4	2.9	1.9
		Sudan	2.65	4.0	2.3	5.8	1.0	5.9	1.0	5.8
		Average	2.26	1.5	0.9	2.2	1.4	2.8	1.4	3.7
	Medium stock	Ethiopia	0.65	-0.2	0.2	-2.5	0.6	-3.5	0.6	-3.7
		Low stock	Pakistan	0.51	4.8	2.4	1.5	5.9	-0.9	5.9
	Yemen		0.51	-0.5	2.8	3.1	2.7	2.7	3.3	2.7
	Average	0.51	3.9	2.4	1.7	5.6	-0.6	5.7	-0.6	
WANA region			1.03	1.2	1.4	0.7	2.9	1.0	3.1	1.0

* The 15 year intervals were selected based on the major consumption changes due to the oil boom in the Gulf region

3.2. Demand side factors

Growth in consumption of animal food products is influenced by economic factors such as incomes and prices; and by lifestyle changes that make people change their dietary patterns (Delgado et al. 1999). Income and population growth are major factors in increasing meat consumption and stimulating growth in small ruminant population. In most cases, meat consumption is income-elastic, meaning higher income is associated with higher consumption.

The two most important factors affecting demand were population growth and changes in income level. However, other factors also played a role. One significant factor has been the dramatic income growth in the Gulf countries, which has led to a rapid increase in meat consumption. However, demand specifically for small ruminant meat depends on various factors – relative price of alternative meats such as poultry and beef; and the influence of urbanization, demographic changes, and changes in attitudes towards red meat or fatty foods, on consumer tastes and preferences.

Although the degree to which changes in consumer preferences have affected the type of meat consumed has not been determined, there is some evidence that demographic changes and changes in the retail sector are having an impact on consumer behavior (Aklilu et al. 2002). Young people have attitudes and food habits different from the older generation. Changes in consumer preferences vary among countries – but there are indications that consumers are shifting away from fatty meat, for example in Egypt and Tunisia. These behav-

ioral changes follow predictable patterns as societies develop and nutritional education and public health awareness improves.

3.2.1 *Population growth*

Rapid human population growth (from 400 million in 1981 to over 706 million in 2004) has been a major factor in increasing the demand for small ruminant meat. Over the last 30 years, annual population growth rate in WANA averaged 2.3 per year, ranged from 1.2 to 4.2% for different countries (Table 3). The fastest growth occurred in the Gulf countries – partly because of low base populations, but largely due to huge labor migration since the 1970s. Afghanistan and Jordan had population growth rates above 3%, and all countries had growth rates ranged between 1.2 and 2.9% per year. High population growth led to high levels of urbanization and this, combined with income growth, changed dietary patterns in favor of meat consumption (Delgado et al. 1999, Huang and Bouis 1996, Anderson et al. 1997).

In response to increasing demand, profitable sheep fattening systems have emerged, targeting urban centers as well as export markets – and better availability has fuelled further demand growth. For the region as a whole, consumption of small ruminant meat increased from 1.2 million tons in 1961 to 3 million tons in 2004, with average annual growth rate of 0.8 % for the period 1990-2004.

3.2.2. *Income growth*

Meat consumption is highly correlated with per capita income (Fig. 2). The Gulf countries, with per capita GNP above \$8000 per year, had the highest

Table 3. West Asia and North Africa population and per capita GNP and their growth rates

Country	Population		Per capita GNP	
	Amount in millions 2004	Annual growth rate (%), 90-04	Value 2003 US\$	Annual growth rate (%), 90-03
High income, low stock				
Bahrain	0.7	2.9	9370	5.4
Kuwait	2.6	1.4	17960	5.6
Oman	2.9	3.6	4820	11.5
Qatar	0.6	2.2	15333	0.6*
Saudi Arabia	24.9	2.8	9240	8.4
United Arab Emirates	3.1	2.9	18060	5.8
Average		3.2		6.7
Middle income, high stock				
Iran	70.3	1.2	2010	5.9
Libya	5.7	2.0	4500	3.1
Syria	18.2	2.8	1160	3.5
Average		1.6		4.1
Middle income, medium stock				
Algeria	32.3	1.9	1930	6.4
Morocco	31.1	1.7	1310	5.6
Tunisia	9.9	1.4	2240	2.6
Turkey	72.3	1.8	2800	7.1
Average		1.8		6.5
Middle income, low stock				
Egypt	73.4	1.9	1390	11.1
Iraq	25.9	2.9	1875	-4.4*
Jordan	5.6	3.9	1850	3.6*
Lebanon	3.7	2.2	4040	2.1*
Average		2.2		
Low income, high stock				
Afghanistan	24.9	4.2	350	-1.0*
Mauritania	3.0	2.9	400	4.0
Somalia	10.3	2.6	130	0.5
Sudan	34.3	2.3	460	3.0
Average		3.0		2.4
Low income, medium stock				
Ethiopia	72.4	2.6	100	1.7
Low income, low stock				
Pakistan	157.3	2.6	520	5.2
Yemen	20.7	4.2	520	2.1
Average		2.8		4.5

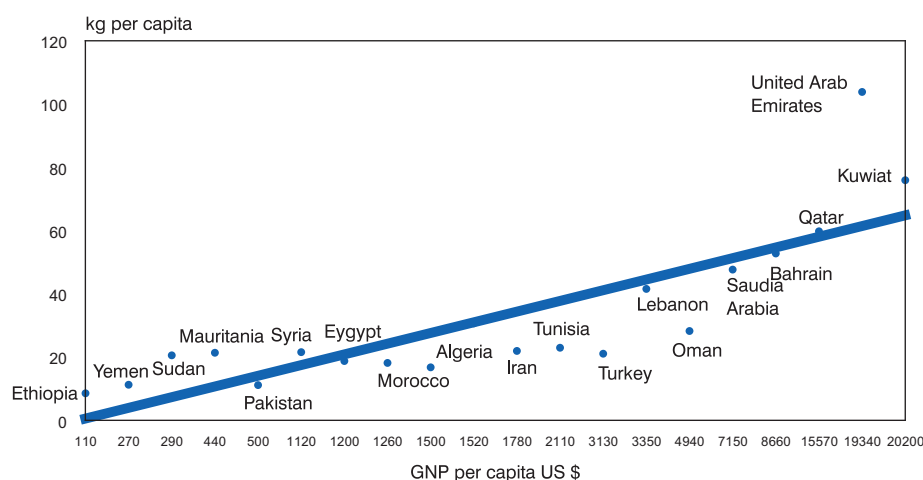


Figure 2. Relationship between small ruminant meat consumption and GNP in WANA, 2003

per capita meat consumption: over 50 kg per year. The poorest countries, with per capita income below \$500, had the lowest per capita meat consumption, below 20 kg. Income growth, as distinct from income *per se*, was an important factor in boosting the small ruminant sector. Per capita GNP of the oil-exporting Gulf countries increased sharply during the 1970s; income growth slowed sharply in the 1980s, following a decline in oil prices from 1982 onwards.

Growth rates for Qatar, Iraq, Lebanon and Afghanistan are for 1990-2003. The World Bank classifies Saudi Arabia and Oman as middle-income countries; but we retained them in the high-income group as they are wealthy by regional standards.

Per capita income growth rates were highly variable among the middle-income countries during 1990-2003, ranging from 11% in Egypt to negative growth (-4.4) in Iraq due to economic sanctions and two wars. Among the low-income countries, GNP growth rates were again variable, from 5.2% per year in Pakistan to 0.5% in Somalia.

In general, growth rates were high in the 1970s, declining in the 1980s and 1990s. The causes of income growth are beyond the scope of this analysis, but the main point here is that income growth has led to increased demand for small ruminant meat and significant growth of the sector. Consumption growth was fastest in high-income countries, but roughly the same in the middle- and low-income groups.

Because of the positive income elasticity of meat demand, we expect demand will continue to grow as income grows. This creates further opportunities for small ruminant producers in WANA, particularly in the meat-exporting countries, which are often the poorest ones. Whether producers can exploit these opportunities, depends on many factors such as producers' capacities and organization, market infrastructure (roads, communication, facilities, etc), health monitoring and control mechanisms, government policies for marketing and infrastructure development, export policies, health concerns of the importing countries, and the capacity to analyze and utilize information on the dynamics of export markets and competitors' mar-

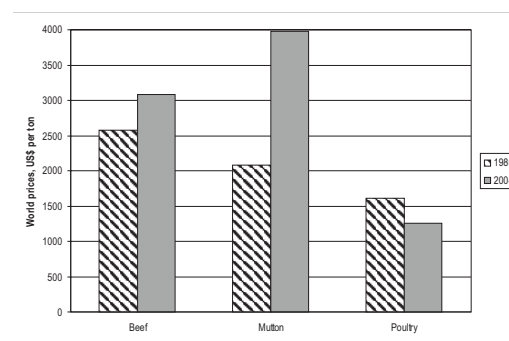
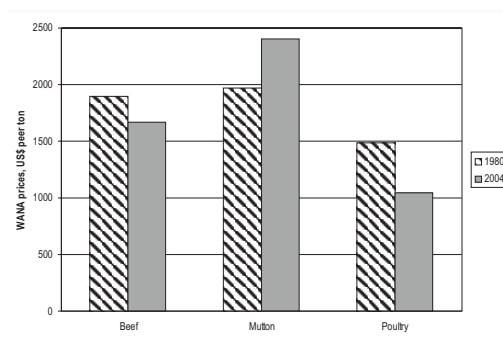


Figure 3. World and WANA prices of beef, mutton and chicken between 1980 and 2004.

keting strategies. The implication is that the unorganized, ill-equipped producers in WANA exporting countries will most likely lose to better organized, better-equipped producers from outside WANA.

3.3. Growth of the poultry industry

Production. Poultry production has developed considerably in the last two decades, mainly in the Gulf states, Algeria, Egypt, Libya, Morocco, Pakistan and Yemen. During the period 1980-2004, production in these countries grew by 6 to 10% per year. However, in other WANA countries the poultry industry has not developed significantly. This rapid development is a response to increased overall demand for meat due to urbanization and population and income growth. Poultry being a cheaper meat source than cattle or small ruminants, the sector was able to take a large share of this increased demand. Development of the poultry industry was particularly fast in the Gulf countries, where grazing land is limited and expansion of small ruminant population in extensive systems is not an option.

World prices from FAOSTAT 2007. WANA prices computed from import values for the whole WANA.

Consumption. Modern poultry production technology resulted in dramatic price reduction, while the price of small ruminant meat increased (Fig. 3). In the WANA region, poultry prices fell from US\$ 1485 per ton in 1980 to US\$ 1042 in 2004, in real terms. The price ratio of small ruminant to poultry meat increased from 1.3 in 1980 to 2.3 in 2004.

These price trends are reflected in the growth of poultry consumption. Poultry consumption rose significantly, particularly in the Gulf. On the average poultry accounts for over half of meat consumption in Iran, Lebanon, Libya, and Jordan and in the Gulf countries (FAOSTAT 2007). Between 1980 and 2004, per capita consumption more than doubled in several countries (Algeria, Egypt, Libya, Morocco, Pakistan) and increased by 52 to 88% in many others (Iran, Jordan, Saudi Arabia, Tunisia, Turkey) (FAOSTAT 2007). The expansion of poultry production has also impacted on the prices of other meats, which would have been otherwise higher than their current trends.

3.4. Growth of beef consumption

Total beef consumption in WANA increased from 1.4 million tons in 1980 to 2.5 million tons in 2004, growing at 2.5% per year. As Figure 3 shows, beef prices have fallen in WANA, while increasing globally – in WANA, beef is cheaper than mutton for consumers. Beef production is very important in Egypt and in countries with large grazing areas such as Afghanistan, Ethiopia,

Iran, Pakistan and Sudan. Between 1980 and 2004, beef consumption increased in all country groups: from 689,000 to 1.13 million tons in low-income countries (growth rate 1.5% per year); 689,000 to 1.35 million tons in middle income countries (2.7% per year); 26,000 to 40,000 tons in the Gulf countries (1.1% per year). Lebanon had the highest growth rate in WANA, 6.7% per year.

4. Production and Consumption Projections for 2020

In order to assess potential surpluses/deficits in each country, we projected small ruminant meat consumption for the year 2020 and compared it with potential production trends. Demand for domestic consumption was projected using estimated per capita consumption levels for 2020, and the UN median variant population projections (UN 1998). Projections of per capita meat consumption for the year 2020 were computed using the following equation (Sarma and Young 1985, Paulino 1986):

$$CT = C1998 [1 + (r \times n)]^T - 1998$$

where C is per capita consumption, r is annual growth rate of per capita real income⁴ (World Bank 1999), n is income elasticity of demand⁵ (FAO 1978), and T is the year 2020. Per capita meat consumption for the base year (1998) was estimated using production, net imports, and population data (FAO 2000).

Total small ruminant meat consumption in WANA is projected to increase from 2.7 million tons in 2004 to 4.4 million tons in 2020, at an average growth rate of 2.4% per year.⁶ The projected consumption growth rates range between 1 and 4% for most countries, with the exceptions of Kuwait, Oman, Afghanistan and Yemen, where projected consumption growth rates are 4.3 to 4.7%.

Countries have differential potentials for production growth. Countries with limited natural resources, specifically grazing land (e.g. the Gulf States), will find it difficult to competitively sustain even similar output growth rates as in the past. Output growth could possibly decline in these countries. Countries with large grazing areas, currently low

level of productivity, relatively cheap labor and good local knowledge of small ruminant production, will have a comparative advantage and the greatest potential for output growth. These are low-income countries with large small ruminant stocks: Afghanistan, Mauritania, Somalia and Sudan. Another group also has potential for output growth: middle-income countries that did not have a net trade deficit in 2000, namely Morocco, Tunisia and Turkey. Sustained growth in the small ruminant sector will depend on feed resources, which come from grazing land as well as cropped land (fodder crops, feed crops for intensive feedlots, residues from grain crops). Therefore, countries with a blend of cropped areas and grazing lands, and good integration of crop and livestock production, are the ones most likely to sustain significant production growth.

Trade deficit and surplus figures were computed using projected consumption data and two output growth scenarios.

Scenario 1: output growth remains the same as past trend for all countries except for the Gulf States, where output growth is assumed to be 50% lower than past trend, because of the limited potential for expansion.

Scenario 2: output growth rates 50% higher than past trend, for countries that did not have a net trade deficit in the year 2000. For other countries, output growth remains the same as past trend. This reflects the likelihood that countries with a deficit are already close to full production capacity, and are unlikely to increase their rate of output growth from current levels.

⁴ Income = GNP per capita, average for 1990-98.

⁵ Income-elasticity coefficients were computed as percentage change in per capita consumption divided by percentage change in per capita income for each country for the period 1990-2000.

⁶ Projected consumption growth rates are similar to those of all meat for WANA (2.5% per year) made by Delgado et al. (1999).

Table 5. Current small ruminant meat consumption, production, and projected growth rates and surpluses and deficits

Country	Base year - 2000			Production consumption growth rates (2000-2020)	Projected deficits/ surpluses under different production growth scenarios 2020 ('000 tons)	
	Production	Consumption	Deficit		Past	50%
	('000 t)	('000 t)	/surplus ('000 t)		trend* past	above trend**
High income Low stock						
Bahrain	7	10	-3	1.7	-4	-4
Kuwait	39	44	-5	4.6	-43	-43
Oman	9	12	-3	4.3	-48	-48
Qatar	8	16	-8	1.5	-7	-7
Saudi Arabia	89	140	-51	3.9	-142	-142
United Arab Emirates	24	40	-16	1.2	-20	-20
Middle income High stock						
Iran	429	449	-20	1.6	-13	-13
Libya	48	56	-8	2.2	4	30
Syria	189	189	0	3.0	-13	-13
Middle income Medium stock						
Algeria	176	182	-6	1.7	25	87
Morocco	147	147	0	1.5	27	73
Tunisia	64	64	0	1.7	28	65
Turkey	404	373	31	1.0	-30	-30
Middle income Low stock						
Egypt	94	118	-24	1.7	-11	-11
Iraq	29	29	0	3.1	-9	-9
Jordan	11	20	-9	0.9	1	12
Lebanon	17	18	-1	1.6	10	22
Low income High stock						
Afghanistan	176	167	9	4.3	25	87
Mauritania	30	24	6	3.9	5	17
Somalia	92	75	17	2.0	17	85
Sudan	270	181	89	2.3	103	162
Low income Medium stock						
Ethiopia	147	146	1	2.5	-65	-65
Low income Low stock						
Pakistan	406	423	-18	2.9	-166	-166
Yemen	47	56	-9	4.7	-49	-49
WANA	2966	3001	-35	2.4	-375	20

Source: Basic data from FAOSTAT

* Output growth is same as past trends for all counties except Gulf States, where growth is assumed to be 50% lower than past trend

** Output growth rates 50% higher than past trends only for countries that did not have a net trade deficit in 2000

Table 5 compares current versus projected data on consumption and production. For the WANA region overall, the deficit in 2000 was 35,000 tons. Under Scenario 1 (production continues to increase at current rates, except in the Gulf States), the gap will increase to 375,000 tons in 2020. Under Scenario 2, the current deficit will become a surplus of 20,000 tons in 2020.

Low-income countries with high stock levels have a comparative advantage in producing small ruminant meat. They could have net trade surpluses under both scenarios, and could benefit from greater trade. For this to happen, however, they will need to increase the availability of feed resources to match animal population growth. The middle-income North African countries, with medium stock levels (Algeria, Morocco, and Tunisia) could also become net exporters if they maintain their current production growth rates, and also improve feed supplies to sustain this growth. Most of the low-stock countries and some medium-stock countries with large human populations (Ethiopia and Turkey) could remain net importers regardless of production growth. Other

countries may shift from being net exporters to net importers or vice versa, depending on production growth rates and availability of feed resources. This analysis does not take into consideration current barriers to livestock and meat trade, such as tariffs and import controls, that if removed could shift countries from being potential net exporters to net importers. Such detailed trade analysis is beyond the scope of this paper.

It is clear from this analysis that some countries will face deficits that will eventually be met by importing from other WANA countries. Achieving higher production growth rates necessarily requires improvements in small ruminant productivity through application of new technologies. Low-income countries with large stock levels – and currently low levels of technology adoption – have the greatest potential for improving animal productivity. Improved productivity and trade in these countries could impact on the many poor households who depend mainly on sheep and goats for their livelihoods.

5. Market Shares and Implications for the Poor

The rapid demand growth for small ruminant meat in the WANA region has created huge opportunities for regional trade. Many WANA countries cannot increase production sufficiently to meet domestic demand, and must import meat. Traditionally, trade was mainly within the region, with deficit countries importing from surplus countries. This trade was a result of competitiveness, proximity, consumer preferences, established trade networks, and religious and cultural familiarity. In the recent past, however, new traders have captured a substantial part of the WANA market. These non-WANA exporters include Australia, Bulgaria, Hungary, New Zealand and Romania, although the share of the Eastern European countries has declined after the collapse of the Soviet Union. As shown in Figure 4, these non-WANA exporters started with about 20% of the market in the 1960s and expanded this share to over 80% in the late 1970s. During the same period the total WANA imports increased eight-fold, from 50,000 tons to 400,000 tons.

WANA exporters regained some of the lost market share in the 1990s and currently hold about 61% of the market within the region. Nonetheless, non-WANA exporters still dominate the WANA market for small ruminant meat. Between 1961 and 2004, imports from non-WANA countries increased from US\$ 7 million to US\$ 328 million in 2004 (average growth of over 3.7% per year during 1961-2004). Imports from WANA countries increased from US\$ 33 million to US\$ 413 million in 2004 (growth of 4.8% per year). Clearly, WANA exporters are not taking full advantage of the regional market; and could even lose market shares in the future, for many reasons. One reason is the existence of health-related trade barriers (Delgado et al. 1999). The most recent example was in year 2000, when Gulf countries banned imports due to Foot and Mouth Disease and Rift Valley Fever. WANA exporters were affected, particularly in the Horn of Africa (Aklilu et al. 2002). Small-scale producers in Sudan and Somalia lost millions of dollars.

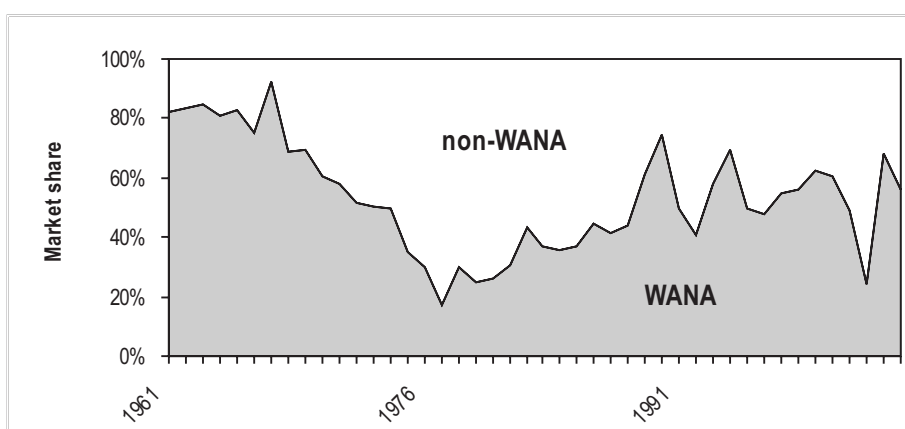


Figure 4. Shares of WANA and non-WANA producers in WANA's small ruminant market, 1961-2004

Poor market infrastructure, lack of information about the dynamics of export markets, and lack of policies to effectively respond to export market requirements are other factors that lead to loss of market share. In contrast, the non-WANA competitors are much more prepared to analyze and respond to market needs and health regulations. Gulf importers contend that livestock from Australia and New Zealand arrive in much better physical condition than those from the Horn of Africa because of better conditioning at or close to the port of departure, acclimatization, mode of travel, and care during the voyage (Aklilu et al. 2002).

Although WANA exporters have increased their market share in the last decade, this trend could soon be reversed. Increasing competition and the use of advanced marketing strategies by competitors, particularly Australian and New Zealand, is already affecting WANA exporters. This has potentially huge impacts on millions of poor traders and producers in WANA, who rely mainly on livestock for their livelihoods.

Many WANA producers use nomadic, semi-nomadic or transhumance production systems, relying on common rangelands to provide feed resources and living space. Because rangelands are state-owned, producers have no incentive to invest in improving their productivity. Therefore, extensive production systems with low productivity dominate. These systems are less competitive (in terms of price) than the high output-input ratio systems of non-WANA exporters, leading to further potential loss of export markets. The capacity of WANA

exporters to export can be increased by improving export facilities (primarily transportation) and animal health care to match international health regulations and standards of animal trade. A lack of region-wide institutions governing animal health regulations and common trade rules may also have led to unilateral decisions to ban trade on the grounds of health concerns, with or without evidence of significant health risks to consumers.

Moreover, recent outbreaks of livestock diseases – Rift Valley fever in East Africa, foot and mouth and mad cow diseases in Europe, SARS in Asia – and the fear of disease transmission from animals to humans will continue to deepen concerns about animal health and human public health. This could increase the chance of bans on affected countries, impacting on the livelihoods of livestock producers. These health concerns highlight the importance of animal health in livestock trade.

More coordinated livestock trade, through regional organizations in WANA, has high potential pay-offs: improving the livelihoods of poor producers in the exporting WANA countries and also benefiting consumers in the high- and middle-income importing countries. In addition to new technologies, efficient markets and access to investment capital are essential to increase the profitability of livestock enterprises. Further research is needed to provide policy makers, traders and producers with information on market dynamics for better decision making.

6. Environmental Implications of Expanded Small

6.1 Impact on the environment

The high stocking rates resulting from rapid growth in WANA's small ruminant population since the 1950s, have undoubtedly contributed to natural resource degradation, mainly degradation of vegetation and soil, and loss of plant biodiversity. Stocking rates beyond the carrying capacity of the land result in land degradation and desertification as greater animal numbers compete for limited grazing resources (Dregne et al. 1991, Oldeman et al. 1991). This is a major cause of land degradation in WANA, where desertification and soil degradation already affect 709 million hectares of rangelands (Lal 2002). The most severely affected countries are Iran, Sudan, Saudi Arabia, Ethiopia, Pakistan, Afghanistan, Turkey, Algeria and Morocco.

Rapid small ruminant population growth and high stocking rates have been exacerbated by the introduction of trucks for transporting animals and water – leading to further overuse of rangelands, and expansion of cultivation of rangelands in some countries. Overgrazing, in addition to other factors such as cultivation and cutting trees for fuel wood, is causing rangeland degradation in Jordan (Tadros 2000). In Turkey, the high stocking rates on rangelands are believed to have caused loss of grazing areas as well as valuable genetic resources (Tahtacioglu 2000). Technological, policy and institutional changes are necessary if the environmental impacts of small ruminant expansion are to be prevented and eventually reversed.

6.2 Technological options

Technological progress is key to competitiveness. Without productivity improvements, domestic producers may not only lose traditional export markets but may also lose domestic markets to more competitive producers abroad. Adoption of improved animal health and nutrition methods, genetic enhancement, and better post harvest handling and transformation are essential for achieving higher small ruminant productivity. Plant species adapted to dry areas can increase feed supplies, particularly during dry years, and improve livestock productivity.

The experience of North African countries in cactus production and utilization provides lessons for other WANA countries with similar conditions (ICARDA 2000). Various species and crop combinations can improve the supply and quality of feed and prevent soil erosion, especially on hillsides: *Atriplex halimus* alone or intercropped with barley, vetch, oats, or other forage crops; oats, barley/fodder pea and oats/vetch mixtures (Norton et al. 2001). Multi-nutrient feed blocks, made from agro industrial byproducts and other ingredients, are a low-cost source of feed and nutrient supplements that can increase animal productivity.

Experience in Iraq shows that farm communities can adapt this technology relatively quickly (ICARDA 2000). However, adoption will depend on commercial factors, i.e. cost and availability of alternative sources of feed. Utilization of forage legumes, specifical-

⁷ See FAO website www.fao.org

ly vetch (*Vicia sativa*) has been demonstrated to offer significant gains in meat and milk yields (ICARDA 2000).

There are several practical, well documented ways of using agricultural and agro industrial byproducts in animal feeding systems. Early weaning of lambs is another technology that can increase milk production and economic returns (ICARDA 2000). Improved rams can be distributed to producers to improve flock performance (Thomson et al. 2003). Transformation and value addition – lamb fattening, dairy processing, targeting of niche markets with specific products – can increase earnings from small ruminant enterprises, but adoption has been slow. To a certain extent, farmers are aware of the growing demand for quality products, but often lack the resources and organization necessary to capitalize on this demand. The growth of supermarket retailing is a clear indication of consumer preferences of high quality products. Producers will have to meet the standards of the emerging retail sector.

6.3 Institutional options

As earlier discussed, lack of supportive policies (including property rights) exacerbates the environmental impact of small ruminants. It is widely accepted that, in some rangelands in North Africa and the Middle East, traditional (tribal) systems governing grazing rights were less damaging to the environment than an open-access regime which resulted from the collapse of traditional systems (Telahigue and Abdulali 2001). Masri (2001) pointed out that in many WANA countries, the environmental impact of

small ruminants is a result of the breakdown of traditional grazing rights, effectively making rangelands open-access resources.

It is not clear how traditional systems have evolved in the last few decades: for example, whether some communities are still able to sustain communal grazing areas. Oram and de Haan (1995) reported that in several countries (Turkey and parts of Jordan, Morocco and Tunisia) local communities have managed the common-property grazing areas fairly effectively, with collective investment in land improvements.

Transformation of customary grazing systems can be a result of socio-political change. For example, population growth and modernization could increase individualistic behavior in a community, and increase the transaction costs of the self-regulating mechanisms of traditional systems.

Governments may also actively reduce the influence of tribes by removing their traditional grazing rights. Collapse of traditional grazing rights could lead to three possible outcomes: (i) complete shift of grazing rights to open access, (ii) appropriation of communal lands by individual families, (iii) de facto continuation of the communal grazing rights. Nordblom and Shomo (1995) observed that, in Syria, local institutions lost control over their tribal lands and tribe members appropriated large areas of the common rangelands. This process was associated with an expansion of barley cultivation on the rangelands, presumably to strengthen claims of private ownership.

Cultivation of fragile rangelands inevitably caused further land degradation by soil erosion and nutrient mining. Further research is needed to determine to what degree these systems can still play a role in communal management of rangelands and what policies, technologies or other collective action entry points, such as the establishment of common water sources, can be effective in stimulating collective action in rangeland management.

6.4. Policy options

At the national level, policy action is needed on measures that (i) stimulate the adoption of productivity-enhancing practices, (ii) increase public and private investment to reduce environmental degradation in rangelands. Rangelands occupy vast areas across WANA, and a large proportion of the rural populations are livestock producers. Policies that recognize the rights of communities and encourage organized communities to collectively manage their grazing areas could have an impact on how rangelands are perceived and managed. Price policies that do not favor urban consumers could improve producers' incomes. Relaxation of restrictions on feed imports and promotion of export

infrastructure could also benefit producers. Policy action is needed from exporting countries on measures to assure importing countries that livestock production meets health and safety standards.

At the regional level, common policies and coordinated efforts on animal health-related regulations and common livestock trade rules are essential to improve trade and producers' incomes. Without such policies, small ruminant producers in WANA may fail to compete in the regional and global markets – impacting on the livelihoods of poor rural communities, particularly in livestock exporting countries.

Many of WANA's small ruminant producers live in marginal dry areas and have no or little landholdings, and are thus ineligible for credit from formal sources. Informal credit from traders is often the only source of capital, with very high interest rates. Small ruminant producers rely heavily on informal credit for feed purchases, which increase during drought years. New institutional forms that improve access to capital (e.g. community-based micro-credit) should be investigated.

7. Conclusions

Increasing population, urbanization and incomes in WANA are leading to growth in demand for animal products. This is creating opportunities for poor farmers in both domestic and export markets. However, livestock retail markets and procurement requirements are changing rapidly and small-scale producers could find it hard to produce for competitive markets with new (changing) market requirements. There is a need for policies that focus on improving production and marketing infrastructure to enable small livestock producers retain a reasonable share of the market.

Careful analysis of local and regional markets is needed to inform policy makers of emerging trends, and of the opportunities and challenges arising from changes in livestock markets. Such analyses will also help identify priority research areas for production diversification, aiming to offer farmers a wider range of technological opportunities.

There is potential for developing and transferring animal production technologies, particularly relating to animal health, improved feeds, better post harvest handling, and farmer access to improved animals. This requires further adaptive research and building of

References

- national capacities in adaptive research as well as extension.
- Aklilu, Y., P. Irungu and A. Reda. 2002. An audit of livestock marketing status in Kenya, Ethiopia and Sudan, vol 1. Community-Based Animal Health and Participatory Epidemiology Unit, Pan African Programme for the Control of Epizootics (PACE), Nairobi, Kenya.
- Anderson, K., B. Dimaranan, T. Hertel and W. Martin. 1997. Asia-Pacific food markets and trade in 2005: A global, economy-wide perspective. *Australian Journal of Agricultural and Resource Economics* 41: 19-44.
- Boughanmi, H. 1996. Drought management and public policy in Tunisia. Paper prepared for the Mashreq & Maghreb Project. ICARDA, Aleppo, Syria.
- Chaherli, N., P. Hazell, T. Ngaïdo, T. Nordblom and P. Oram. 1999. Agricultural growth, sustainable resource management, and poverty alleviation in the low rainfall areas to West Asia and North Africa. *Proceedings of the International Conference*, 2-6 September 1997, Amman, Jordan.
- Delgado, C., M. Rosegrant, H. Steinfeld, S. Ehui and C. Courbois. 1999. Livestock to 2020, the next food revolution. *Food, Agriculture, and the Environment Discussion Paper 28*. International Food Policy Research Institute, Washington DC, USA.
- Dregne, H., M. Kassas and B. Rosanov. 1991. A new assessment of the world status of desertification, *Desert Control Bulletin*. 20: 6-29.
- FAO (Food and Agriculture Organization of the United Nations). 1978. Parameters of demand functions. Fifth run (computer printout). Rome, April 1978.
- Hazell, P., P. Oram and N. Chaherli. 2001. Managing drought in the low-rainfall areas of the Middle East and North Africa. *Environment and Production Technology Division*, International Food Policy Research Institute, Washington DC, USA.
- Huang, J. and H. Bouis. 1996. Structural changes in the demand for food in Asia. *Food, Agriculture, and the Environment Discussion Paper 11*. International Food Policy Research Institute, Washington, DC, USA.
- ICARDA. 2000. Integrating crop/livestock production systems in the low-rainfall areas of West Asia and North Africa: the Mashreq/Maghreb Project. ICARDA, Aleppo, Syria. 28 pp.
- Laamari, L. and M. El Mourid. 1998. Drought management in Morocco: from 1969 to 1995 cropping year. Paper presented at the Mashreq & Maghreb Project Workshop on Policy and Property Rights Research in the Low-Rainfall Areas of the Mashreq and Maghreb Regions, Hammamet, Tunisia, 26-29 Nov 1998.
- Lal, R. 2002. Carbon sequestration in dry-land ecosystems of West Asia and North Africa. *School of Natural Resources*, Ohio State University; and John Wiley & Sons, Ltd.
- Masri, A. 2001. Country pasture/forage resources profile: Syria. FAO, Rome, Italy.
- Ngaïdo, T., F. Shomo and G. Arab. 2001. Rangeland management options and sheep feeding strategies in Syria. Paper presented in the International Conference on Policy and Institutional Options for the Management of Rangelands in Dry Areas, Hammamet, Tunisia, 6-11 May 2001.
- Nordblom, T. and F. Shomo. 1995. Food and feed prospects to 2020 in the West Asia/North Africa region. *ICARDA Social Science Papers No. 2*. ICARDA, Aleppo, Syria. vi + 56 pp.
- Norton, E.B., M. Bounejmate and F. Ghassali. 2001. Reviving over-grazed rangeland and degraded cropland: ICARDA'S experience. *Proceeding of*

- Vegetation Recovery in Degraded Land Areas: Capacity Building Workshop for the Asia Pacific Region. Kalgoorlie, Western Australia, 27 Oct -3 Nov.
- Oldeman, L.R., R.T.A. Hakkeling and W.G. Sombroek. 1991. World map of the status of human induced soil degradation: an explanatory note. ISRIC/UNEP, Wageningen, The Netherlands.
- Oram, P. and C. de Haan. 1995. Technologies for rainfed agriculture in Mediterranean climates. A review of World Bank experience. World Bank Technical Paper No. 300. World Bank, Washington, DC, USA.
- Oram, P. 1998. The influence of government policies on livestock production and the environment in West Asia and North Africa. In A.J.Nell (ed) *Livestock and the Environment: International Conference*, IAC, Wageningen, Netherlands.
- Paulino, L.A. 1986. Food in the Third World: past trends and projections to 2000. Research Report 52. International Food Policy Research Institute, Washington DC, USA.
- Sarma, J.S. and P. Young. 1985. Livestock products in the Third World: Past trends and projections to 1990 and 2000. Research Report 49. International Food Policy Research Institute. Washington D.C. USA.
- Tadros, K. 2000. Fodder shrubs in Jordan. In: *Proceedings of the Workshop on Native and Exotic Fodder Shrubs in Arid and Semi-arid Zones* (Gintzburger, G., M. Bounejmate and A. Nefzaoui, eds), Hammamet, Tunisia, 27 Oct-2 Nov 1996. ICARDA, Aleppo, Syria.
- Tahtacioglu, L. 2000. Research on fodder shrubs and their management in the rangelands of East Anatolia. In: *Proceedings of the Workshop on Native and Exotic Fodder Shrubs in Arid and Semi-arid Zones* (Gintzburger, G., M. Bounejmate and A. Nefzaoui, eds), Hammamet, Tunisia, 27 Oct-2 Nov 1996. ICARDA, Aleppo, Syria.
- Telahigue, T. and Abdouli, A. 2001. Strategies for institutional options for rangeland management in the NENA region. IFAD Experience Discussion Paper. International Fund for Agricultural Development.
- Thomson, E., M.A. Martini and R.N. Tutwiler. 2003. Sheep management practices in Iraq, Jordan and Syria: the case of reproduction and fertility. *Integrated Natural Resource Management Research Report Series No. 2*. ICARDA, Aleppo, Syria. viii + 43 pp.
- Umali, D.L., G. Feder and C. de Haan. 1994. Animal health services: finding the balance between public and private delivery. *World Bank Research Observer* 9(1): 71-96. The World Bank, Washington, DC, USA.
- United Nations. 1998. *World population prospects: The 1996 revision*. Department for Economic and Social Information and Policy Analysis, United Nations, New York, USA.
- World Bank. 1999. *Entering the 21st Century. World Development Report*. Oxford University Press, pp. 300.

World Bank. 2006. World Development
Report.

