I F A D

Document of

The International Fund for Agricultural Development

For Official Use Only

THE HASHEMITE KINGDOM OF JORDAN
NATIONAL PROGRAMME FOR RANGE REHABILITATION AND DEVELOPMENT
BASELINE SURVEY OF SOCIO-ECONOMIC AND ANIMAL PRODUCTION DATA

VOLUME I,1: MAIN REPORT

VERSION 2.0

Near East and North Africa Division
Project Management Department
Project Controller: M.A. Hassani

Submitted By: Roger Blench

Ministry of Agriculture, Amman,
Hashemite Kingdom of Jordan

Cambridge, April, 1996

Executive Summary

1. As part of the preparation for the Jordan Range Rehabilitation Project (JRRP) IFAD commissioned a socio-economic baseline survey of the rangelands (Badia) and adjacent areas to examine basic subsistence parameters of livestock-owning households, including;

a) Migration strategies
b) Input and output costs and expenditures for livestock enterprises
c) Basic reproductive characteristics of herds
d) Role of women in livestock related enterprises

2. In addition, to establish the potential for community involvement in a future rangeland management strategy, as well as issues of land tenure and responsibility for the condition of the range, a further survey was conducted. This examined attitudes to conservation and management and authority structures through which these might be implemented.

3. The survey was conducted between February 20th and July 4th, 1995. The data was entered, checked and analysed in Amman. The sample was intended to reflect the frequency of producers in all regions of the Badia. Numbers of questionnaires were as follows;

Type of Questionnaire	Number	Dates
Community	85	23/2 to 6/4/95
Household 1.	664	23/2 to 8/4/95
Household 2.	56	27/4 to 3/5/95
Household 3.	80	28/6 to 4/7/95
Women	122	4/4 to 8/4/95
Livestock (Sheep)	193	23/2 to 2/4/95
Livestock (Goats)	248	23/2 to 2/4/95

4. The survey took place in a year of exceptional rainfall, as regards the north of Jordan. By contrast, the south and south-east were unusually dry and this had the effect of attracting many of the larger flocks to the north-eastern Badia. The results of the survey should be read in this light. In addition, visible regrowth demonstrated the potential for range regeneration in protected areas such as frontier zones.

5. The main findings were as follows;

- There has been a major breakdown in 'traditional' migration patterns in favour of the opportunistic search for pasture
- This is associated with an analogous breakdown in land tenure systems in the rangelands. In practice almost any rangeland is available to those who can exploit it.
- The monetarisation of sheep production is leading to stratification of herd ownership. Large-scale herdowners (>1000) can take advantage of the economies of scale (shepherding, investment in vehicles, veterinary callout costs etc.) and certainly survive the removal of feed subsidies. Medium herdowners cannot take advantage of these and do not have the resources to manage their herds without getting into debt.
- The very large herds in the Badia regions have essentially switched from using the rangeland as a source of feed to simply treating it as vertical and horizontal space to raise ani-

mals. Most pastoralists do not use the natural vegetation for more than two months a year and for the rest, truck in feeds. This means that the *economic motivation* to conserve the rangelands is minimal.

- The survey also suggested that producers do not generally feel *responsible* for the condition of the range. Its problems are largely attributed to poor rainfall or encroachment of agriculture.
- This suggests that urging radical destocking will not work. The alternative solution is to encourage herdowners to switch to year-round feeding; a feedlot system in all but name.
- This would have to go hand in hand with a major change in ruminant nutrition to compensate for the loss of roughage and minerals represented by range.
- At present there are almost no linkages between the present survey and other, related work carried out by bodies such as Badia Research and Development Project and the RSCN Dana Project. It is proposed that a common approach to public awareness is developed along with standard data entry interfaces.

GEOGRAPHICAL CONVENTIONS

Badia.

Throughout this report, Jordanian common usage is followed in referring to the low-rainfall desertic regions as *Badia* (See Map 1). The Badia is conventionally divided into three unequal zones, Northern, Central and Southern.

IMPORTANT

This report is also presented as an electronic document with 'live' embedded charts and attached spreadsheets. The basic word-processor is Microsoft Word 6.0 (Word 6.0 Arabic for the Annexes) with embedded Excel 5.0 charts and worksheets. This permits additional data to be added or changed as new material becomes available.

The original field data used in the preparation of this report is attached in the form of a database with menus, allowing readers to explore the data in a variety of ways. The native format of the database is Microsoft Access 2.0 (Arabic) but a text-delimited export version is also presented. Detailed material, such as the names of some 700 informants and the grazing areas associated with interview sites, is given in the original Arabic.

CURRENCY EQUIVALENTS

Currency Unit	=	Jordanian Dinar (JD)
1 Jordanian Dinar	=	1000 fils
JD 1.000	=	USD 1.45
USD 1.00	=	JD 0.67

The value of the United States Dollar fell substantially during the course of the survey (February-April, 1995). However, since the economic data quoted in the report are based on retrospective recall of incomes in 1994 the figures quoted above are a fair indication of the values of the USD during that year.

WEIGHTS AND MEASURES

1 *dunum*	=	0.1 hectare
1 *rotl*	=	3.0 kilogrammes

ABBREVIATIONS AND ACRONYMS

GHKJ	Government of the Hashemite Kingdom of Jordan
JRRP	Jordan Range Rehabilitation Project
PPR	Peste des Petits Ruminants
RSCN	Royal Society for the Conservation of Nature

TRANSCRIPTION

Arabic terms cited in the text are transcribed as accurately as possible. Phonetic symbols are avoided through the use of orthographic conventions. Spellings of place names follow those on maps published by the Royal Geographical Society where practical. Other words are spelt according to current pronunciation in Jordan.

The pharyngeal 'emphatic' consonants are marked with an underline instead of a subdot. Thus;

h̲	=	ḥ	*or*	ɦ
t̲	=	ṭ	*or*	ţ
s̲	=	ṣ	*or*	ş

Long vowels are marked by doubling rather than with a macron over the vowel. Thus;

aa *not* ā

Original Arabic forms of interview sites, plant names etc. are given in the annexes.

TABLE OF CONTENTS

GEOGRAPHICAL CONVENTIONS ..... **III**
CURRENCY EQUIVALENTS ..... **III**
WEIGHTS AND MEASURES ..... **III**
ABBREVIATIONS AND ACRONYMS ..... **III**
TRANSCRIPTION ..... **IV**
TABLES ..... **VII**
FIGURES ..... **IX**
I. PROJECT AND SECTORAL BACKGROUND **1**
A. Background **1**
B. Country and Agricultural Sector Background **1**
C. Rationale and Objectives **2**
D. Method and Context of the Survey **2**
II. PROJECT AREA **4**
A. Development and Socio-economic Status **4**
B. Physical and Biological Resources **4**
Rainfall 4
Geomorphology 4
Flora 5
Fauna 5
Land use in the Rangelands **6**
Pastoralism 6
Agriculture 6
Forestry 6
Hunting 6
Others 7
Sources of Degradation in the Rangelands **7**
Grazing and Overgrazing 7
Plastic Waste 7
Declining Rainfall 7
Cutting of Woody Vegetation 8
Gathering of Wild Plants 8
III. SURVEY (I) **9**
A. Objectives and Methodology **9**
Livestock Producers **9**
Bedu 9
Village Producers 10
Livestock Holdings **10**
Determinants of Livestock Holdings and Distribution 11
Flock Size 12
Conversion to a Common Unit (SRUs) 13
National Livestock Data in the light of findings of the survey 13
D. Household Structures and Labour Availability **15**
Size and Structure of Households 15
Sources and Allocation of Labour 15
Shepherding 15
Other Livestock Labour 18
Shearing 18
E. Forage, Feeds and access to Water **19**
Access to Forage 19

Entry to Rangeland or Crop Residues 19
Purchased Feeds 20
Water 20
F. Transport 20
G. Costs and Expenditures in Livestock Production 21
Expenditures on Livestock Production 21
Shepherding 21
Other livestock labour 22
Shearing 22
Water 22
Forage Production 23
Purchased Feeds 23
Veterinary Services 23
Sources of Income from Livestock 24
Dairy Products 24
Wool 26
Animal Sales 27
H. Income and Expenditure 29
The Livestock Cost Cycle 29
A Model Herd, 1994-1995. 29
Hidden costs and income from livestock production 31
I. Migration 33
Traditional Classifications of Migration 33
Tribal Migration 33
Migration versus sedentary production 34
Reclassifying Migration patterns 34
Surrogate migration 35
J. Land and Land Rights 35
Two views of Land Tenure 35
Collapse of rights in rangeland 35
IV. SURVEY (II) - LIVESTOCK MANAGEMENT AND PRODUCTIVITY 37
A. Livestock Species in the Jordanian Rangelands 37
Sheep 37
Sheep Breeds 37
Goats 37
Camels 37
Cattle 37
Horses and Mules 38
Donkeys 38
Dogs 38
Poultry and others 38
Poultry 38
Rabbits 39
B. Production Systems of Principal Livestock Species 39
Goats 39
Camels 39
C. Management of Flocks 40
Leading the Flock 40
Seasonality of Births 41
Burning Sheep 41
Milking and Milk Production 42
D. Productivity Parameters 42
Sheep 42
Goats 42
Frequency of Twins and Triplets 43
Goats 44

Offtake 45
Sheep 45
Goats 45
Factors affecting productivity 46
Disease 46
Nutrition 46

V. SURVEY (III) - THE ROLE OF WOMEN IN LIVESTOCK PRODUCTION 48
A. Objectives and Methodology 48
B. Women as Livestock Producers 48
Women's Self-Perception 49
D. Women's Aspirations 51
Marketing and Business Skills 51
Credit 51
Literacy 52

VI. POLICY IMPLICATIONS 53
A. General 53
Producers' Views 53
Rangeland degradation: who is responsible? 53
Management and Authority Structures 54
C. A Conservation Ethos 55
D. Recommendations 56
Immediate 56
Long Term 57

VII. IMPLICATIONS FOR PROJECT DESIGN 58
A. Information Systems 58
Public Awareness 58
Project phasing 59

References 59

TABLES

Table 1. Percentages of households owning different livestock species 11
Table 2. Mean Herd Size by Rainfall Zone for all Households possessing sheep 11
Table 3. Mean Herd Size by Rainfall Zone for All Households possessing camels 12
Table 4. Mean Herd Size by Rainfall Zone for All Households possessing goats 12
Table 5. Mean flock size recorded by the survey 12
Table 6. Mean flock/herd size by region different livestock species 12
Table 7. Conversion to SRUs 13
Table 8. Census data for livestock numbers ('000 head) 14
Table 9. Absolute numbers of animals recorded by survey 14
Table 10. Inter-species ratios recorded by this survey 14
Table 11. Mean household size present and total 15
Table 12. Professions of migrant household members 15
Table 13. Shepherding in the Jordanian Rangelands 16
Table 14. Nationalities of Hired Shepherds 16
Table 15. Regional Variation in hiring of Shepherds 17
Table 16. Months for which Shepherds are hired 18
Table 17. Regional Variation in use of Professional Shearers 18
Table 18. Knowledge and Use of Protected Rangelands 19
Table 19. Pastoralists paying to use Crop Residues 19
Table 20. Households paying for water 20
Table 21. Percentage households owning vehicle types 21

Table 22. Costs of Shepherding (in JD) 22
Table 23. Payment for water 22
Table 24. Payments for Crop Residues and Access to Pastures 23
Table 25. Possession of farmland and forage production 23
Table 26. Purchased Feeds: Use and Expenditures 23
Table 27. Private Veterinary Services: Use and Expenditures 24
Table 28. Use of Private Veterinary Services 24
Table 29. Households selling Dairy Products 25
Table 30. Income from sale of dairy products 25
Table 31. Percentage of Households selling Wool by Region 26
Table 32. Income from sale of wool by region 27
Table 33. Income from sale of sheep by region 28
Table 34. Income from sale of goats by region 28
Table 35. Mean income from sale of ruminants by region 28
Table 36. Annual Cycle of Livestock Costs and Sales 29
Table 37. Costs and Income from a typical small ruminant herd in the Northern Badia 30
Table 38. Costs and Income from a typical small ruminant herd in the Northern Badia 32
Table 39. Households still migrating by land category 34
Table 40. Productivity parameters for sheep 42
Table 41. Lambing interval for ewes 42
Table 42. Productivity parameters for goats 43
Table 43. Kidding interval for goats 43
Table 44. Lambing percentage in sheep 44
Table 45. Frequency of twin births among sheep 44
Table 46. Kidding percentage in goats 44
Table 47. Frequency of multiple births among goats 44
Table 48. Fate of lamb crop born in 1993/4 45
Table 49. Fate of kids born in 1993/4 46
Table 50. Position of Women interviewed 48
Table 51. Sheep ownership by women 49
Table 52. Women's contribution to pastoral household labour 50
Table 53. Women's access to credit 52
Table 54. Existing Authorities community 55
Table 55. Authorities community leaders would work with 55

FIGURES

Figure 1.Percentage households owning goats by region 11
Figure 2. Mean Sheep Flock Size by Region 13
Figure 3. Distribution of Nationalities of Shepherds 16
Figure 4. Percentage of Households hiring shepherds in different regions 17
Figure 5. Percentage of Households hiring Shearers in Different Regions 18
Figure 6. Percentage Households owning Different Vehicle Types 21
Figure 7. Expenditure on Feed in Different Land Categories 24
Figure 8. Mean income from sale of Dairy Products in Different Regions 25
Figure 9. Percentage of households selling wool in different regions 26
Figure 10. Relationship of value of wool sales to sheep flock size 27
Figure 11. Comparative Income from Ruminant Sales of Households in Different Regions 28
Figure 12. Income and Expenditure of average livestock producer in the northern Badia 30
Figure 13. Seasonality of goat births 41
Figure 14. Kidding interval in Goats 43
Figure 15. Percentage of multiple births among goats 44
Figure 16. Fate of lamb crop, 1993-4 45
Figure 17. Fate of kids, 1993-4 46
Figure 18. Women's contribution to labour in pastoral households 51
Figure 19. Perceived problems of the rangelands 54
Figure 20. Existing Authorities community leaders deal with 55

THE HASHEMITE KINGDOM OF JORDAN
NATIONAL PROGRAMME FOR RANGE REHABILITATION AND DEVELOPMENT
BASELINE SURVEY OF SOCIO-ECONOMIC AND ANIMAL PRODUCTION DATA

I. PROJECT AND SECTORAL BACKGROUND

A. Background

1.1 The Government of the Hashemite Kingdom of Jordan (GHKJ) first requested IFAD to identify and formulate a project to rehabilitate the Badia rangelands in 1991. A mission to identify the modalities of such a project was undertaken in 1993 and basic terms of reference established (IFAD, 1993).

1.2 The present survey was undertaken between February and April 1995 to form a background for the appraisal.[1/] The terms of reference (given in full in Annex I) were to;

identify socio-economic characteristics of pastoralists
develop indicators of pastoral household income
examine the relation between pastoralists, farmers, government and NGOs
identify conditions under which herders would adhere to a Range Rehabilitation Programme
describe present-day migration patterns
elaborate the role of women in herder households

1.3 An opportunity was taken to extend the original survey which covered the Badia region in May and June 1995. A survey in May covered the pastoralists living in the Jordan Valley north of the Dead Sea. In June, a further survey covered the pastoralists living in the Wadi Araba and the regions immediately south of the Dead Sea. In this way, the sample now covers all the pastoral regions of Jordan. The data from these two additional surveys has been entered into the data base and checked but has yet to be fully analysed. For this reason, the samples is this version of the report continue to refer to the Badia survey.

1.4 IFAD (1993) describes environmental data such as rainfall, soils, forage availability and deals with economic issues, including feed subsidies and exports, in some detail. It also covers legal and institutional frameworks. These issues are therefore not discussed at length in the present study, but only given as necessary background to understanding the argument.

B. Country and Agricultural Sector Background

1.5 The Hashemite Kingdom of Jordan has a land area of some 90,000 km^2 and a human population of nearly 4 million. It is situated between 29°N and 33°N and between 35°E and 40°E. It is bordered by Syria in the north, Iraq in the east, Saudi Arabia in the south and east and Israel and the West Bank in the west. Of the entire land area, only 5% is estimated to be arable.

1.6 Jordan has long been heavily dependent on the service sector, both internally (tourism, transport, trade) and externally (via a highly educated expatriate population sending money back). This pattern underwent a dramatic change following the Gulf War, following the return of large numbers of expatriate

---

[1/] The analyses and report was prepared by R.M. Blench, under the supervision of Project Controller, M.A. Hassani, Near East and North Africa Division. See Annex I for details of other personnel involved in the survey. I would like to acknowledge discussions with William Lancaster, British Institute for Archaeology and History, Amman, Prof. Dawud El-Eisawi, Department of Botany, University of Amman, Roderick Dutton, CORD, Antoine Swenne, Consultant to RSCN, Sherifa Zein Bint Nasser and Mohamed Sha'abaz, respectively directors of finance and research of the Jordanian Badia Development Project. It was presented in Amman on 25th Arpil, 1995 in the form of a working draft and I would like to thank those present for their constructive comments on the text.

workers and consequent boom in housing and expansion of the urban population. Jordan also depends heavily on foreign aid and concessionary foreign assistance. One of the benefits of the 'Peace Process' has been substantial promises of debt forgiveness.

1.7 The agricultural sector contributes some 7% of the GDP and has a substantial export element. However, Jordan also has a policy of subsidies on basic foodstuffs, flour sugar and rice and until recently, on animal feed, notably barley and wheat bran. Public expenditure in the agriculture sector has generally been declining and levels in the rangeland areas are very low indeed. There have been a number of projects initiated for the rangelands (cf. IFAD, 1993, Appendix 2) but none are presently very active.

1.8 Map 1 shows a general political map of the Hashemite Kingdom of Jordan. Since the signing the peace treaty with Israel, there have been some boundary changes not reflected on available maps. None of these, however, are relevant to the area discussed in this report.

C. Rationale and Objectives

1.9 Initiatives for the conservation of the Jordanian rangelands are not new - indeed there is a long history of reports recognising the problems and proposing solutions. Most notable among these are Park (1955), Tuttle (1971), Draz (1979) and Juneidi & Abu-Zanat (1993). In each case the authors noted erosion and degradation in the rangelands and proposed action to arrest the situation. Actions following these reports seem to have been minimal.

1.10 Since the period of these reports, it is safe to say that the situation has become substantially worse. Almost certainly, there has been a major expansion in both the size and number of sheep flocks with a correspondingly greater pressure on range resources. The greater availability of water-tankers and trucks has meant that pastoralists are able to reach regions previously inaccessible, especially in the *harra* pebble desert. At the same time, the gradual tightening of restrictions on cross-border movement has meant that the pasture resources of the broader region are no longer available to Jordanian producers.

1.11 Whether the range can fully 'recover' is unknown due to an absence of baseline data. Moreover, the grazing regime of sheep and goats is very different from the grazing of antelope and camels which contributed to its evolution. However, evidence from protected areas and border zones is unequivocal that biodiversity can be greater and biomass much increased with proper management.

D. Method and Context of the Survey

1.12 The principal method of the survey was intensive administration of questionnaires, combined with more informal and unstructured interviews. The questionnaires were pre-tested for two days before the survey proper and then remained fixed for the rest of the survey. Three teams were used, to complete the survey as rapidly as possible. More details of the teams and timing of the survey and the actual questionnaires can be found in the Annexes.

1.13 The sample interview sites were chosen to be as representative as possible of settlement in the rangelands and the adjacent areas of steppe and highlands. The sample universe of the survey was problematic as it was planned in the absence of any up-to-date census or village maps. The decade since 1985 has seen a major expansion of pioneer farming in Northern Jordan and new settlements, roads and other infrastructure exist that are not shown on any maps. As a result it was decided to try and obtain sample coverage of all the communities identified. The map references of the interview sites are given in Annex I in the absence of cartography. In April, 1995, advance copies of a recent human population census were in circulation. Once this information has been summarised and digested it will be possible to compare the survey sample with existing villages.

1.14 The survey focused on livestock producers, rather than being a general household survey. In the Badia proper, outside the service towns on roads, most households are producers, but in the towns and villages along its western fringe, cultivators predominate with a few livestock owners in each settlement. It was therefore decided to treat possession of thirty animals as the lower limit of the sample, with an attempt to interview principally owners with at least 50 animals.

1.15 The survey took place in a year of exceptional rainfall, as regards the north of Jordan. By contrast, the south and south-east were unusually dry and this had the effect of attracting many of the larger flocks to the north-eastern Badia. The results of the survey should be read in this light.

II. PROJECT AREA

A. Development and Socio-economic Status

2.1 The land area of Jordan's rangelands depends largely on the definition adopted. An inclusive definition joins together much of the desert proper, the steppe region and the highlands, regarding the spaces between cropped land as 'range'. In this case, some 97% of the land area of Jordan can be considered 'rangeland'. Alternatively, only the regions unsuitable for rainfed cropping, with rainfall below 200 mm annually, are defined as range which gives a figure nearer 80% of the total land area.

2.2 The decade since 1985 has seen an acceleration of all types of agriculture, gradually eating into the area of the rangeland. The practice of 'pseudo-cropping' especially along the Syrian border has effectively excluded both natural forage and livestock from significant areas of former rangeland and it is natural to regard these areas as extensions of the cropped area of the steppe. Similarly, in the Jordan valley intensive cultivation has caused the disappearance of all but the smallest strips of natural forage and livestock production now depends on feeds and vegetable residues. This process cannot be reversed and this former rangeland can be regarded as permanently eliminated.

2.3 The rangeland which is still available for producers and for which it is possible to reverse the process of degradation is the region known in Jordan as the Badia. Nearly all of this has rainfall under 200 mm, and the great majority is under 50 mm. Although crossed by some major roads for long-distance trade, the vast majority of the Badia has virtually no infrastructure and no development at all. The land is technically Government land and permission to put up permanent structures is rarely given.

B. Physical and Biological Resources

2.4 The original description of the bioclimates of Jordan goes back to Long (1957) and almost all subsequent descriptions follow this. Shehadeh (1985) has compiled a more up-to-date description of the climate of Jordan. This section considers only elements of the physical resources directly relevant to livestock.

Rainfall

2.5 The rainfall and associated parameters have been described in some detail in Shehadeh (1985) and IFAD (1993). Map 2 shows the principal rainfall zones affecting the Badia, indicating that almost all of it falls within the 100-200mm isohyets. There are few stations in much of the east and south-east, otherwise it is likely that these regions would fall below 50 mm. annually. These regions show substantially greater coefficients of variation than in the northeast (see Map 4 in Shehadeh, 1985).

2.6 Annex IV contains the actual rainfall data from 1970-71 to 1993-4 for selected stations within the rangelands and presents these as linear charts with the rainfall trend projected until 2000. The trend varies from station to station, but in no case is it very marked. This suggests that there has been no significant overall change in the trend of rainfall in the last quarter-century. However, the contrary is widely believed and is also held to explain the poor state of pasture in the rangelands.

Geomorphology

2.7 The broad categories into which the survey area is divided are highland, steppe and desert. The highlands with high rainfall and high population densities are only marginally covered by the survey, as some livestock producers who exploit the Badia live in this region. The steppe is represented by a narrow band, perhaps only 20 km wide, between the highlands and the desert proper.

2.8 The *harra*, black basalt plains that cover a great proportion of the northern Badia, remain a difficult environment to exploit for subsistence. The sometimes large, evenly scattered stones, make the movement of human and ruminants difficult and for a vehicle to pass, a track has to be cleared. Nonetheless, such clear-ways have been made and herds can be moved in to graze the annual grasses that penetrate the stone cover. Where the stones are large, herds are small and goats are preferred to sheep because of their sure footing.

Flora

2.9 The main floral regions of Jordan have been classified into some thirteen types (Eisawi, 1985). However, many of these occur only in the highland areas. The rangelands and their western edge can effectively be divided into seven categories. These are as follows;

Juniperous Forest.
Mediterranean non-Forest.
Steppe
Hammada. This subdivides into three distinct categories;

Run-off Hammada.	Wadis and pools
Pebble Hammada	The plain is covered with pebbles or stones, usually of black basalt. Locally known as *harra*.
Sand Hammada	Sandy plains with scattered plants

Sand Dunes

Confined to Wadi Araba and Wadi Rum. It consists almost entirely of shrubs and bushes which act to fix the sand dunes.

Hydrophytic vegetation

2.10 This occurs principally around Azraq Oasis

Mud Flats (*Qa'a)*

2.11 The *Qa'a* or mud-flats are virtually lifeless plains of cracked mud scattered throughout the Badia. The largest one is due East of Al-Jafr in the south-east.

2.12 Vegetation zones are a major determinant of livestock distribution. In particular the pattern in the rangelands has eliminated cattle, a major pastoral species in other parts of the world. The *hammada* deserts, where annuals dominate, favour sheep and the wadis and dune vegetation are where goats predominate.

Fauna

2.13 The Jordanian rangelands used to be quite rich in both small and large mammals and reptiles. These are described in Mountfort (1965) and to a lesser extent in Hatough, Eisawi & Disi (1986). Although small mammals such as rodents survive and indeed flourish in the reserved areas, large mammals have undergone a significant decline due to hunting and habitat destruction. Very few antelope remain, and carnivores such as the Asiatic wolf survive through predation on sheep flocks. The precipitous slopes west of the highlands have conserved fauna more effectively because of their relative inaccessibility. The remoteness of much of the Badia makes effective hunting control virtually impossible.

Land use in the Rangelands

Pastoralism

2.14 The single most significant economic use of the rangelands is pastoralism. 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 graze cannot be eaten by sheep and goats. Controlled systems of land use in the rangelands, the *hema* system, persisted until the early twentieth century in some form, but grazing is now virtually uncontrolled.

Agriculture

2.15 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. Yields are so poor that is difficult to demonstrate that such production is economic and its function may be as much to bolster land claims as to provide cereals. IFAD (1993) refers to this practice as 'pseudo-cropping'.

2.16 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. The IBRD has recommended that no further drilling permits be given as a condition of its Agricultural Sector loan.

2.17 Another quite different pattern is observed in the extreme South, between Al-Mudawarra and Wadi Rum, where large-scale irrigated agriculture has been established. This depends on the extraction of fossil water from some 800m. Since most of the areas represent almost lifeless desert, the impact on grazing resources is limited, but the sustainability of systems based on fossil water is clearly open to doubt.

Forestry

2.18 Of the low rainfall areas considered in this report, only some of the regions fringing the highlands proper used to be forested. There is evidence to suggest that acacia woodland was considerably more common in the southern desert regions, especially along the wadis, but extensive wood-cutting during this century effectively destroyed the forest and there is little evidence that it will ever regrow.

Hunting

2.19 Hunting with both dogs and falcons has long been part of the culture of the Bedu pastoral nomads. Large numbers of wild animals probably survived until vehicles became common. A combination of modern rifles and fast transport reduced mammal populations to remnants, mostly around the edges of reserves. Hunting has not been eliminated, as numbers of *salugi* dogs attest. Should a conservation programme lead to increased wild animal numbers, regulation of hunting would have to be considered.

Others

2.20 One of the most visible uses of the rangeland and a source of some complaint by producers is the very extensive network of army bases and training grounds. While these do represent unexploited range, it is most unlikely that any range project will alter this situation.

2.21 Tourism is yet to develop as a major factor in land use, but there is evidence that this is increasing. Since the opening of the border with Israel, there has been a major expansion of both facilities and the use of recreational four-wheel drive vehicles, especially in the wadis of the south. The income brought in by tourists is so substantial that no representations by livestock producers is likely to affect this process of development.

Sources of Degradation in the Rangelands

2.22 This section enumerates all the sources of degradation of the rangelands cited by livestock producers or noted during the survey. These are assigned very different degrees of importance by producers (Figure 19) whose views reflect their own concept of responsibility for resource management.

Grazing and Overgrazing

2.23 The level of grazing is determined as much by the accessibility of the area as the actual plant cover. For example, the *harra* areas of the northern Badia are covered in large stones that are extremely difficult for both animals and vehicles. As a result, patches of *harra* remain almost ungrazed because the costs of reaching them are too high. Similarly, in the southern wadis, some are so remote and windswept that pastoralists avoid them. The vegetation in these wadis is visibly in better condition than elsewhere.

Plastic Waste

2.24 The use of synthetics for all types of industrial and commercial purposes has increased considerably in Jordan in the decade since the mid-1980s. No public ethos of recycling or even litter prevention exists in many parts of the country. Hence many agricultural areas and adjacent rangelands are covered in plastic waste. Apart from plastic bags, the black plastic laid in strips to reduce evapotranspiration in fields under drip irrigation is left to blow into the rangelands once the harvest is in.

2.25 Apart from the aesthetic aspect, plastic waste is extremely dangerous for ruminants, especially goats, as they will eat it. The plastic becomes twisted around their intestines and effectively strangles them. Owners living adjacent to agricultural areas, cited swallowing plastic as the single most important cause of death in their flocks.

Declining Rainfall

2.26 There is a widespread conviction throughout the entire region that the present state of the rangelands is due to declining rainfall. This is emphatically not the case (cf. data in Annex V). It is certainly true that there is an important seed reserve in the Badia regions and a year of exceptional rainfall, such as 1994-5, caused the appearance of herbs and other perennials not seen for more than a decade.

2.27 Declining rainfall has an important function as far as producers are concerned; it absolves them from responsibility. The idea frequently propounded was that if only the rainfall would return to 'normal' levels then grazing would return to 'former' levels. Since rain is at 'normal' levels this is best described as a convenient fantasy.

Cutting of Woody Vegetation

2.28 The disappearance of almost all large specimens of woody vegetation has meant that households in the Badia are pressed to find wood for the principal fire. This fire, used for cooking the morning coffee, has an important symbolic value for the tent, as much of the actually cooking is done in the *haram* using gas cylinders. Cut wood is sold in the larger settlements on the roads, but in remoter areas it is difficult to buy or transport. As a result, branches are cut from shrubs, especially *Artemisia herba-alba*. However, the frequent cutting has led to a shortage of burnable wood and the response has been to use hoes to dig up the woody roots to burn. Swenne (1992:20) has documented the extensive uprooting of woody shrubs in the Shobak area which is far more accessible by road than the more remote parts of the Badia.

2.29 This strategy is little short of disastrous, since the plant is permanently destroyed. The soil-fixing properties are also lost, leading to greater erosion. Although some Bedu complain about this practice, and many can see, when pressed, that it is contributing to long-term degradation, there are no communal sanctions operating to prevent this practice. Such sanctions would in any event be difficult to enforce since this occurs most commonly where tents are scattered and there is no effective community.

Gathering of Wild Plants

2.30 The practice of gathering herbs for food and medicinal purposes is still widely practised throughout the Jordanian rangelands. Sometimes these are gathered in large sacks and sold. The scale of this is hard to determine and probably only causes very local declines in plant populations. Plants are usually gathered by tearing off the heads rather than by cutting them down at the roots, so the effect is similar to grazing.

III. SURVEY (I)

A. Objectives and Methodology

3.1 The broad objective of the proposed project is the development of a conservation strategy for Jordan's Badia rangelands. Within this, the intention of the socio-economic baseline survey is;

- to provide the socio-economic matrix into which a feasible project can be slotted
- to provide baseline data against which the overall impact of the project can be measured.

3.2 The principal method was the administration of two questionnaires; a community and a household questionnaire (Annex II). The community questionnaire was administered in an informal manner to senior figures in the community who were also livestock producers. In preference, they were asked to call as many other producers as was practical; thus an open-ended discussion could evolve.

3.3 The household questionnaire was designed to elicit basic numerical data on livestock numbers, inputs and expenditures and to allow estimates of the cash income from livestock. It also explored basic issues of sedentarism versus migration and livestock holdings. It did not look at overall household income as this would have required a considerably more detailed investigation of kinship and residence patterns.

3.4 The information gathered was based on recall of 1994 so in general in could not be checked except on the rare occasions where producers kept written records. There is every reason to believe that the majority of producers answered reasonably honestly. The questionnaires included a certain degree of self-checking, so internal checks often revealed inconsistencies. In some cases the questionnaire was rejected on the spot and left incomplete, in other cases it was eliminated during data entry. Overall, some 10% of the questionnaires were thrown out.

Livestock Producers

3.5 Livestock producers using the rangelands divide into the Bedu, who may be described as occupationally specialised pastoralists and village producers, who by and large combine livestock production with agriculture. Such a distinction is not hard and fast, as many villages, especially in the steppe regions consist of Bedu who have settled within the last few generations. Similarly, although the Bedu generally have larger herds than the settled producers, this is not invariably the case.

Bedu

3.6 Livestock production in the rangeland areas of Jordan is largely in the hands of the Bedu (Bedouin). Although sharing many cultural features with the settled populations, *fellahin*, their distinctive systems of production have set them apart since the earliest records of this region.

3.7 The Bedu are divided into numerous tribes, *ashira*, of varying size and these are subdivided into clans and lineages, *qabila*. These affiliations until recently have constituted the single most important organising principle in Bedu social organisation, defining livestock production strategies, patterns of migration, marriage and warfare, as well as access to pasture.

3.8 There is a substantial literature on the Bedu of this region, most notably Musil (1927), Marx (1978), Lancaster (1981), Chatty (1990), Lancaster and Lancaster (1990), Abu Jaber et al (1987). Except the last-mentioned these works tend to focus on specific tribal units. Moreover, despite publication dates they refer to the 1970s or earlier, prior to the profound changes that have overtaken Jordanian society since 1975.

3.9 Important changes that have gradually occurred over the course of this century;

Increasing settlement of Bedu on the marginal lands
Switch from camel production to sheep production
Collapse of traditional migration patterns through widespread use of motorised transport.
High level of dependence on imported feeds

3.10 All these have had the effect of transforming Bedu society both economically and socially.

''From Camel to Truck'

3.11 This evocative phrase, taken from the monograph by Chatty (1986) describing the transformation of pastoral society in South Lebanon is equally applicable to the Bedu of this entire region. With few exceptions, the rangelands-based Bedu seem to have been specialised in camel production until the 1940s. The monograph on the Rwala by Musil (1927) describes a society based around camel production with horses kept as prestige animals. At that date, the term 'Bedu' appeared to be coincident with camel production, as Musil notes that sheep producers were called Al-Frejje.

3.12 The appearance of vehicles as early as the 1920s began to make a major economic impact in the 1940s. The camel had as its major function transport, especially of water. Once it was evident that this function could be fulfilled more effectively by the truck, camel production was threatened. As the need for money became more pronounced the products of the camel, hair and milk were observably less marketable than products of sheep.

3.13 The virtual demise of the camel as an economic element in livestock producers' lives was sealed by a major drought between 1958 and 1962. Lancaster (1981:100) estimates that at least 70% of the camels died during this period. Combined with the disappearance of the raiding economy and the increased demand for ruminant meat in the growing urban areas, camel production never recovered. Bedu are generally perceived as small ruminant producers today, specialising above all on sheep, a perception which is amply confirmed by the survey (see Table 1).

Village Producers

3.14 Down the central spine of the Jordanian steppe are villages which are primarily agricultural, but with variable holdings of domestic animals. They have long traditions of exploiting rangelands, that were traditionally attached to a particular community or group of communities. These rangelands were used seasonally when crop residues were not available and the animals were often herded collectively.

3.15 Although such villagers perceive themselves as having tribal affiliations, they do not link themselves with pastoral groups. Their social organisation is very much the same as villagers in the intensive agricultural areas. Few of them move long distances with their animals, although this is necessary for those whose herds grow to very large numbers.

Livestock Holdings

3.16 The majority of livestock producers in Jordan probably have just a few animals to meet ceremonial obligations and which can be tended effectively within the family and fed on household and agricultural wastes. The survey focused on owners with more than 30 head of either sheep or goats on the grounds that such flocks were likely to make an impact on rangeland use and exploitation. This should be borne in mind when assessing the mean figures for livestock holdings.

Determinants of Livestock Holdings and Distribution

3.17 As has been suggested above, the dominant domestic species is the sheep. 97% of all the households surveyed owned sheep as opposed to only 82% owning goats. Table 1 shows the percentages of households owning different species overall and in different regions.

Table 1. Percentages of households owning different livestock species n=664

	All n=664		North n=313		Central n=157		South n=194	
Species	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
Sheep	644	97.0	309	98.7	152	96.8	183	94.3
Goats	543	81.8	234	74.8	130	82.8	179	92.3
Camels	37	5.9	3	1.0	7	4.46	27	13.9
Donkeys	460	69.3	229	73.2	92	58.6	139	71.7
Chickens	297	44.7	126	40.3	73	46.5	98	50.5

Numbers of horses and cattle are too small to be treated in this way. The survey noted 15 households owning 20 horses and 8 households owning 14 cattle.

3.18 These figures show trends for some species only. For example, sheep are kept at virtually the same frequency in all parts of the rangelands (Table 2). Goats and camels, however, show a marked upward trend from north to south (Figure 1, Table 3, Table 4). Donkeys represent an essential work-animal needed everywhere and ownership patterns show virtually no inter-regional variation.

Figure 1.Percentage households owning goats by region

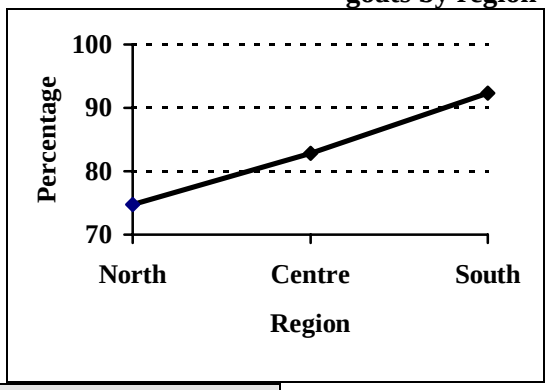


Table 2. Mean Herd Size by Rainfall Zone for all Households possessing sheep 1994

Zone (mm)	n	Mean Herd Size
All	644	296.7
<50	53	197.7
<75	24	711.0
<100	178	419.4
<200	308	241.0
<300	68	168.0
<400	13	254.6

3.19 These results suggest, as would be expected, that sheep predominate in the higher rainfall rangelands, whereas goats and camels are more important as rainfall decreases.

3.20 The mean size of sheep flocks peak in the 75 and 100mm isohyets represented largely by the northern Badia. Below this figure, the vegetation becomes too difficult to digest for sheep. The higher rainfall zones are too densely settled to permit such large flocks except on a feedlot basis.

Table 3. Mean Herd Size by Rainfall Zone for All Households possessing camels		
Zone	**n**	**Mean Herd Size**
All	37	7
<50	21	9
<75	1	16
<100	6	10
<200	7	4
<300	2	3
<400	0	0

Table 4. Mean Herd Size by Rainfall Zone for All Households possessing goats		1994
Zone	**n**	**Mean Herd Size**
All	543	38.6
<50	55	73.6
<75	21	71.3
<100	146	40.2
<200	258	30.8
<300	51	27.9
<400	12	17.3

These figures suggest that the distributions of all three species correlate well with rainfall isohyets.

Flock Size

3.19 Sheep predominate numerically in the Jordanian rangelands and herds are very large indeed by the standards of pastoralists world-wide, especially in the northern Badia. Table 5 shows the mean flock size for the entire sample of households contrasted with the flock size for households owning that species.

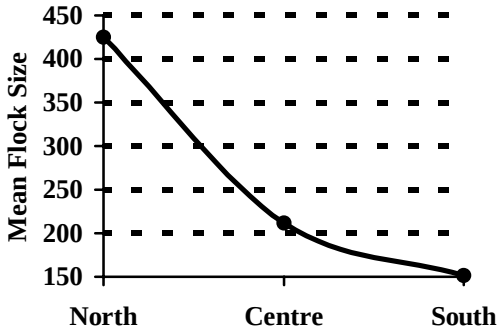
Table 5. Mean flock size recorded by the survey		1995
Species	**All**	**For Households with this species**
Sheep	287.9	296.8
Goats	31.6	38.6
Camels	0.56	8.2
Horses	--	1.3
Donkeys	1.13	1.5

Table 6 shows the overall mean and then the mean herd sizes in different regions for each species.

Table 6. Mean flock/herd size by region different livestock species								n=664
	All owners		**North**		**Central**		**South**	
	n	**Mean**	**n**	**%**	**n**	**%**	**n**	**%**
Sheep	644	296.7	309	424.8	152	211.7	183	151.5
Goats	543	38.6	234	35.7	130	35.1	179	45.0
Camels	37	7.7	3	6.3	7	11.4	27	7.5
Donkeys	460	1.5	229	1.6	92	1.4	139	1.5
Chickens	297		126	18.7	73	18.4	98	12.5

Sheep show a marked upward trend from south to north (Figure 2). Goats, however, show little variation in the north-central region but increase markedly in the south. Although there are markedly more camels in the south, the mean herd size does not change significantly, suggesting that constraints on camel herd size may be more to do with labour than feed. As with ownership percentages, there is no significant difference in the size of donkey herds between the different regions.

Figure 2. Mean Sheep Flock Size by Region



Conversion to a Common Unit (SRUs)

3. The principal domestic species both consuming natural forage and purchased feeds are sheep, goats and camels. All other species, such as donkeys, represent a very small fraction of the total feed consumed. Donkeys are rarely fed purchased feeds but graze on the same shrub vegetation as camels.

3. To calculate the potential impact of grazing on the environment, it is useful to convert all species to a single unit. Unfortunately there are a diversity of ways of achieving this, which produce rather dissimilar results. The formula used in this report is the one proposed by USAID in their policy review of the low rainfall zone (USAID, 1992). This is;

Unit = 1 sheep or 1 goat.
1 camel = 13 units.
Small Ruminant Units are thus sheep + goats + 13 x camels

3. This formula is similar to that used for Tropical Livestock Units (TLUs). Using this conversion a mean herd size in SRUs can be calculated for the entire sample (Table 7). To obtain the figure for mean SRUs the herds were individually summed according to the formula above and the mean taken of those sums. This allows expenditures such as feeds and veterinary services to be averaged over SRUs.

Table 7. Conversion to SRUs n=664

Species	Mean Herd Size
Sheep	296.7
Goats	38.6
Camels	7.7
SRUs	325.3

National Livestock Data in the light of findings of the survey

3. National livestock figures are presented in Table 8. As previous reports note, they show a remarkable rise in 1991-1992, which is clearly attributable to a change in methods of data collection. In October, 1991 there was a national livestock census, conducted on a single day with thousands of enumerators. Figures given before and after that date are essentially projections. The previous national livestock census was in 1983.

Table 8. Census data for livestock numbers ('000 head)					
Species	**1989**	**1990**	**1991**	**1992**	**1993**
Sheep	1523	1556	2524.00	2524	2878
Goats	475	479	1062.00	1062	1151
Camels	18.3	18.3	32.16	33	32
Horses			9.44		
Donkeys			43.76		

3. Various explanations have been proposed to explain the jump in figures as a result of the census (IFAD, 1993, Annex II:5-7). The data from the census were used to determine allocations of subsidised feed. In view of this, there is a considerable likelihood that numbers were increased well above actual figures, especially for wealthy and powerful herd owners.

3. The present survey did not cover all of Jordan and it did not sample a known percentage of owners so it cannot definitively claim a different result. However, it did cover all the regions of the country where the largest flocks are kept and it attempted to reach the great majority of communities where significant herds were located. On the basis of this, there are two features of the survey that seem to be at odds with the census figures;

a) The absolute numbers of animals recorded
b) The ratios between species

3. The survey recorded absolute totals of animals as in Table 9;

Table 9. Absolute numbers of animals recorded by survey 1995		
Species	**Absolute Number**	**% of Census Figure**
Sheep	191171	7.57
Goats	20986	1.98
Camels	302	0.92
Horses	20	0.21
Donkeys	708	1.62

These represent very different percentages of the census figures and would mean that quite different percentages of animals were missed in the two cases.

3. The survey recorded the following inter-species ratios (Table 10);

Table 10. Inter-species ratios recorded by this survey n=664		
Species Ratios	**This Survey**	**1991 Census Ratio**
Sheep-Goats	9.1	2.38
Sheep-Camels	633.0	78.48
Goats-Camels	69.5	33.02
Sheep-Horses	9558.5	267.37
Sheep-Donkeys	270.0	57.68

3. Again, these vary markedly from the census figures. Other, independent surveys have recorded similar ratios. Campbell (ined) gives a ratio of 9:1 for sheep to goats in the Northern Badia. This suggests that the relationship between census results and the present survey is at best problematic.

D. Household Structures and Labour Availability

Size and Structure of Households

3. The size and structure of households in the rangeland areas is not an easy variable to analyse because of the complex relations with collateral branches of the family (see Lancaster, 1981 for more detailed descriptions relating to the Er-Rwala Bedu). The householders were asked for members of the family present and those away working. However, schoolchildren or aged relatives may stay in the concrete house in the west while parts of the family migrate with the tent. There is a constant flux of family members between the Badia and the permanent house and an ever-changing labour resource. Results for this part of the survey should therefore be taken as indicative rather than absolute.

3. Table 11 shows the mean household size for the entire survey. The number away working is given in the second column and the mean for total members, present and away in the third column. Members working away or abroad do not contribute labour, but they are usually extremely punctilious about sending monetary contributions to the family and their presence is thus felt economically.

Table 11. Mean household size present and total **n=664**

Region	n	Present	Away	Overall
All	664	10.5	1.0	11.5
Highlands	10	6.5	1.4	7.9
Steppe	405	10.2	1.2	11.4
Badia	249	11.1	0.7	11.9

3. The professions of absent household members suggest something about the alternative occupations available to livestock producers. Soldiering was the most common form of work, but otherwise government service and casual labour are the only other options (Table 12).

Table 12. Professions of migrant household members **n=283**

Region	Number	%
Soldier	203	71.7
Government Official	47	16.6
Unskilled Employment	29	10.3
Other	4	1.4

3. Becoming a merchant or trader, especially in livestock products, is a common option for Bedu, but such merchants normally cease producing animals.

Sources and Allocation of Labour

3. The single most important source of labour for livestock production is family labour. All members of a family can be involved in managing the herds, although in principal the men are considered the most important. However, in reality, more and more families have more members away, either working, in education or in the army.

Shepherding

3. The management of herds has always been given out to non-family members. A system that was formerly more common was *matteye* or 'partnership' where the shepherd was entitled to a share in the produce of the flock. This could be as a form of charity to poor households or as a practical means of getting animals managed for civil servants. In its modern version the shepherd is given some gifts in kind, such as clothes and cigarettes, free access to dairy products and part of the offspring of the herds. This system is in decline

and some examples of 'mixed' systems were given where the owner made part payments in cash. Only 8 examples for 664 households were recorded by the survey.

3. The disappearance of this system and its replacement by a simple payment of wages is in part due to the advantageous exchange rate. Most families, especially those with large herds, hire shepherds, and sometimes other labour to manage their herds (Table 13). Giving a shepherd actual animals was relatively expensive compared with the amount a Syrian shepherd would accept in Jordanian dinars. The shepherds are available because they come from countries where an unstable exchange makes payment in Jordanian dinars an attractive prospect. Other livestock labour, such as watering and feeding is also supplied from the same source, although it is less common.

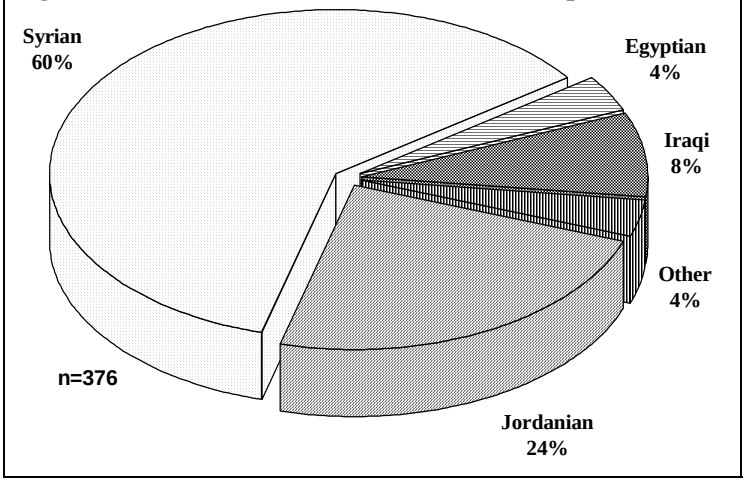
Table 13. Shepherding in the Jordanian Rangelands		**n=664**
	No.	**%**
Households employing shepherds	354	54.5
Households employing other labour	56	8.4

3. The most important source of shepherds is Syria, although Iraqi, Egyptian, Sudanese and some other nationalities were also recorded. Syrian shepherds are generally supposed to be most skilled and are correspondingly more expensive. Of the 664 households sampled, some 346 (52.1%) reported using one or more shepherds. Table 14 and Figure 3 show the distribution of shepherding among nationalities among households employing them.

Table 14. Nationalities of Hired Shepherds		**n=376***
	No.	**%**
Jordanian	89	23.7
Syrian	228	60.6
Egyptian	14	3.7
Iraqi	31	8.2
Other	14	3.7

*n represents all employed shepherds including cases where households employ more than one

Figure 3. Distribution of Nationalities of Shepherds



Shepherds can be hired individually or collectively. Collective herding is most common where owners only have a few animals. As such it was rarely encountered by the survey, which focused on owners with herds larger than thirty head. Owners either combine together to hire a shepherd or else agree to herd their collective animals in rotation.

Shepherds usually come to livestock markets to seek work. The largest livestock market is at Sahab, some 20 km, south-east of Amman, and many owners go there to seek shepherds. Shepherds do not stay with the same family for many years at a time, because between contracts they go home and the household generally hires another shepherd. This is not to say that quite close relationships cannot develop. Shepherds are often left to manage many aspects of the herd including the purchase of feed. Similarly, the householder usually makes presents to the shepherd, including cigarettes and clothes, as well as supplying food and dairy products.

Shepherding is one area where there are important economies of scale for householders. A single shepherd is reckoned to be able to manage as many as 500 sheep, although most shepherds manage many less than this. Some owners said that they paid slightly more to shepherds with very large herds, but this is not a general practice. In general it costs as much to hire a shepherd for a flock of a hundred sheep as for five hundred.

There are important regional differences in the hiring of shepherds. Broadly speaking, hired shepherds are far more common in the north and centre of the Badia and very uncommon in the south (Table 15).

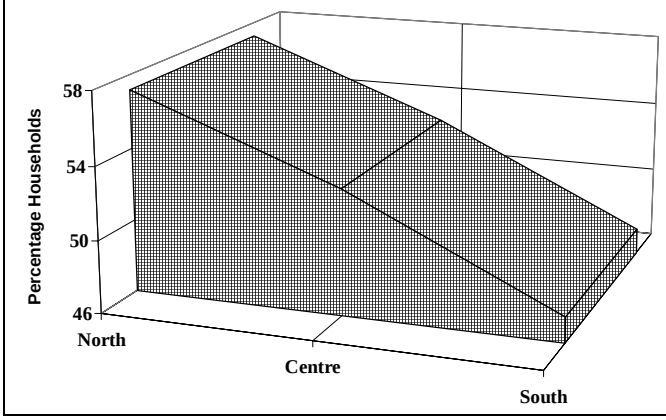
Table 15. Regional Variation in hiring of Shepherds **n=664**

Region	**n**	**No.**	**% region**	**% total**
North	313	179	57.2	
Centre	157	83	52.9	
South	194	92	47.4	
Land Category	**n**	**No.**	**% LC**	**% total**
Highland*	10	3	30.0	
Steppe	405	209	51.6	
Badia	249	142	57.0	

*Not statistically significant

Figure 4 represents this as an area-chart.

Figure 4. Percentage of Households hiring shepherds in different regions



The reasons for this variation are uncertain, but may partly reflect geographic location. Since all the best shepherds come from Syria, they prefer to be employed near their home. It is also simply that the south maintains many more 'traditional' Bedu values, where handing over your flocks to stranger for a cash payment is still seen as slightly shameful. In addition, flocks in the south contain a higher proportion of goats and generally produce less income, making the economics of hiring shepherds more doubtful.

Shepherds are usually (in 93% of cases) hired for an entire year. Very often at the end of the year they return to their base in Syria or elsewhere, spend some time with their family and then return to Jordan. This has the effect of forcing owners to go to the market to hire another shepherd, so there is little continuity in the system.

Alternatively, shepherds can be hired when there is a major labour constraint within the family. This can be sporadic (for example when a family member is ill) or during the planting or harvest season in the case of families with agricultural land. Table 16 shows the frequency of hirings by number of months.

Table 16. Months for which Shepherds are hired n=354

No. Months	No.	%
2	4	1.1
4	4	1.1
5	2	0.6
6	9	2.5
7	1	0.3
8	2	0.6
10	2	0.6
12	330	93.2

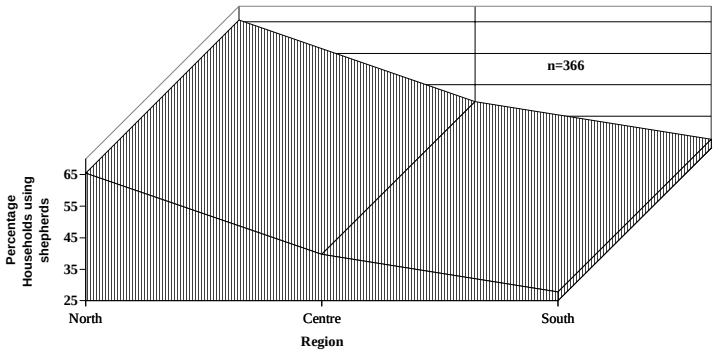
Other Livestock Labour

Apart from shepherding, there is other work to do in the framework of livestock production, and more rarely, households hire individuals for this type of work. This work includes giving feeds to the animals, watering them and caring for the lambs and kids that are not sent out on the range. Syrians are rarely hired, and Egyptians and Sudanese seem to be more common for this less skilled work. The survey found that 8.4% of all households hire other types of labour. This was more common in the north, with almost no cases occurring in the southern region.

A restricted speciality has also grown up in the *hammada* desert of the Northeast, the professional milker. The very large herds in this area are frequently beyond the labour resource of a single household to milk within a reasonable time. Professional milkers, individuals without their own flocks, but otherwise living as the Bedu, set up tents close to them and do the milking for cash payments. The usual rate in 1995 appeared to be about JD100 per month per herd of 200 milking ewes.

Shearing

Figure 5. Percentage of Households hiring Shearers in Different Regions



Most of the sheep-shearing is done by professional shearers. These shearers come in from Syria between May and June and move rapidly through the country removing fleeces very expertly. Some 336 households (52%) of all those owning sheep hired shearers. However, in larger herds (those over 200 head) some 85% of owners employed shearers.

As with shepherding, there were significant differences between north and south. Many fewer households in the south employed shearers. This is partly because of the higher frequency of goats and lower overall herd size. Also the shearers do not range so widely in the south, so it is more difficult to attract them to the flock. Table 17 and Figure 5 show the regional variation in use of shearers.

Table 17. Regional Variation in use of Professional Shearers n=336

Region	n	No.	% region
North	313	205	65.5
Centre	157	77	39.7
South	194	54	27.8

Goats are not professionally sheared as a rule, and the hair may or may not be cut. Goathair was the traditional material of the *beet sha'ar*, tent of the Bedu. However, as few tents are now made in Jordan the value of goathair is minimal.

E. Forage, Feeds and access to Water

Access to Forage

In Islamic tradition, access to pasture is free. Although it has been a long time since this was the case in actuality, it exerts a powerful force on the imagination of pastoralists. It explains why they are so very resistant to the concept of private ownership of land in the Badia and why some of the 'new' herders entering livestock production feel that they can move anywhere to exploit forage.

Historically, the system in the Badia was the *hema* system, which controlled access to pasture. This system has to all effects and purposes broken down. The fragmentation of tribal loyalties and the use of lorries and water-tankers to get access to remote pastures has meant that there is virtually unrestricted access.

Entry to Rangeland or Crop Residues

Protected rangelands have been created in the facing areas, especially in the highlands. These have been fenced and gazetted by the Forestry Department and entry is controlled by Forest Guards. Grazing is occasionally allowed in these reserves on payment of fees. However, overall these made a very small contribution to the nutrition of animals. Table 18 shows that most producers were aware of these reserves although only a very small number actually make use of them.

Table 18. Knowledge and Use of Protected Rangelands	**No.**	**%**	**n=664**
Producers aware of protected rangelands	553	83.3	
Producers making use of protected rangelands	39	5.9	

Considerably more important is the use of cereal stover for livestock nutrition. There was originally a tradition of allowing livestock to graze freely on harvested fields, in return for the rather marginal contribution this would make to fertility. However, as farmers have realised the value of cereal residues, especially barley, they now require cash payments. In areas of rainfed cultivation, if the moisture is too weak to support a good harvest, farmers do not allow the crop to come to term but sell it directly to a producer. Table 19 shows the numbers of livestock owners paying for access to crop residues in the regions.

Table 19. Pastoralists paying to use Crop Residues			**n=664**
Region	**n**	**% total**	
All	464	69.9	
North	239	76.4	
Centre	127	80.9	
South	98	50.5	

The north and centre show an approximately similar value whereas the south is markedly less. This reflects the fact that farms are considerably more dispersed in the southern region, in contrast to the north-central area which has seen much of the pioneer agricultural expansion in recent years.

Some producers complained that farmers are increasingly allowing the residues to be ploughed in instead of allowing grazing. Presumably this reflects farmers' awareness of their contribution to soil fertility, an important consideration where returns on natural fertility decrease every year. Perhaps more importantly, is the gradual disappearance of cereal crops. With the large-scale importation of cereal staples and markets developing for other types of produce, notably horticulture and silviculture, especially olives and almonds, there is less and less incentive to plant barley. As a result, pastoralists complain that it is getting harder very year to actual find fields of residues to buy.

Purchased Feeds

The buying of feeds is the single most important expenditure for all livestock producers. *Every single livestock producer* interviewed spent some money on feeds. Feeds are purchased in bulk by the Government and sold according to allocations denoted by the 1991 livestock census. It is government policy not to allow purchase of subsidised feed for camels. Despite this, many of the camels, especially those kept for milk on the western edge of the rangelands are fed on purchased feed.

The most important purchased feed is barley, followed by wheat bran. The use of these feeds has spiralled in the last few years with the ever-declining rangeland resources. The system of allocating subsidised feeds on a per-head basis has created a major incentive to increase herd sizes.

Water

Water represents the key to exploitation of the rangeland areas. Surface water is scattered and only available during the winter. Artesian water is sufficiently deep to be unavailable through traditional well-digging. Although one of the traditional uses of camels was to carry water into areas where it was unavailable, the sheer volume required placed a major constraint on the areas available for exploitation.

Camels are able to travel considerable distances between water sources and their endurance must have been of major importance in permitting Bedu migration in the pre-drought era. However, the gradual transfer to sheep production also required a major re-orientation in terms of making water available regularly.

Some 86% of the households surveys paid directly for water, either to be delivered or for access to a private source, such as a borehole. Many of the remaining householders regarding themselves as not paying directly for water. However, some of these owned water-tankers, which would have to be discounted against their livestock income in a total household balance. Table 20 shows the regional variation in payments for water.

Table 20. Households paying for water		**1994**	**n=664**
Region	**n**	**%**	
All Rangelands	575		86.6
North	292		93.3
Centre	138		87.9
South	145		74.7

Although the south is generally drier, there are less payments for water, which probably indicates less overall pressure on resources. The costs of water per household are given in Table 23.

The development of a system of water-trucks is certainly the key both the management of substantially larger herds in the rangeland areas and considerably increased grazing pressure. Water-trucks became important during the 1970s and are now owned by some 10% of the population using the Badia (Table 21).

F. Transport

3. Access to motorised transport is presently the key to all types of large-scale livestock production in the rangelands. The principal types of transport used by pastoralists are as follows;

a) Pickup	Either 2 or 4-door
b) Lorry	Usually a Mercedes 911 or similar
c) Water-tanker	A lorry with a water-tank and a load-carrying shelf locally built above it
d) Tractor	Usually with a towable water-tank
e) Car	Miscellaneous

Table 21, Figure 6 shows the percentage of households owning different vehicle types for the whole sample of producers. Households actually located in the Badia region are more likely to own lorries and tankers but markedly less likely to own other types of vehicles.

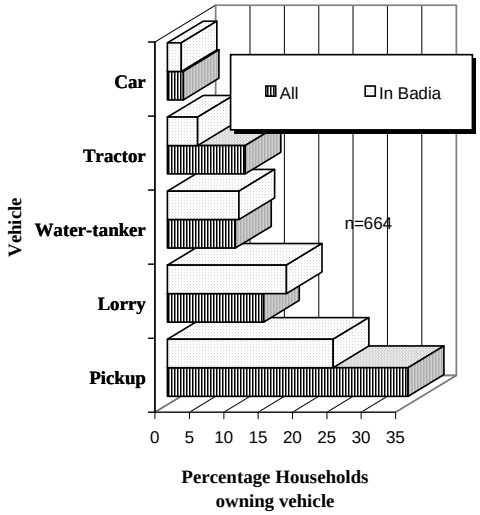
Table 21. Percentage households owning vehicle types 1995 n=664

Vehicle	All		In Badia	
	n	%	n	%
Pickup	234	35.2	60	24.1
Lorry	93	14.0	43	17.3
Water-tanker	66	9.9	26	10. 4
Tractor	75	11.3	11	4.4
Car	15	2.3	5	2.0

It is possible to hire all types of vehicles and producers that only use the rangelands on some occasions are likely to do this. For example, an owner of a large flock in the steppe area who only sends his sheep to the rangelands in a year of high rainfall may find it more effective to hire a lorry for migration rather than maintain one permanently.

It should be noted that the costs of keeping vehicles in the Badia are somewhat less than might appear from costs in Amman. Nearly all the Bedu buy their vehicles in Saudi Arabia, where there is no tax and the price is virtually half that in Jordan. If these vehicles remain in the Badia they can remain unlicensed. This situation is officially tolerated by Government as an additional subsidy to producers.

Figure 6. Percentage Households owning Different Vehicle Types



G. Costs and Expenditures in Livestock Production

Expenditures on Livestock Production

This section considers the actual costs a livestock producer incurs in managing his or her flock. The previous sections cover the social and organisational background to these expenditures.

Shepherding

Shepherds are most usually hired on yearly contracts. Some 93% of those hiring shepherds did this. Other producers hire shepherds only during the months when they have to attend to other work. For example, in

the agricultural areas it is common to hire shepherds during the periods of planting and harvesting when the farmers must be on his own fields.

Payments to shepherds in 1995 were of the order of JD90-120 per month. This varies with supply of shepherds, the known skill of an individual, and the informal agreement with the householder concerning non-monetary items. Table 22 shows the approximate costs of shepherding.

Table 22. Costs of Shepherding (in JD)		**1994-5 n=354**
	Mean	**Range**
Monthly payments to shepherds	91.8	70-130
Annual payments to shepherds	1364.6	840-1560
Mean annual expenditure per SRU	4.19	

Notes:
Monthly payments to shepherds is calculated by summing all the 'shepherd months' and dividing them by the total payment.
Annual payments to shepherds includes households employing shepherds for only part of the year, hence it is not a simple multiplication of the monthly payments.
Mean annual expenditure per SRU is the product of dividing the mean annual payment for shepherding by the mean flock size in SRUs (325.3 *see* Table 7).

Other livestock labour

Shearing

The usual charge in 1994 was 250-300 fils per fleece, *jezzeh.* Mean expenditure on shearing in 1994 was JD55.1 for the 336 households employing shearers.

Water

Almost all livestock producers must spend money on water in one way or another. The large-scale producers often own either towable tanks or water-tankers, in which case they may pay for access to wells, taps or other sources. Owners of smaller herds usually pay for water to be delivered to wherever their herd is stationed. Table 23 summarises the total and regional means for water payments

Table 23. Payment for water		**1994**	**n=664**
Region	**n**	**% region**	**Mean (JD)**
All Rangelands	549	82.7	270.0
North	273	87.2	348.1
Centre	134	85.4	240.4
South	142	73.2	147.9

The cost to large owners of maintaining either trucks or water-tankers cannot easily be factored in, especially as these vehicles are always multi-purpose.

Table 24 shows the expenditures on access to protected pastures and cereal residues during 1994.

Table 24. Payments for Crop Residues and Access to Pastures		n=664
	No.	**%**
No. of households paying for this	348	52.4
	(JD)	**per SRU**
Mean Annual expenditure	384.3	1.18

Forage Production

Since many livestock producers do in fact own farmland, some of them produce forage on their land. The most common forages are immature barley or alfalfa. Table 25 shows the numbers of households possessing land and those actually using to produce forage.

Table 25. Possession of farmland and forage production		1994 n=664
	No.	**%**
Households possessing farmland	485	73.0
Mean size of farmland (in ha)	16.8	—
Households producing forage	467	70.3

Not all households which produce forage own land; some producers rent land to grow forage.

Purchased Feeds

The main types of feed are barley and wheat bran (*tibbin*). The use of sorghum, cited in earlier reports, ceased in 1992. Householders were not asked to divide their purchases into specific types of feed, since many keep only the most general figures in their heads concerning these expenditures.

Table 26 shows the expenditures on feed and ratios between outgoings and herd size.

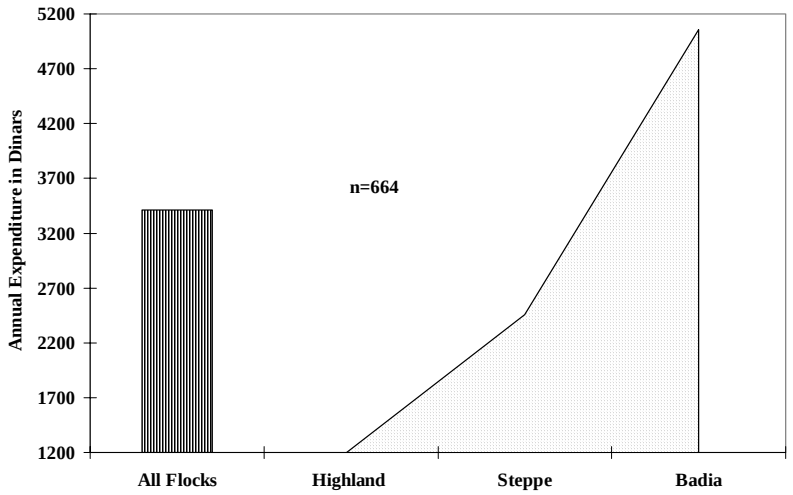
Table 26. Purchased Feeds: Use and Expenditures			1994
SRUs	**n**	**Mean (JD)**	**per SRU**
All Flocks	664	3412.0	10.5
Highland	10	1235.0	
Steppe	405	2454.1	
Badia	249	5057.5	

In general, the amount spent on feed is strongly correlated with the size of the small ruminant herd.

Veterinary Services

The general pattern for use of veterinary services in Jordan is that the Government is responsible for vaccination against epizootics, whereas other conditions are the responsibility of the owner. Expenditure on veterinary services is extremely variable, with some owners spending quite highly, and many owners, even with quite large herds, trusting to luck or traditional herbs.

Figure 7. Expenditure on Feed in Different Land Categories



This is partly a reflection of the sporadic availability of such services. Essentially, the further from Amman, the worse the private veterinary services and the higher the cost of drugs. Given the value of an individual sheep or goat, the cost of attempting to treat it for an individual condition is probably too high, and it may be simpler to leave to recover or die, or alternatively slaughter it. Producers usually make an exception for a *mereeya*, one of the favoured castrate sheep or goats that are used to lead the flock. These are given extra nutrition and are often carried individually to vets should anything happen to them.

Table 27. shows expenditures on private veterinary services at a national level.

Table 27. Private Veterinary Services: Use and Expenditures				**1994 n=664**
SRUs	**n**	**% total**	**Mean (JD)**	**fils per SRU**
All Flocks	590	88.9	97.000	298

The use of private veterinary services is strongly regionalised and notably more use of them is made in the north. The lack of interest in the south is attributed to their lack of accessibility, but also the fact that the proportion of goats is higher and goats are generally considered to be more hardy. Table 28 shows the regional variation in use of veterinary services.

Table 28. Use of Private Veterinary Services		**1994 n=664**
Region	**n**	**% region**
All Rangelands	590	88.9
North	281	89.8
Centre	147	93.6
South	162	83.5

Sources of Income from Livestock

Dairy Products

The milking of sheep, goats and camels is essential to the pastoral production system. Milk is drunk fresh, but also processed into a great variety of products that are both consumed within the household and sold outside. Annex III lists the dairy products made in Jordan and discusses the marketing of individual products in more detail.

Camel milk is widely drunk in parts of the rangelands, especially in the south, but it is nowhere processed into dairy products and sold. The milk of camels is widely believed to have medicinal properties. For this reason, apart from small herds of camels, there are many individual camels kept for their milk, especially in the region east and south of Mafraq.

In the north and centre of the Badia, the principal channel for dairy income is the sale of fresh milk to the cheese factories that set up close to the herds during the lambing season (January to June). The cheese factories only process sheep milk, so goat milk and its processed products are essentially drunk only within the household. Processed goat milk, such as ghee or butter can be sold, but usually commands a lower price than sheep products.

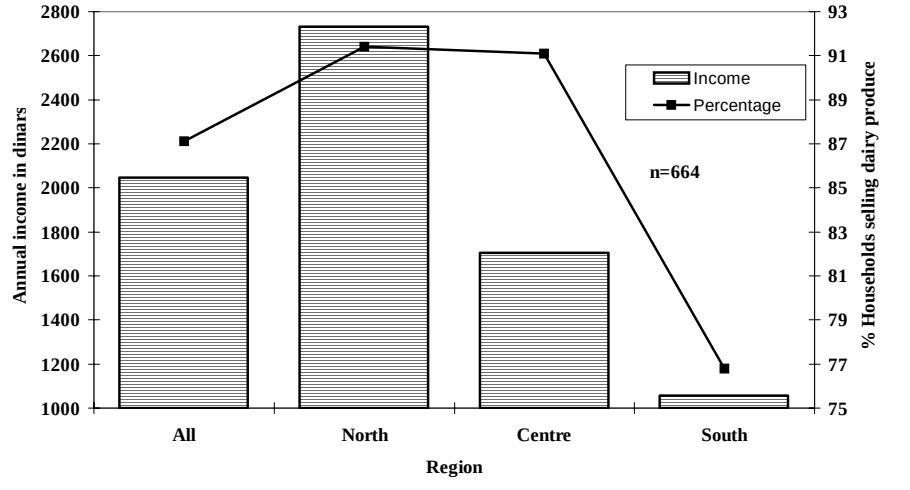
Even so, the sale of milk is not inevitably part of producers' incomes. Many owners stated that they did not sell milk products but used them all within the family. There still exists a slight tradition that it is somehow 'shameful' to sell animal products. This was presumably much stronger in the past. However, such an idea has largely disappeared in the northern and central areas. Because of this, and because communities are more scattered in the south, many more households do not sell milk or dairy products (Table 29, Figure 8).

Table 29. Households selling Dairy Products		**1994 n=664**
Region	**n**	**% total**
All Rangelands	578	87.1
North	286	91.4
Centre	143	91.1
South	149	76.8

Table 30. Income from sale of dairy products		**1994 n=664**
Region	**Mean (JD)**	**JD per SRU**
All Rangelands	2046.5	6.29
North	2733.0	
Centre	1705.0	
South	1056.5	

The sale of dairy products is the second most important source of income after sale of lambs and kids. Figure 8 shows the mean income from households selling their milk products in the different regions. This also illustrates that the terms of trade for dairy producers are very much weighted against those in the south. This is partly because they have to process their milk into ghee and dried yoghurt, *jemeed*, rather than selling it direct as fresh milk.

Figure 8. Mean income from sale of Dairy Products in Different Regions



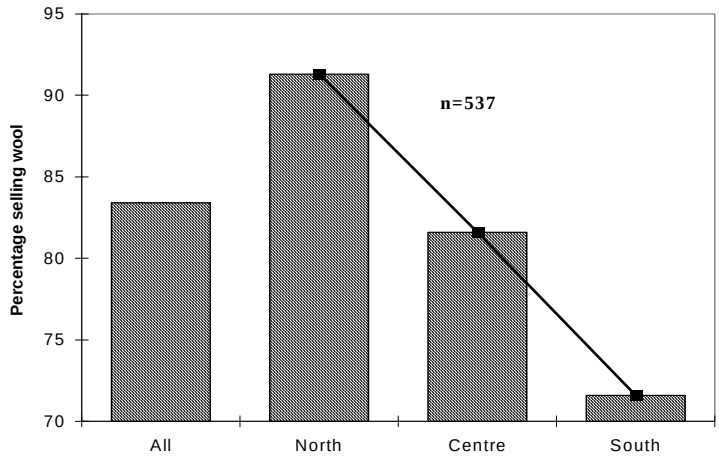
Wool

Almost all households shear their sheep, the majority professionally, using Syrian shearers. However, there is considerable variation in the amount of wool a household chooses to sell. More traditional households tend to use much of the wool themselves, to make blankets, or simply fleeces for lining and for sitting on. More than one owner expressed this idea that this was an acceptable charity, giving away fleeces to relatives or to the poor. In addition, the amount of intra-household wool used is significantly affected by the number of family members. As with other variables, there were significant regional differences between north and south (Table 31, Figure 9). This can be partly attributed to the higher incidence of goats in the south, but also to the more traditional orientation of society, and the greater production of traditional blankets and hangings.

Table 31. Percentage of Households selling Wool by Region **1994 n=664**

Region	n total	n selling wool	% sheep-owning households
All Rangelands	644	537	83.4
North	309	282	91.3
Centre	152	124	81.6
South	183	131	71.6

Figure 9. Percentage of households selling wool in different regions



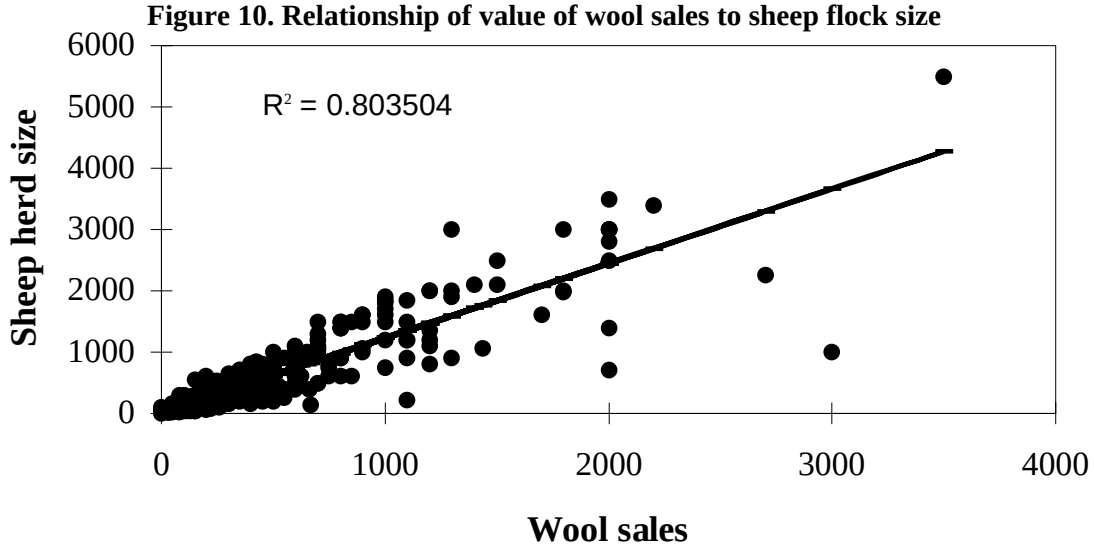
Another factor that has recently begun to affect wool sales is the problem of finding buyers. Wool is principally bought by Turkish merchants for fairly large sub-industrial operations within Turkey. As with livestock, the relative softness of the Turkish lira compared to the Jordanian Dinar has made wool from Syria and Iraq substantially cheaper. Wool from Jordan is no longer competitively priced. The number of Turkish traders has reduced and there has been no corresponding expansion of internal demand. Many sheep producers, especially in the northern rangelands have retained their last year's wool, since they were unable to sell it. It is likely that prices will come down still further, since wool is problematic to store and only a limited amount can be used by households.

A fleece usually sells for JD1-1.500 unwashed. Fleeces weigh approximately 2 kg. so the actual farmgate price of wool is ca. 500 fils/kg. assuming a buyer can be found. Table 32 shows the mean income from wool sales in 1994 by region, both as a mean across all producers and in relation to individual flocks.

Table 32. Income from sale of wool by region		1994 n=537
Region	**n**	**Mean (JD)**
All Rangelands	537	427.5
North	282	566.4
Centre	124	334.6
South	131	216.7

The relationship between income from wool sales and total sheep flock size is quite strong; suggesting that if a producer decides to sell wool then he will sell most of the fleeces. Figure 10 plots this as a normal probability plot.

Figure 10. Relationship of value of wool sales to sheep flock size



Goat and camel hair were used principally for blankets, especially the coarse weave types used in constructing the traditional Bedu tent, the *beet sha'ar*. However, this type of weaving is markedly in decline and most tents these days are being gradually repaired with fertiliser sacks or canvas fragments. Some producers are buying new goathair tents from Syria. Income from the sale of goathair is minimal.

Animal Sales

The single most important source of income to producers is livestock sales. These are principally of young animals and are designed for the slaughter market. Male animals are generally sold, either to the merchants involved in export to the Gulf or to Amman and other cities. Lambs and kids are sold comparatively young, with an average weight of between 20 and 30 kg. Producers noted a marked discontinuity between the prices they received from traders and the price per kilo in the markets. Prices given in the 'Assumed price' column were cited by producers during the course of the survey. Table 33 and Table 34 show the mean household income from sales of sheep and goats. Figure 11 represents the regional variation in income from sheep and goats sales.

Table 33. Income from sale of sheep by region		1994 n=664
	n	% total
Households producing & selling sheep	644	97.0
Region	**Mean no. sold**	**JD***
All Rangelands	91.5	5949
North	130.3	8466
Centre	82.6	5370
South	53.6	3481

*Assumed Price per Sheep (65 JD)

Table 34. Income from sale of goats by region		1994 n=543
	n	% total
Households producing & selling goats	456	84.0
Region	**Mean no. sold**	**JD***
All Rangelands	9.37	515
North	4.34	239
Centre	10.51	578
South	14.34	789

*Assumed Price per Goat JD55

Figure 11. Comparative Income from Ruminant Sales of Households in Different Regions

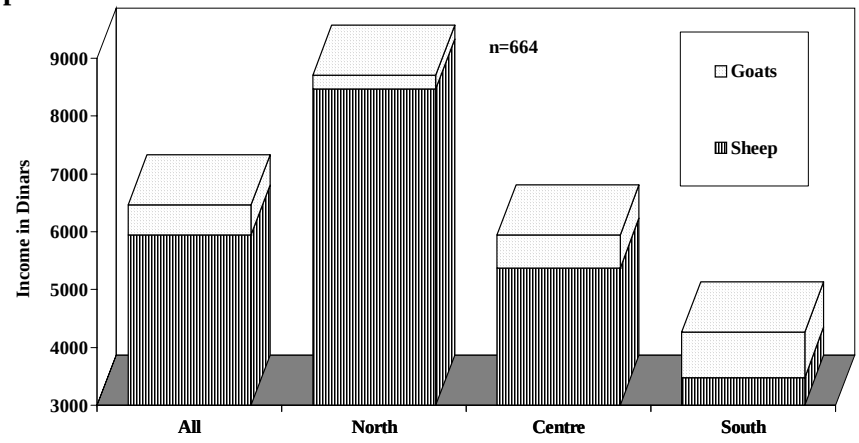


Table 35 consolidates these sales figures into a single amount showing the mean income from ruminant sales.

Table 35. Mean income from sale of ruminants by region Region	1994 n=664 JD
All Rangelands	6464
North	8705
Centre	5948
South	4270

H. Income and Expenditure

Lancaster (1981) provides a useful account of the problems of tabulating overall household economics on Bedu households. Networks of obligation both in services and kind, stretch over many years and multiple currency dealings with fluctuating exchange rates make an overall accounting impractical. He also notes that sporadic displays of extreme generosity are part of the maintenance of prestige by community leaders. These lead to major inter-annual fluctuations in the overall wealth of a household.

In the light of this, this section looks only at the livestock enterprise itself. It considers the livestock cost cycle in terms of expenditure month by month and then takes a 'model' herd and tabulates expenditures based on 1994 costs as established by the survey.

The Livestock Cost Cycle

Table 36 shows a schematic outline of the annual cycle of livestock expenditures and sales of products and live animals.

Table 36. Annual Cycle of Livestock Costs and Sales

Month	Expenditures						Sales		
	Shepherds	Shearing	Water	Forage	Feeds	Vets	Dairy	Wool	Live animals
January									
February									
March									
April									
May									
June									
July									
August									
September									
October									
November									
December									

Light-coloured blocks represent lower levels of expenditure.

This table shows only columns for expenditures with quantified monetary data. These are developed as actual figures in Table 37.

A Model Herd, 1994-1995.

The following is a model of a herd in the Northern Badia, based on the prices and outputs derived from the survey. The herd is assumed to consist of 425 sheep and 36 goats, approximately typical for this region (Table 6). Table 37 (also Figure 12) gives mean costs for monetary inputs and outputs based on the survey. This should be compared with Table 38, which brings in 'hidden' costs such as access to free forage and ascribes a value to household consumption.

Table 37. Costs and Income from a typical small ruminant herd in the Northern Badia

n= 425 sheep and 36 goats

Month	Expenditures						Sales		
	Shepherds	Shearing	Water	Forage	Feeds	Vets	Dairy	Wool	Live animals
January	113.7		29.0	128.1	210.7	8.1	780.8		
February	113.7		29.0	128.1	210.7	8.1	650.7		1741
March	113.7		29.0	128.1	210.7	8.1	520.6		1741
April	113.7	55.1	29.0		421.5	8.1	390.3		1741
May	113.7		29.0		421.5	8.1	260.2	566.4	1741
June	113.7		29.0		632.3	8.1	130.1		1741
July	113.7		29.0		632.3	8.1			
August	113.7		29.0		632.3	8.1			
September	113.7		29.0		421.5	8.1			
October	113.7		29.0		421.5	8.1			
November	113.7		29.0		421.5	8.1			
December	113.7		29.0		421.5	8.1			
Total	**1364.6**	**55.1**	**348.1**	**384.3**	**5057.5**	**97.0**	**2733.0**	**566.4**	**8705.0**
Totals			**7306.6**					**12004.4**	
Net annual income (cash)				**JD 4697.8**					

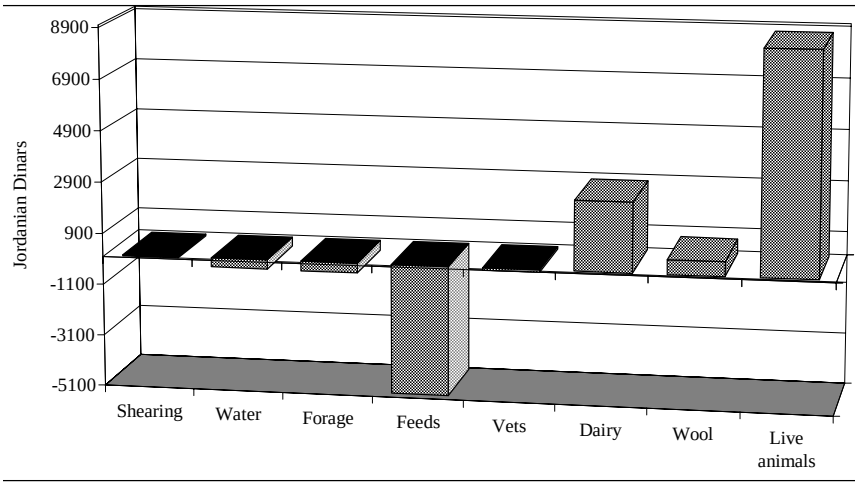
Notes:

1. Aseasonal costs are ascribed an equal amount in all months of the year.

2. The cost of feed is assumed to be reduced in the winter months, January to March, when animals have some access to forage, and highest in the summer when the grazing has finished and no residues are available. In reality, the uncertain availability of feeds at the depots make it inevitable that producers buy the feed when it is available, whether it is financially convenient or not.

3. The sales of dairy products are shown as gradually decreasing from a peak in the first month. This is a realistic assumption in the northern Badia where most sales are liquid milk direct cheese factories. Where the milk is stored and processed into ghee and dried yoghurt, the income from sales would be spread over a greater proportion of the year, and would increase towards the end of the lactation rather than decreasing.

Figure 12. Income and Expenditure of average livestock producer in the northern Badia



This table is essentially a table of cash earnings. It ignores the costs represented by maintenance on vehicles as well as the sunk costs these represent. More importantly, it does not ascribe a value of the meat, milk and wool used in the household.

Nonetheless, it gives a reasonable schema of the livestock enterprise. It suggests that livestock is not a very profitable business in itself, although the supply of meat and milk is evidently important from a substance point of view. Certainly the profitability is markedly lower than suggested by various model herds.

Hidden costs and income from livestock production

Table 37 shows only the cash flows relating to livestock production. However, a more realistic model of the livestock enterprise would also include inputs to which producers do not ascribe a cash value, notably household labour and access to range, as well as sunk costs, such as vehicles. Similarly, the outputs include most importantly the value of the products consumed within the family. Estimates for these are made in Table 38 and the annual income then recalculated.

Table 38. Costs and Income from a typical small ruminant herd in the Northern Badia

n= 425 sheep and 36 goats

Month	Expenditures										Sales					
	Labour															
	Hired	Family									Dairy		Wool		Live animals	
	Shep-herds	Male	Fe-male	Shea ring	Wat-er	Range Forage	Resi-dues	Feeds	Vehicles	Vets	Sold	Eaten	Sold	Used	Sold	Eaten
January	113.7	113.7	56.9		29.0		128.1	210.7	100.0	8.1	780.8	**227.7**		**23.6**		30.0
February	113.7	113.7	56.9		29.0	421.5	128.1	210.7	100.0	8.1	650.7	**227.7**		**23.6**	1741	30.0
March	113.7	113.7	56.9		29.0	421.5	128.1	210.7	100.0	8.1	520.6	**227.7**		**23.6**	1741	30.0
April	113.7	113.7	56.9	55.1	29.0			421.5	100.0	8.1	390.3	**227.7**		**23.6**	1741	30.0
May	113.7	113.7	56.9		29.0			421.5	100.0	8.1	260.2	**227.7**	566.4	**23.6**	1741	30.0
June	113.7	113.7	56.9		29.0			632.3	100.0	8.1	130.1	**227.7**		**23.6**	1741	30.0
July	113.7	113.7	56.9		29.0			632.3	100.0	8.1		**227.7**		**23.6**		30.0
August	113.7	113.7	56.9		29.0			632.3	100.0	8.1		**227.7**		**23.6**		30.0
September	113.7	113.7	56.9		29.0			421.5	100.0	8.1		**227.7**		**23.6**		30.0
October	113.7	113.7	56.9		29.0			421.5	100.0	8.1		**227.7**		**23.6**		30.0
November	113.7	113.7	56.9		29.0			421.5	100.0	8.1		**227.7**		**23.6**		30.0
December	113.7	113.7	56.9		29.0			421.5	100.0	8.1		**227.7**		**23.6**		30.0
Total	**1364.6**	**1364.6**	**682.2**	**55.1**	**348.1**	**843**	**384.3**	**5057.5**	**1200.0**	**97.0**	**2733.0**	2733.0	**566.4**	283.2	**8705.0**	**360.2**
Totals	**11396.4**										**15380.8**					
Net annual income (cash)	**JD 3984.4**															

Notes:

1. Conventions are as in the previous table except that 'hidden' costs of production, notably family labour are shown in a Helvetica font, thus; **Family**.

2. Managing an average herd usually keeps one male household member occupied during the daytime, so the cost of this labour is ascribed the same value as an average shepherd

3. The value of female labour is harder to cost, both because it is discontinuous throughout the day and because women do not naturally hire themselves for work in this sector. The value of female herding is thus tentatively ascribed as half that of male herding labour

4. A herdowner with a flock of this size is likely to own a pickup but unlikely to own a lorry or water-tanker. The costs of a water-tanker are included with the costs of water, but lorries must occasionally be hired for flock movements. Vehicles are old and often unlicensed, so costs are essentially maintenance and fuel. This is costed at 100 JD per month, based on some of the statements of herdowners, but will be subject to substantial variability.

5. The calculation of the value of eaten stock is complex. Essentially, the percentages of stock eaten as against sold are derived from Table 48 and Table 49 showing the fate of the lamb and kid crops. This gives a mean number of animals eaten for an average Badia herd (Table 33 and Table 34). These values are then multiplied by the sale price assigned to sheep and goats. The respective values for sheep and goats are JD 338.7 and JD21.5 giving a total value of consumed stock as JD360.2. These are shown as equal for each month, but in reality, the slaughter of stock depends on guests and ceremonial obligations and is subject to considerable intra- and inter- annual variation.

These calculations suggest that overall profitability is reduced once 'hidden' costs and expenditures are taken into account. Annual cash income from the herd drops some JD713.4 or to 84.8% of the previous level.

I. Migration

Traditional Classifications of Migration

One of the most distinctive features of pastoral production is migration; highly visible in certain seasons, it is usually described in some detail in descriptive studies. One of the staples of such studies is the 'migration map' with arrows criss-crossing the map showing seasonal movements of the herds.

In Jordan, the traditional classification of migration is threefold;

a) Migration from the mountains to the valleys westward
b) East-West transhumance
c) Nomadism, i.e. all year round movement

This has been described in various sources including Nesheiwat (1991). Mountain-valley transhumance, also called 'vertical' transhumance is outside the scope of this study and will not be further discussed.

It is hard to judge the reality of such a system in the past. However, it is evident that by 1995 it had broken down irretrievably. A combination of the use of vehicles to move flocks, the rise of detribalised 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 a considerably more fragmented system of migration.

Tribal Migration

An analogous staple of the literature is the tribal migration. This argues that particular tribes have specific migration routes which they follow most years. The usual product of this view is the migration map with arrows assigned to particular tribes.

As with annual migration patterns, it is hard to judge the reality of this in the past, but the present survey does not support such a view. Economic individualism has meant that individual members of particular tribes decide both whether to go on migration and if so, where. Hence the scatter of individuals from a wide variety of tribes encountered, especially throughout the Northeast, where the good rains in the winter of 1994-5 attracted numerous herders from all over Jordan.

In the villages, producers with large herds who do not identify themselves as Bedu, nonetheless make use of the rangelands in good rainfall years. The case history below gives an example of such a producer.

Case History 1. A New Urban Nomad

Mohammed S. is a resident of a village near Tafila. He owns some 300 sheep as well as a substantial farm and a house. He does not regard himself as Bedu and will criticise Bedu intrusions into grazing lands attached to the village. However, he makes use of the Badia grazing every year to reduce expenditure on purchased feeds. To find out where rain has fallen and grazing is consequently good, he makes extensive use of the telephone and of a network of contacts. After identifying a region of pasture, he uses his lorry and water-truck to graze his sheep there for as long as the forage lasts. Although he considers himself a member of a tribe, the Er-Hwetat, he will go to any area of the country and does not consider it necessary to ask permission or even to enquire into traditional grazing rights in the region where he plants his sheep.

Migration versus sedentary production

By contrast one of the striking findings of the survey was the large number of livestock producers who have ceased to move. Of the entire sample, only 216 households (32.5%) migrate in any way. Many of those questioned had ceased migration in recent years due to the costs and problems associated with it and the availability of subsidised feed. Table 39 shows the numbers migrating broken down by region. It might seem surprising that a lower percentage in the Badia migrate but this includes pastoralists who are permanently resident in the desert and who simply move around a central encampment.

Table 39. Households still migrating by land category 1994

Region	n	%
All Rangelands	216	32.5
Highlands	1	10.0
Steppe	148	36.5
Badia	67	26.9

This pattern is strongly associated with feed availability; subsidised feeds have allowed householders to become more sedentary. If the price of feeds rises substantially it is inevitable that producers will either cease production or begin migration.

Reclassifying Migration patterns

In the light of the responses to the survey and broader discussions with producers a more comprehensive classification of migration was evolved. This suggests the following six categories;

a. Owners whose herd is always resident in one place
b. Owners whose herd is mostly resident in one place but who occasionally move it to pasture in a year when the rains are good.
c. Owners who move their herds every year to pasture according to a reasonably regular schedule (‘transhumants’?)
d. Owners whose herd is on the move all the time over the Jordanian rangelands (‘pure nomads’?)
e. Owners whose herd is on the move all year but stays within a reasonably small ambit (e.g. 50 km. radius)
f. Owners who move their herds across the border to other countries

It is perfectly possible to be a nomad and farm, because it is easy to rent both land and agricultural labour. It is also possible to be a nomad in the Badia and 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.

Surrogate migration

The gradual development of national borders and the increasing difficulty of seeking pasture in other countries has stimulate the development of a number of subterfuges 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 resale 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 owner. 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, no information is available as to the extent of this practice.

J. Land and Land Rights

Land rights can be effectively divided into two; rights over farmland and rights in the rangeland. In principle, tenure in farmed areas is related to patrilineal inheritance. Owners with rights in such land usually inherit it from their family. This land can in principle be bought and sold.

Rangeland, however, is legally at least, controlled by government and the construction of buildings and ploughing up for farms is controlled. In reality, however, the boundary between 'rangeland' and private farmland is constantly shifting due to pioneer agricultural settlement which can confer title to land.

Two views of Land Tenure

There are essentially two views of land tenure in the rangeland areas; 'complex' and 'simple'. Rights in pasture are viewed, especially by anthropologists as highly elaborated and sanctioned by traditional society. Numerous interlocking systems of rights existed in the past and development can only be effective if these are respected or strengthened. The alternative view, the 'simple' one, is that although tenure may exist in theory it is non-functional today. In other words, although pastoralists can explain their rights in a region of pasture these rights cannot be made operational except through agriculture or related types of land development. Traditional tenure has to all intents and purposes broken down.

Collapse of rights in rangeland

Traditional theory holds that rights to pasture are not held by individuals and that in principle all producers are free to exploit it. This theory has not been operative through much of the history of this area (for a historical account of changing systems see Nesheiwat, 1991). The evolution of the *hema* system, essentially allocated pastures to individual subgroups, where authority was exercised via a sheikh.

Several key elements of the *hema* system allowed it to survive for many centuries;

a) a high degree of militarisation of society which allowed violent retribution against rule-breakers
b) the slow pace of movement to a given pasture (on foot)
c) the fact that herding was done more directly by the owners of the animals
d) actual herd sizes were smaller implying less competition for pastures

These conditions have all been transformed within the last half-century. The Bedu have come under control of central government, they have acquired trucks to transport animals, herding is largely actual done by hired shepherds and herd sizes are now very large.

Many individuals or families conceive of themselves as having rights in rangeland and can classify an area as their 'traditional' grazing area. However, this does not mean they have any mechanism to prevent outside herds from coming in and exploiting the grazing. In general this pattern seems quite acceptable because of the uncertain nature and inter-annual fluctuation of forage resources. If you do not allow someone to graze 'your' area this year, in another year your herds may have access blocked elsewhere.

In the same way, there is a strong resistance to private or individual ownership of the rangeland. While notions of rights subsist in a conveniently ambivalent form they can persist. If private ownership meant the erection of fences across the rangelands, there would be considerable resistance.

IV. SURVEY (II) - LIVESTOCK MANAGEMENT AND PRODUCTIVITY

A. Livestock Species in the Jordanian Rangelands

Sheep

Sheep Breeds

Baladi/Awassi

4. The principal breed of sheep in Jordan is the Baladi or Awassi, a fat-tailed breed with a variable-coloured coat. Many herds are pure white, but brown and pied brown are also present. Resistant to cold, the Awassi is valued both for its wool and its meat. The characteristics of the Awassi have been described in detail in Epstein (1985).

Nejd

4. The Nejd sheep is a fat-tailed wool breed usually found in Saudi Arabia and regions further south. They can be recognised by the black wool and white head, an inversion of the more common blackhead pattern. They are reputed to be good milking animals, but to be much less resistant to cold. Occasional Nejd sheep are found in Jordanian Bedu herds, especially in the south-east.

Goats

4. The goats generally encountered throughout the rangelands are the Baladi type. They have a highly variable coat colour, ranging from white through brown to black. Black goats are predominant in the southern areas. They have a long coat, which is usually clipped.

4. There are two other breeds found occasionally, the Shami and the Abrussi (Cyprus). Shami goats have a red-brown coat and are noted for their productivity. They are the focus of a pregnant doe sale programme promoted by the Ministry. Occasional herds with some Shami goats were encountered but these still remain a very small proportion of the national herd. Abrussi goats were not seen in the rangelands area.

Camels

4. Camels were formerly the dominant species throughout the Jordanian rangelands. They are described at length in the classic monographs on Bedu life (Musil, 1927, Oppenheimer, 1940). Musil describes a complex classification of different camel types, depending on colour and function. Camels have declined drastically in number and importance, although their symbolic significance remains strong. Camel herding remains associated with high status and camel milk is widely held to have important medicinal properties.

Cattle

The traditional breed of cattle is a small, humpless taurine usually brown in colour. This breed, the Baladi, has been almost entirely replaced by imported European breeds in the highland areas, but survives in some settlements in the Ghors and on the sides of the wadis leading west into the Jordan valley.

Cattle pastoralism has never been of importance in Jordan, and most of the other cattle kept in Jordan today are in intensive operations. Presumably the reason for the survival of these cattle is their ability to tolerate the intense heat of region by the Dead Sea as well as to suggest the highly saline vegetation. They are usually kept as single milking cows for a family milk supply. Their potential seems to have remained virtually uninvestigated.

In the higher altitude regions, cattle were used extensively until recently as plough animals (See Lancaster & Lancaster, 1995). The spread of tractor hiring units seems to have rapidly displaced plough-oxen with no cases recorded in the survey.

Occasional exotic breeds are kept, single animals for their milk. They are probably not economic, as the high cost of both feed and veterinary services is likely to outweigh the value of the milk. Nonetheless, it was striking that a number of households proposed cattle production as an income generating enterprise.

Horses and Mules

Horses are now only rarely kept in the whole of the Badia region. The survey only recorded 20 horses. Ethnographic accounts suggest that horses were once considerably more important[1/] and they were usually the preserve of sheikhs and wealthy individuals. Horses had to be fed on imported feed brought long distances from the agricultural zone.

Donkeys

4. Although their absolute numbers are not large, donkeys are essential to the production system of small ruminants. Some 70% of herders kept donkeys as both transport for small items and to help lead the herd. In contrast to horses, the use of donkeys has not declined in the face of mechanised transport. This is in part a reflection of their hardiness, unspecialised diet and their surefootedness in difficult terrain.

Dogs

4. There are two types of dog that usually accompany pastoral households in Badia areas, the *salugi*, or hunting dog and the sheep-dogs, which may be of various breeds. The *salugi* was bred to for the hunt and the decline of wildlife throughout this region has led to a corresponding decline in the breeding and use of this dog.

4. The sheepdog, on the other hand plays an essential role in flock management throughout the rangeland areas and almost all households with more than 100 head kept one or more dogs. Indeed, it is likely that with the increase in labour migration and the reduction of shepherding by family members, sheepdogs are now more important than in the past.

Poultry and others

Poultry

4. The main species of poultry kept in this area are chickens, ducks, pigeons and geese. Some turkeys and guinea-fowl were also recorded. Poultry production is not a high-status activity, and male interviewees frequently professed to be unaware of the numbers and types of birds kept. However, poultry-keeping

1/ Musil records a myth of the Rwala Bedu that they were originally horse-owners and stole their camels from the Arabian Jews.

is an important minor source of both income and protein and appears to on the increase, especially as more and more pastoralist families are resident in one place for most of the year.

Rabbits

4. Rabbits are a relatively recent introduction into the pastoral areas, but a few households were recorded keeping them and they appear to be becoming more common.

B. Production Systems of Principal Livestock Species

Goats

4. Goats are kept in markedly smaller herds than sheep because their products are generally less marketable. Goats are more susceptible to chills and this limits their numbers in the northern Badia which can become very cold at night. Goats do, however, have a number of advantages;

a) They produce milk for 6-7 months as opposed to sheep which only lactate for 3-4 months. They are often kept for milk to drink as opposed to milk for sale.
b) They can eat a much wider range of vegetation including woody perennials which sheep cannot digest
c) They are less susceptible to disease than sheep
d) They are more intelligent and thus less likely to get lost. In consequence, goats are often used as castrates, *mereeya*, to lead large sheep flocks.

For these reasons, even very large sheep flocks usually include some goats.

4. In the southernmost parts of the Badia, goats are preferred. Some of the very poorest producers in Jordan subsist on extremely small herds of goats, usually in remote wadis where there is much reduced competition for forage. Case History 2 gives an example of one of these producers.

Case History 2. Life in the southern *Wadis*

Ali B. lives with his wife in a *wadi* west of Al-Quweyra in south-west Jordan. The *wadi* has a typical vegetation of dune-fixing shrubs and there is a continuous wind blowing along it. He owns only twenty goats and live off these goats as far as possible. To supplement his income he depends on Social Welfare. He sees no chance of improvement as he can never accumulate enough capital to increase his herd size. The *wadi* is such a difficult place to live, that there is limited competition for what browse there is.

Camels

4. The herding of camels has been described in some detail in Musil (1928) and Lancaster (1981). Camel herds are much reduced since this period and camel production has essentially split into two quite distinct elements;

a) the management of medium-sized herds in remote wadis and desert areas by nomadic pastoralists
b) the keeping of small numbers of animals on the edge of the cultivated area, essentially for their milk which is regarded as highly prestigious

4. Camel-herding requires considerable skill, both because camels take a long time to mature and because they depend more on natural forage than sheep or goats. Camel-herding is not a very 'profitable' enterprise in monetary terms because of the difficulty of selling the milk or slaughter animals. This has led to curious 'split' production systems, where the small ruminants are managed as a commercial enterprise while the camels are kept in the traditional manner. Case History 3 given here shows a concrete example of this system.

Case History 3. Herding Camels for Honour

Abu-Salem and Mohammed K. are two brothers from the aristocratic caste of the Rwala tribe. They have a herd of some 50 camels and 700 sheep. The sheep they manage in a commercial manner, using hired shepherds from Syria, purchased feeds, and water moved with a water-truck. The sheep are moved around the Badia with their own truck.

The camels, however, they manage both for honour and because the camels form part of the tradition of their tribe. They herd these camels themselves, and are constantly on the move all through the year, in search of forage. They do not feed the camels purchased feeds. The camel-hair is not clipped and sold but 'left for the wind'. Camel-milk is taken and drunk as well as processed into dairy products, but only consumed within the household and never sold. They also claim never to sell camels for slaughter as this would be a 'shame'. The two production systems, sheep and camels, allow the brothers to navigate in two distinct worlds, meeting their financial obligations with the profits from sheep and maintaining camels as an honourable lifestyle.

Camel-production is likely to decline still further as the system of values to which they are linked declines.

C. Management of Flocks

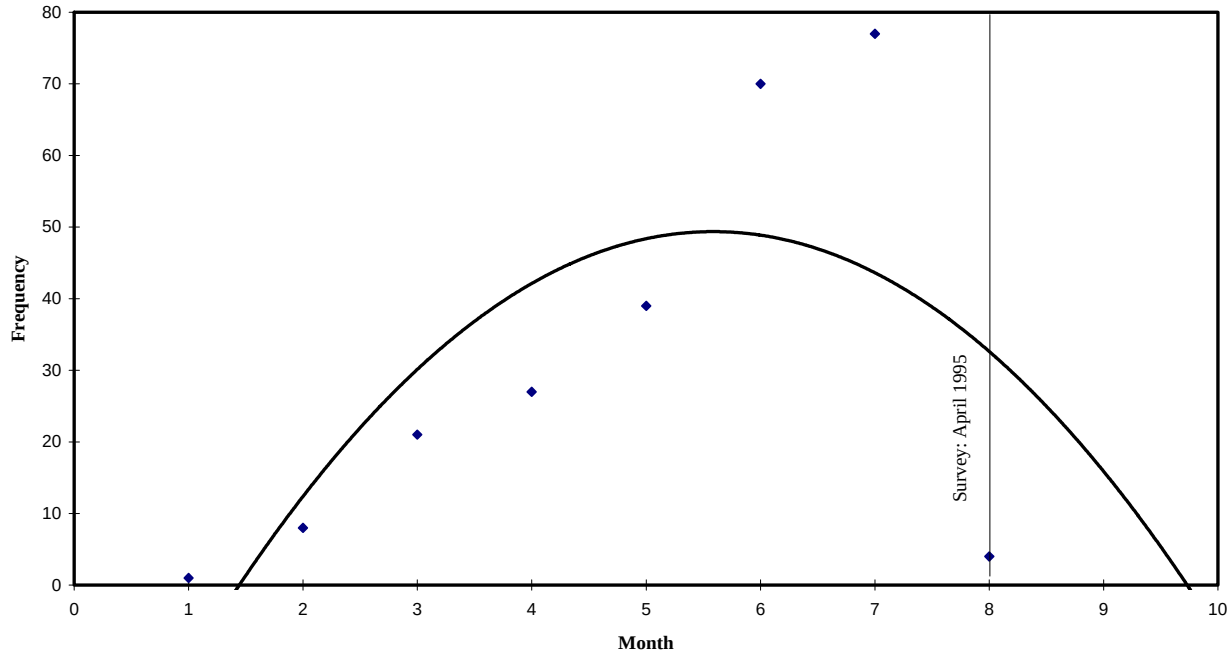
Leading the Flock

4. One of the key elements in small ruminant production is the use of castrates, *mereeya*. These are sheep and goats castrated after birth and then kept apart from the herd. They are given supplemented feed and tied to special rope close to the tent. They are often deliberately put with the donkey so that they should get used to it. When they are mature enough, they are fitted with bells and are trained in leading the herd. The *mereeya* are regarded as working animals and are not sold despite their high bodyweight.

Seasonality of Births

4. Unlike tropical regions, where males are frequently allowed access to females all year round, breeding is strictly limited in many of the herds studied. Oestrus itself appears to be a limiting factor; the high frequency of offspring born in the winter months December to March suggests conceptions between June and September. However, herders also exercise fairly strict control, in the sense that the rams or bucks are only allowed access to females during these months. The consequence is that the great majority of parturitions occur within a window of about 6 months (October-April) when the grazing can be expected to be at a maximum (Figure 13).

Figure 13. Seasonality of goat births



The low figure for April is probably reflects the fact that the survey was done during April and pregnant ewes had not all given birth. A survey conducted in June would likely produce a smoother curve.

4. Nonetheless, seasonality of oestrus is determined by nutritional constraints; with the use of purchased feeds for most of the year, these constraints are largely eliminated. As a result, it is possible for small ruminants to come into season at almost any month of the year and the overall frequency of births to rise to greater than once a year.

Burning Sheep

4. Usual sheep management strategies involve a relatively low level of feed and sporadic dependence on natural forage and residues. In consequence, sheep usual produce offspring once a year and these are usually single births. However, it is possible to pursue a high cost/high return strategy as well. One individual reported was spending nearly JD40 per year on feeds for his sheep, which were not grazed on pasture at all. The output was nearly twice-yearly lambing and twins or even triplets at most parturitions. One of the consequences of this pattern was the ewes were exhausted after three to four years and either died or had to be sold. This is an extreme case, but individuals occasionally reported high expenditures on feed and it is clear that the pattern of seasonal oestrus is breaking down.

Milking and Milk Production

4. Precise figures for milk yields of sheep and goats in Jordan are not available, although work is in progress to measure these. However, a fair working assumption is that sheep yield 40 kg. and goats 60 kg. over a single lactation. The butterfat content of sheep milk is correspondingly higher, some 6.2% as opposed to 4.0% for goats (Lancaster, 1991). Wattenbach and Ströbel (1991:2) give 47.4 kg for sheep although this was based solely on farmers' estimates. Goats on the other hand can be milked for up to six months, whereas sheep may well only last for three. It is usual to leave at least the first month entirely to the offspring and then begin to milk the dam for human consumption. Weaning takes place at 3 months approximately.

4. Milking is usually carried out twice a day, at dawn and then in the early afternoon. Professional milkers are sometimes used where the herd is extremely large. The animals are tied to a special rope in two lines placed head to head and the milkers move rapidly along the line.

D. Productivity Parameters

4. To obtain basic productivity parameters for sheep and goats, the Mature Breeding Female History Method (MBFH) was used. Sample case histories for some ten animals in a different herds were obtained, using the ages of ewes and does, date of first parturition and most recent parturition. Ewes were selected on the basis of having given birth at least once, but no other criteria were applied. This has enabled the calculation of basic productivity parameters given in Table 40 and Table 42.

Sheep

Table 40, Table 41 show the basic productivity of the sample of sheep recorded in the survey. The data indicate that actual productivity of sheep in the rangelands is much poorer than the estimates used in conventional models. The age at first lambing is especially high.

Table 40. Productivity parameters for sheep	**n=193**
	Value
Mean Age (mths)	53.4
Mean no. offspring	3.4
Mean Age at 1st parturition (mths)	17.5

Table 41. Lambing interval for ewes	**n=169**	
	Months	**SD**
Mean lambing interval	11.7	4.5

Epstein (1985:91) quotes an age at first lambing for Awassi sheep of 15.5 months, while Wattenbach and Ströbel (1991:2) give 'almost 21 months'.

Goats

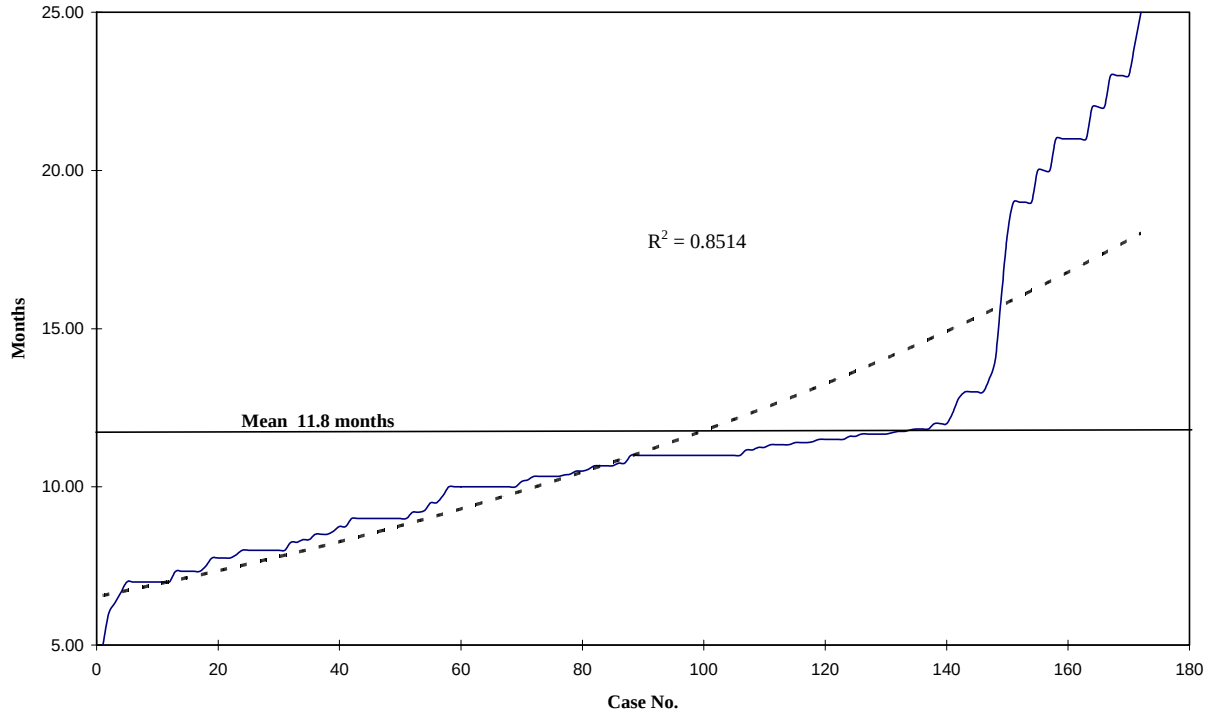
Despite having more multiple births and a lower age of first parturition, goats are not significantly more productive than sheep (Table 42, Table 43).

Table 42. Productivity parameters for goats	n=248 Value
Mean Age (mths)	48.1
Mean no. offspring	3.3
Mean Age at 1st parturition (mths)	14.5

The mean kidding interval is close to a year; Figure 14 shows the distribution of intervals. Some owners reported intervals close to six months, suggesting that they are operating high-feeding strategies. By contrast, in other flocks, two-year intervals were common. Hence the striking spread of intervals.

Table 43. Kidding interval for goats	Months	n=172 SD
Mean kidding interval	11.8	4.26

Figure 14. Kidding interval in Goats



The reason for this is almost certainly the lower overall survival rate of goats. The mean age of does is lower than sheep and almost a significantly higher proportion of kids die before maturity (Table 49).

These figures represent a median between much lower figures that obtain in many tropical pastoral systems and the higher productivity in intensive operations. Even within the herds examined there were considerable variations, almost certainly due to the owners' feeding strategies.

Frequency of Twins and Triplets

Both sheep and goats can drop twins and triplets regularly. In practice, however, twinning is rare among sheep and triplets do not occur in the sample. This seems to reflect the nutritional state of the animals, since much higher productivities can occur with high levels of feeding. Table 44 shows the lambing percentage for sheep; it should be contrasted with Table 46 showing the notably higher figure for goats.

Table 44. Lambing percentage in sheep	1993-95
Parameter	**Value**
Total parturitions	366
Total live births	392
Lambing percentage	107.1

Table 45 and Table 47 contrast the levels of multiple births among sheep and goats.

Table 45. Frequency of twin births among sheep		1993-5
Total parturitions	**Twins**	**%**
366	26	7.1

Goats

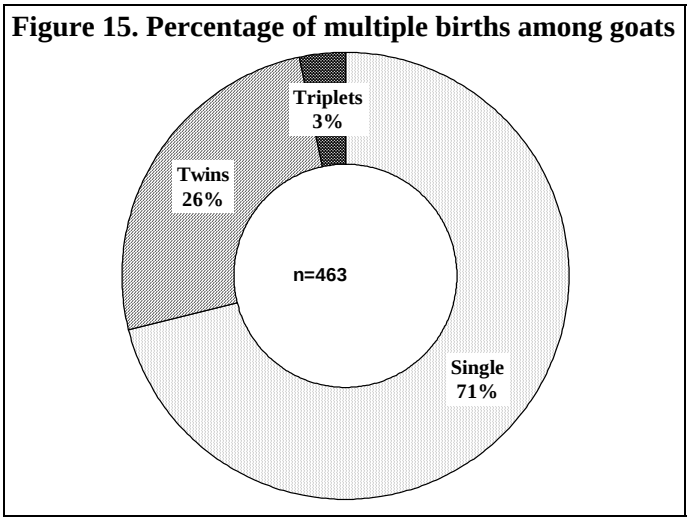
Multiple births are more common among goats and the kidding percentage is correspondingly higher. Table 46 shows the relation between live animals born and parturitions.

Table 46. Kidding percentage in goats	1993-95
Parameter	**Value**
Total parturitions	463
Total live births	612
Kidding percentage	132.2

In contrast to sheep, triplets do occur among goats, although with a relatively low frequency (Table 47).

Table 47. Frequency of multiple births among goats				1993-5
Total parturitions	**Twins**	**%**	**Triplets**	**%**
463	119	25.7	15	3.2

Figure 15. Percentage of multiple births among goats



There was considerable variation between individual herds, with some showing almost no multiple births and others greater than 50%. The factors responsible are unknown, although disease incidence and different feeding practices are clearly factors.

Offtake

There are two ways of approaching offtake levels in sheep and goat flocks. The mean number of animals sold is given in the household record in somewhat general terms. This figure represents all sales, including barren ewes and other unproductive animals. A more precise result is given by the analysis of herd exits through the fate of lambs or kids.

Since the present year's crop of lambs was in the process of being sold as the survey was conducted it was considered more useful to analyse only the fate of the previous year's births. Otherwise a 'transitional' result would result, with animals present over-represented.

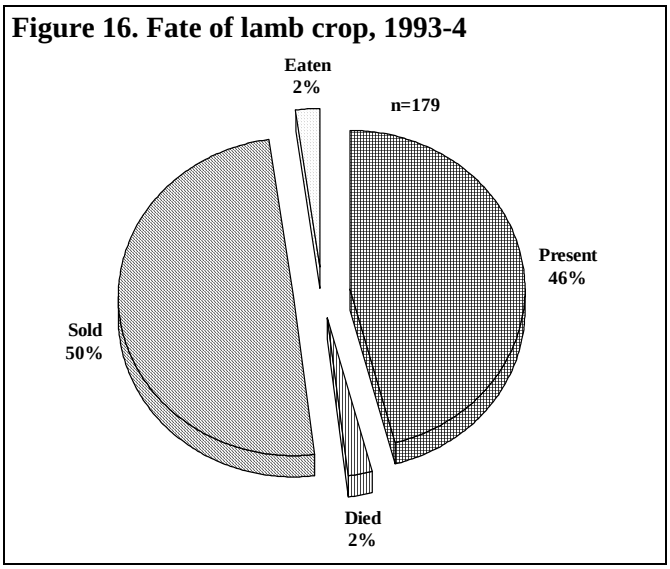
Sheep

The fate of the lamb crop for the previous period of oestrus (1993/4) was analysed to provide an estimate of offtake. The figures are shown in Table 48 and Figure 16.

Table 48. Fate of lamb crop born in 1993/4	n	%	n=179
Present	82	45.8	
Sold	89	49.7	
Died	4	2.2	
Eaten	4	2.2	

Combining the figures for sale and household consumption suggests that just over 50% of any flock is sold. This consists principally of the males, although a small percentage of females are also sold.

Figure 16. Fate of lamb crop, 1993-4



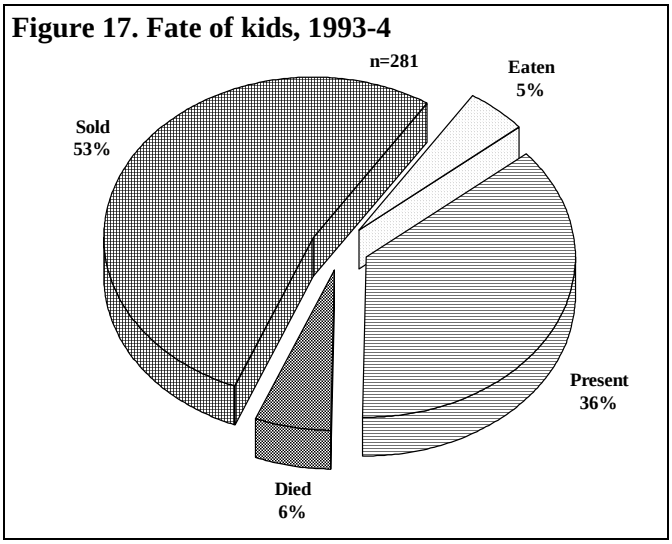
Goats

The reasons for herd exits and the percentage still present were analysed for the kidding season of 1993-4 (Table 49 and Figure 17).

Table 49. Fate of kids born in 1993/4	n=281	
	n	%
Present	102	36.3
Sold	149	53.0
Died	17	6.0
Eaten	13	4.6

Goats have a slightly higher rate of sales than sheep, more are eaten and more also die, despite the reputed hardiness of goats. Indeed the higher percentage of kids eaten may reflect slaughters of near-death animals. Death rates may also reflect the sparser availability of veterinary services in the drier areas, especially the south, where goats are more common.

Figure 17. Fate of kids, 1993-4



Factors affecting productivity

5. The productivity of sheep and goats in the rangelands is relatively poor, compared with the potential from more intensive operations. There are two principal factors contributing to this; disease and nutrition.

Disease

5. Apart from internal parasites, small ruminants in Jordan suffer from bluetongue, PPR (Peste des Petits Ruminants) and foot-and-mouth disease. These are endemic in this region and are not fatal; however, they have a debilitating effect on the mature animals and lead to fewer conceptions and reduced rates of multiple births. As the veterinary service has not recognised this problem until recently, there has been little work and almost no vaccination. Trials are under way through JCO and the Badia Project to explore the incidence of these diseases and the potential for increased production through vaccination.

Nutrition

The switch to a diet of predominantly cereal grains has the effect of reducing both the intake of roughage and trace minerals ruminants would normally gain from natural forage. As this practice of is relatively new, most livestock producers are not informed about the importance both of minerals and of a balanced diet for sheep and goats. There has been no extension effort to increase awareness of these

problems. Producers are not generally aware of the use and importance of mineral blocks and salt licks. Moreover, there is virtually no use of industrial by-products such as tomato waste and olivecake. The same observation was made by Wattenbach & Strobel (1991:5) in their survey of Western Jordan.

The declining consumption of natural forage by ruminants and the practice of keeping them in one place for most of the year has increased markedly the incidence of disease, especially in the high rainfall areas. Most owners observed this, especially in the Jordan Valley, but they were generally unaware of the causes of the problem. Staying in one place is likely to increase the parasitic load on domestic animals. Without an effective veterinary diagnosis the consequence is decreasing productivity, especially in the regions adjacent to the Badia.

Fertility drugs

There is a widespread but clandestine use of fertility drugs to attempt to induce multiple births. The exact incidence of this is unknown, as owners are rarely willing to talk about it. However, some did remark that although the drugs work, they just as often induce abortions. As a result, there is unlikely to be long-term use of these drugs by individual producers. Nonetheless, the unsupervised use of such drugs without knowledge of their long-term effects is a cause for concern.

V. SURVEY (III) - THE ROLE OF WOMEN IN LIVESTOCK PRODUCTION

A. Objectives and Methodology

5.1 Women play an important role in the care and management of livestock throughout the Jordanian rangelands as well as in the processing and distribution of livestock products. Although there have been many surveys of women's role in the agricultural villages, survey data from the Badia region are scarce.

5.2 As a result, a preliminary survey was undertaken to try and establish;

to what extent women regard themselves as having an income separate from that of their household
where women have a separate income, what its level is and what its sources are
what their aspirations are, both in terms of generating more income and in terms of their quality of life

The questionnaire used is given in Annex II.

5.3 The results should be regarded as tentative, because the sample is neither as large nor as geographically complete as the household survey. The focus was Bedu women, especially those living in tents in the Badia, as it was felt that the aspirations of women in settled villages would probably resemble more closely those of non-livestock producers.

5.4 Although female enumerators who could enter the *haram* were used it was immediately apparent that women were much less used to being questioned or to summarising financial data of any sort. As a result, their answers to open-ended questions tended to be more negative. The essential feedback in developing a questionnaire was therefore partly lost. The data should therefore be regarded as indicative. Many of the most useful ideas came from informal conversations with widows, who are more used to dealing with the external world.

5.5 Although the standard nuclear family with one or more wives is the normal pattern in the Badia, other social arrangements also exist. In the general household survey, which sought householders regardless of sex, only nine widows (1.4%) owning livestock were encountered which is probably representative. In this survey, where women livestock owners were specifically sought, more widows were interviewed. In some cases widows live alone with their children, but very often they live with brothers or other relatives. Table 50 summarises the social position of the women interviewed.

Table 50. Position of Women interviewed n=122

Social position	No.	%
Housewife	91	74.6
Second wife	9	7.4
Widowed householder	17	13.9
Unmarried daughter	4	3.4
Divorced	1	0.8

Second wives are, of course also housewives, who thus comprise some 82% of the sample.

B. Women as Livestock Producers

5.6 Women have a right to inherit property such as livestock, in Islamic tradition, although a woman's share is very often merged with that of her brothers in practice. Women can receive animals at marriage

and these are simply placed within the household flocks. Only when a woman is widowed and does not remarry will she become a major producer in her own right.

5.7 Of the 122 women interviewed, some 100 (82%) thought of themselves as owning specific animals. Table 51 shows the mean sheep flock sizes for women animal owners, divided into widows and others to illustrate the striking difference between these two segments of society.

Table 51. Sheep ownership by women		**n=122**
	No.	**%**
Women with no sheep	64	18.0
	n	**Mean sheep-flock size**
Widows	10	49.7
Other categories	48	14.6
All	58	20.7

5.8 A single woman camel-owner was encountered in the Azraq area. Although the she herded her own sheep she had handed over the management of her camels to a hired shepherd.

5.9 This does not mean that widows are in an enviable position. Bereft of many of the social resources upon which men can draw and with a much more restricted range of options for alternative income generation, many of them are desperately poor. The problems of moving to the rangeland have meant that their dependence on subsidised feed is often greater than men. This has resulted in some of them entering a debt trap from which it is increasingly difficult to emerge. Case History 4 gives and example of one such woman.

Women's Self-Perception

5.10 Most of the women interviewed did consider that they had a personal income (102 or 84%). In nearly every example this was made up from individual animals that they themselves owned (100 or 83%). In all cases this was merged with the household herd for management purposes, although the female owner was able to take a notional share of the milk and sell it for her own gain.

C. Women's Contribution to Household Labour

5.11 A notable feature of the gradual conversion of livestock production in the Badia to a commercial enterprise has been an increase in the responsibilities of women. The main forces behind this are;

a. Increased likelihood that the husband will have a paid job
b. Growing numbers of children sent to school and thus unavailable for animal management
c. Older children leaving semi-permanently for tertiary education or jobs in the city

5.12 Women, on the other hand, are more likely to remain with the tent and thus have to shoulder more a of the day-to-day responsibilities of animal management. This is actually most visible in regions where there is ready access to a major road or intensive agricultural operations. The men frequently obtain labouring jobs and the women are left to herd the flocks.

5.13 Women take part in almost all the major household tasks except driving vehicles which is almost always a men's task. Indeed this relative flexibility over allocation of labour is characteristic of pastoral societies world-wide in comparison with settled communities.

Case History 4. The Widow Maryud D.

Maryud D. is a widow living in a scattered settlement south of Amman on the western edge of the Badia. At the time of her marriage, much of this region was rangeland and the family was able to subsist on a herd of some fifty goats. As time went on, the surrounding rangeland was gradually given over to extensive and then intensive agriculture. Gradually, it became impossible to feed the goats on natural vegetation. For a time, they attempted to keep the goats fed by taking them on a hired truck to the eastern Badia. However, the costs of this, plus the fact that they did not own a water-tank and the existing rights of much larger herd-owners made this uneconomic. During the same time, the market for goat-hair has almost disappeared and the price of goats' milk has fallen. As a result, they began to feed the herd on purchased feeds.

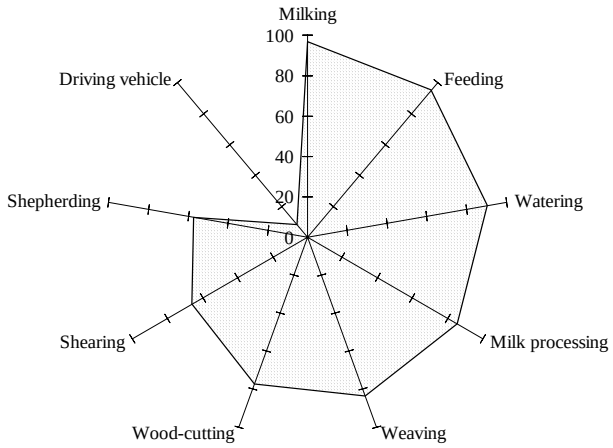
Two years ago, her husband died and she was left to bring up her daughter on her own. The income from the herd no longer covers the cost of feeds so she has been selling her gold marriage ornaments to buy feed for the animals. Her reserve of gold is now finished and she is hoping that the price of feeds will fall next year. In fact, however, the subsidy on feeds is being progressively withdrawn and Maryud D. is likely to become further indebted and her herd eventually sold, leaving her with no source of income.

Table 52 and Figure 18 show the relative number of women who take part in different household task within the Badia environment.

Table 52. Women's contribution to pastoral household labour n=122

	No.	%
Milking	118	96.7
Milk processing	104	85.3
Shearing	81	66.4
Watering	111	90.0
Feeding	116	95.1
Wood-cutting	94	77.1
Shepherding	70	57.4
Driving vehicle	10	8.2
Weaving	102	83.6

Figure 18. Women's contribution to labour in pastoral households



D. Women's Aspirations

5.14 A major objective of this survey was the attempt to discover women's aspirations both for themselves and their children. However, this proved in many ways a problematic question since many Bedu women do not clearly separate the well-being of the household from their own situation. Put crudely, as long as the flock is flourishing their personal wealth is immaterial. Thus it was common for women either to have no answer to the open-ended questions or simply to suggest that their life would be improved by an even larger flock.

5.15 In many ways, the opinions about the potential for improving incomes or the quality of life are opinions of a minority. Many women pointed out that typical improvements such as schools, roads and clinics, while they were in principle interested, the mobile lifestyle made it difficult to see how they could benefit more than marginally.

Marketing and Business Skills

5.8 Encounters with individual women suggested that where women acquired trading skills, they were able to exercise them to generate an independent income. Most women, however, felt that they knew very little about dealing with traders and suppliers, which discouraged them from entering this arena.

5.9 Weaving of sheepswool blankets and covers is still quite widely practised throughout the Badia region. These products are rarely sold and women produce only enough for the use of the household. However, especially with the expansion of the tourist trade, the market for such crafts will potentially expand. It would be unfortunate if the practice of importing such crafts from Syria eliminated this potential source of income to Bedu women.

Credit

5.8 Very few of the women interviewed felt they had any access to credit at all. It is usually possible to borrow money from relatives or friends for very short periods or at extortionate rates. This system, however, is not a practical way to build up a system of income generation. Table 53 shows the numbers and percentages of women who stated they had access to different types of credit.

Table 53. Women's access to credit		n=122
	No.	%
All	19	15.6
Government/official	8	6.6
Co-ops/NGOs	4	3.3
Informal	17	13.9

These low percentages indicate the difficulties women find in building up any independent business.

5.18 Most women saw buying sheep and goats through a credit system as the most practical way to increase their income. Since the household already has a herd, increasing the number of animals means that many inputs such as vehicles are already taken in place.

Literacy

5.19 Literacy was at very low levels among women throughout the Badia area. Many women had either not attended school or had only had one or two interrupted years. Many of them, especially younger women, felt disadvantaged by this, especially as Jordan is generally a highly literate society where printed media is used to disseminate information. Women also felt that that if they themselves were literate they could pass on skills to their children, even in the absence of formal schooling.

5.20 With such a highly mobile society, bringing schooling to the remoter reaches of the Badia presents problems, both of recruiting teachers and of fixing locales for classrooms. Nonetheless, such problems have been solved in other countries and there is apparently a strong desire for assistance.

VI. POLICY IMPLICATIONS

A. General

6.1 One of the principal conclusions of the survey is that by and large livestock producers do not feel responsible for the condition of the rangeland. Moreover, their dependence on it as a feed supply is limited; they have thus little or no economic motivation to conserve it. Therefore to conserve the Jordanian rangelands, the strategy of a project should be to make good the economic loss to livestock producers represented by the withdrawal of this resource. This is similar in principle to 'set-aside' for farmland in Europe.

6.2 The absence of responsibility among producers is mirrored by the lack of trained and qualified researchers and administrators with a mandate for the rangeland areas. The small numbers of personnel in the Ministry, in parastatals such as the Badia Project and in the Universities suggests that policies to conserve rangeland areas are rarely likely to get a fair hearing in contrast to policies directed towards all forms of intensive agriculture.

6.3 Until a critical mass of concerned staff can be created it is problematic to see how the administration of any project can be effective over such a large area with additional logistical difficulties.

Producers' Views

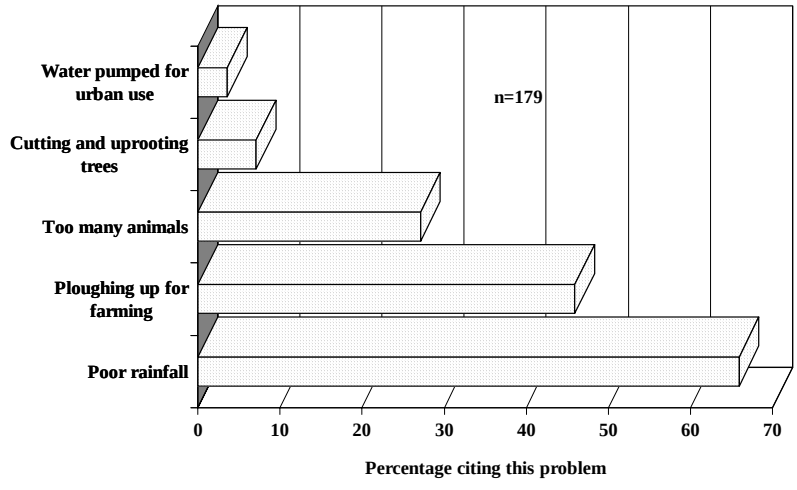
6.4 No project to manage the rangelands effectively can succeed without the participation of the users. To this end, the opinions of community leaders were sampled as part of the community questionnaire. This consisted of a series of open-ended questions relating to economic changes, problems observed within the rangeland and potential solutions (See questionnaires in Annex II).

6.5 By definition, open-ended questions lead to a scatter of answers an general discussion, not all of which is germane to the issue at hand. For example, general complaints about the recession and the cost of living featured prominently in the answers, although this cannot be addressed within the context of a rangelands project. The answers were thus coded and the elements that cast light on producers' attitudes are analysed in this section.

Rangeland degradation: who is responsible?

6.6 One of the most striking responses was the uniformity with which community leaders attributed rangeland degradation to low rainfall. Most (66%) respondents considered the rainfall to be responsible for the state of the range. Many fewer (27%) attributed the problem to a surplus of animals. A significant number (46%), especially in the steppe and western Badia, considered that ploughing up the land for irrigated agriculture was a major source of degradation. In a sense, this a less a problem of degradation and more one of change of use. Figure 19 shows the percentage responses concerning the problems of the rangeland.

Figure 19. Perceived problems of the rangelands



6.7 One problem may be that livestock producers are probably used to inferring the rainfall from the state of the range. Since they do not measure it, they gauge it from the plant cover. As the plant cover declines, so do they estimate the decreasing rainfall.

6.8 Few respondents mention the cutting and uprooting of woody vegetation but this unfortunately does not mean that it is not a real problem. Since those being questioned are also mainly responsible for this practice they are unlikely to accuse themselves. The pumping of water for urban use is a very real concern in limited areas, notably Azraq oasis and the Wadi Mujib.

6.9 The principal conclusion that can be drawn from is that only a small proportion of livestock producers accept responsibility for the state of the rangelands. Most attribute it to external forces which they are unable to control. Until producers demonstrate a clear awareness of their own role in bringing about the present situation it will be difficult to involve them in the management of rangeland through selective destocking.

Management and Authority Structures

6.10 Bedu society has always been noted for its ideology of equality, both in terms of equal access to leaders and in the system of justice. Lancaster (1981) noted that the power of the sheikhs is always mediated through the consent of the tribe. While tribal groups were bound together by a common ideology this system could function effectively.

6.11 However, once pastoralists began to function within the framework of the modern state they were subject to the demands of conflicting authority structures. The combination of the changing state and the growth of economic individualism has had the effect of breaking down allegiances within tribal groups. During interviews with individual householders, many spoke against the authority of the traditional leaders.

6.12 Following this, pastoralists with grievances tend to look to 'government' for assistance or redress. Table 54 shows a summary of the bodies that community leaders had dealt with in matters relating to rangeland. It should not be assumed that the result of their dealings was positive.

Table 54. Existing Authorities community leaders deal with	No.	%	n=85
Governor	43	50.6	
M.P.	14	16.5	
Ministry of Agriculture	72	84.7	
Tribal leaders	31	36.5	

Figure 20. Existing Authorities community leaders deal with

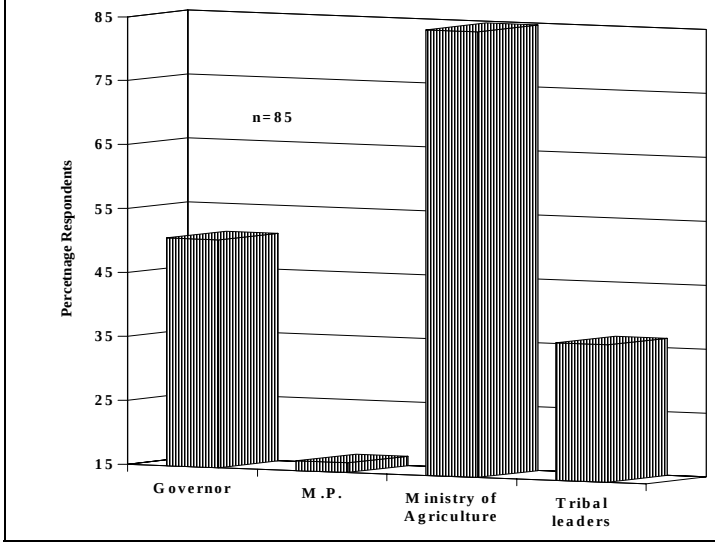


Table 55. Authorities community leaders would work with	No.	%	n=85
Co-operatives	28	32.9	
Tribal Associations	16	18.8	
Ministry of Agriculture	75	88.2	
Others	11	12.9	

Asking a speculative question such 'who would you work with?' invites an answer influenced by the interviewee's perception of the interviewer. It proved nearly impossible to disentangle the fact that teams were from the Ministry of Agriculture with a positive response. Presumably, if the interviewing team had been from a Co-operative organisation or an NGO, this would have elicited a substantially more positive response.

Perhaps more interesting is the negative responses; very few interviewees put much faith in tribal associations. This is probably a good indicator of the breakdown of traditional authority. Table 55 shows the institutions that community leaders claimed they could work with in the event of a project to improve rangeland.

C. A Conservation Ethos

6. It is important to recognise that it is *not* in the immediate economic interest of individual producers to conserve the rangeland. Indeed most of them see it as the task of government to help them exploit it still further. Despite this, the benefits of rangeland conservation remain in the larger national interest and probably the long-term interests of producers.

6. Individual studies have shown that protection of rangeland areas increases biomass, increases biotic diversity of both fauna and flora and increases the moisture-holding capacity of the soil (Hatough, Eisawi and Disi, 1986). The development of reserved areas and use such as As-Shaumari at Azraq, the Dana reserve suggests there is local pressure for conservation and that this can be seen as beneficial.

6. Whether a rangeland is 'overgrazed' will inevitably remain controversial, as the long-term climatic cycles make it difficult to establish the 'natural' condition of the range. Also the virtual disappearance of the species of wild ruminants that grazed in substantial numbers until the turn of the century mean that the present system of intense pressure form small ruminants cannot be considered to replace 'natural grazing'.

6. However, there is little doubt that such heavy pressure from just two species, aided by mobility through the use of water-trucks and lorries represents a poor management strategy. Biomass is never allowed to development, plants may never reach the phase of setting seed and habitats for small fauna are virtually eliminated. Studies at Dana have shown that with dissected terrain, larger mammals can also survive.

6. Where wild fauna actually become predators on the flocks, the two world-views come directly into conflict. As in Dana, a number of sheep producers reported predation by wolves on their flocks in the northern *hammada* desert. Losses were not great, perhaps 10 sheep from a herd of one thousand. Nonetheless, as far as the owners were concerned, these were losses, and their solution was to shoot the wolves. The Asiatic wolf is now extremely rare throughout all of the Middle East and in national terms may be considered a priority for conservation.

6. Resolving the conflict between these opposing attitudes is similar to issues of conservation of biodiversity against maximum use by ruminants. As far as the Bedu are concerned the diversity of species and even the development of biomass is simply an irrelevancy in the business of producing sheep. Yet there must sometime be larger national priorities and wider concerns may sometimes displace local needs.

D. Recommendations

6. Recommendations from the survey fall into two categories, immediate and long-term. Immediate recommendations can be summarised as follows;

Immediate

- Action should be taken to prevent the uprooting of woody vegetation for firewood. This is best done through a combination of public awareness and facilitation of gas supplies in remote areas
- A strategy should be adopted to encourage the bringing to market of more mature animals, especially sheep, thereby reducing the need for large flocks. One possible strategy is a subsidy on animals over a certain weight
- The use of feed supplements, mineral blocks and industrial by-products by herd-owners should be encouraged, since the poor nutrition of animals fed only on cereals is an important reason for herders whose animals subsist largely on feeds to continue to use the rangeland in certain periods
- The use of fertility drugs without strict veterinary supervision should be discouraged
- Veterinary services should be monitored and improved, especially in regions close to the western edge of the Badia. Particular attention should be given to vaccination against bluetongue, PPR and foot-and-mouth. Poor health of stationary animals is another reason for encouraging migration.
- A public awareness campaign should be mounted, focusing on the following issues;
    - The rainfall situation and the consequent responsibility of producers for the situation of the rangelands
    - The dangers of plastic waste
- A complete illustrated reference list of local and scientific names of all the useful plants of the Badia should be prepared and circulated to all extension staff in this region. Without such a

tool it is difficult to see how discussions about rangeland management can proceed at a more than superficial level.

- A preliminary survey of the faunal resources of the rangeland area should be commissioned to help understand the conservation issues more clearly

Long Term

The long-term objective any rangeland rehabilitation project must be the assignation of demarcated regions of the rangeland to social groups for management. The traditions and culture of the users argue that individual ownership would be strongly resisted. Since it is not practical or economic to fence such large areas, prevention of incursions must be in the hands of the community of users.

Communities of users will only make the effort to police a large open area of this type if;

a) the economic benefit of using it is substantially greater than at present
b) they have effective support from the local regulatory authorities (police, forest rangers) etc. to act against intrusive herds or even their own members overusing the resource

Priority should be given to rangelands within reasonable access of farming communities. There are two reasons for this;

a) the community is stable and the members remain in touch with one another
b) the associated rangelands are close enough to the village to be policed by its residents

The following stages have to be gone through;

- Communities of users who are prepared to co-operate with a rangeland project must be identified. Ideally these should be settled groups with a strong livestock orientation and a proven record of community co-operation on other issues
- Rangeland areas with a tradition of association with a particular community ('facing areas') need to be identified, demarcated and gazetted
- The community needs to form or adapt an existing association to manage the rangeland
- The community association in collaboration with the livestock and range departments must establish a grazing capacity for their range and assign usage quotas to their members
- The community must develop a system of levies on members to pay the cost of policing the area
- The community association must develop in collaboration with the police and range department a procedure for dealing effectively with defaulting herds or producers.

VII. IMPLICATIONS FOR PROJECT DESIGN

A. Information Systems

7.1 The multiplicity of researchers producing data on some aspect of livestock production in the Jordanian rangelands, especially in the As-Safawi region, has been noted above. The absence of any central reporting system or indeed committee to oversee research has meant that results and reports may be duplicated. Since there is no system of circulating such documents, their existence is often unknown to new researchers coming into the field. Apart from the waste of resources this represents, there is a severe risk of alienating the Bedu themselves, whose hospitality is somewhat strained by numerous visitors but who see no resultant change in their situation.

7.2 In addition, since there is no central monitoring, data is often entered into databases in incompatible formats, with codes assigned by the researcher and not attached to the data. The result is that the opportunity to compare results and create integrated databases useful for monitoring and impact assessment studies is very limited. Extension workers and researchers wishing to consult existing sources must seek out scarce hard copies. Moreover, printed or duplicated sources are usually wither in English or Arabic, creating difficulties of translation and comparability. A database could have all the results in a single format, with a dual language interface, making all the data available to all parties.

7.3 Apart from linking comparable data, it is also necessary to integrate data from different fields. For example, socio-economic data is usually compared with other socio-economic data. However, data on rainfall, soils, vegetation, exchange rates, market prices etc. are continually being collected and updated. Such data should also be entered into the same database, allowing for more sophisticated correlations.

7.4 A project should have as a necessary precondition the establishment of a standard data entry interface with standard codes. The relevant software should be available to all bodies working rangelands and all research and monitoring data could be available in a standard format.

Public Awareness

7.5 In the field of public awareness, the MoA is conspicuous only by its absence. The present focus on high-intensity agriculture and on sites close to Amman has meant that not only are initiatives related to rangeland ineffective but there is an absence of communication about goals and initiatives in this area. This has the effect of sowing distrust between officialdom and the pastoralists themselves. Yet conservation and development in the Badia can only occur when a relationship of trust is established.

7.6 There is a broader issue, which is communication with the media and general public. The Jordanian rangelands and such special sites as the Azraq oasis are part of the national heritage. Only greater public awareness can lead to changes on the issue of plastic waste or the pumping out of key water resources. As tourism expands, only links outside purely agriculture will permit the development of responsible tourism.

7.7 At present, there appears to be little awareness of these issues and certainly no action. However, other projects, notably the Badia Research Project and the Dana Project, have been considerably more energetic both in promoting their work in the media and in contacting individual producers affected by their operations to evolve collaborative structures. Again, a precondition of any project should be the development of a common approach in this area.

Project phasing

7.8 The opinion survey of pastoral communities demonstrated clearly there is presently a lack of awareness of the issues and certainly no commonly agreed solutions. Combined with an absence of effective institutional infrastructure, this implies a long initial phase of capacity building. This applies both to socio-economic monitoring and to rangeland survey.

7.9 Assuming that a resource assessment mission is able to provide baseline data for the overall ecological status of the rangelands, then the main activities of Phase I of a project should consist of;

- the selection and training of personnel in both survey techniques and the entering and manipulation of data in computer databases
- the selection and evaluation of both sample households and rangeland sites for long-term monitoring
- the establishment of public fora where livestock producers and planners can meet and discuss issues relating to range where the agreements reached are publicly disseminated
- the creation of a public awareness unit to bring the conservation and management issues to a broader audience and to tackle the issues of responsibility. This should particularly responsible with issues such as plastic waste and uprooting of perennials
- establishment of an appropriate policy environment that both encompasses the views of all bodies with interests in the rangelands and harmonies the policy with other areas, notably agriculture

7.10 A second phase should only be embarked upon when set targets relating to a-e) are in place.

References

Agricultural Policy Department. 1993. *The Agricultural Policy Charter.* Ministry of Agriculture, Amman.

Barham, N. & Mensching, H. 1988. Pressure on the pastureland environment in Jordan. *Applied Geography and Development,* 31:37-53.

Boulos, L, Lanham, J. & Jallad, W. 1977. Studies on the flora of Jordan. 7. On the desert flora of the area of H-4 and H-5 Pumping Stations, N.E. Jordan. *Candollea,* 32,2:256-268.

Boulos, L. 1977. Studies on the flora of Jordan. 5. On the flora of the El-Jafr-Bayir Desert. *Candollea,* 32,1:99-110.

Chatty, D. 1986. *From camel to truck: The Bedouin in the Modern World.* Vantage Press, New York.

Chatty, Dawn. 1990. The currentsituation of the Bedouin in Syria, Jordan and Saudi Arabia and their prospects for the future. In Salzman, Carl and John G. Galaty. 1990. *Nomads in a changing world.* 123-138. Naples: Istituto Universitario Orientale.

Chilcott, B.J. et al. 1995. *Dana Nature Reserve Baseline Wildlife surveys: Carnivora: Canidae, Hyaenidae and Felidae.* RSCN, Amman.

Draz, O. 1979. *Range Land development and stabilization of nomadic sheep husbandry in Hashemite Kingdom of Jordan.* Report to Ministry of Agriculture, Amman, Jordan.

Eisawi, D. & Takruri, R. 1989. A checklist of wild edible plants in Jordan. *Arab Gulf Journal of Scientific Research. Agricultural and biological Sciences.* B7,1:79-102.

Eisawi, D. 1985. Vegetation in Jordan. Pp. 45-57 in *Studies on the History and Archaeology of Jordan, II.* ed. Adnan Hadidi. Amman, Jordan.

Epstein, H. 1985. *The Awassi Sheep with special reference to the improved dairy type.* Animal Production and Health Paper, 57. FAO, Rome.

Hatough, A.M.A., Eisawi, D.M.H. & Disi, A.M. 1986. The effect of conservation on wildlife in Jordan. *Environmental Conservation,* 13, 4:331-335.

Hatough-Bouran, A.M. & Eisawi, D. 1990. Rodent Ecology in the Shaumari Wildlife Reserve of Jordan. *Dirasat,* B, 17, 3:62-85.

ICARDA 1993.*Pasture, forage and livestock program. Annual Report, 1993.* ICARDA, Aleppo.

Jordan Badia Research and Development Programme. *Summary of Demographic and Socio-economic survey.* ms, Safawi Centre.

Juneidi, M.J. & Abu-Zanat, M. 1993. *Jordan Agricultural Sector Review: Low Rainfall Zone*. USAID, Amman.

Lancaster, W. & Lancaster, F. 1990. Desert devices: the pastoral system of the Rwala Bedu. In Galaty, John G. and Douglas L. Johnson, eds. 1990. *The world of pastoralism: Herding systems in comparative perspective.* 177-194. New York: Guilford Press and London: Belhaven Press.

Lancaster, W. & Lancaster, F. 1991. Limitations on sheep and goat herding in the Eastern Badia of Jordan: and ethno-archaeological enquiry. *Levant,* XXIII:125-138.

Lancaster, W. & Lancaster, F. 1993. Sécheresse et stratégies de reconversion économique chez le bédouins de Jordanie. in Bocco, R. Jaubert, R. and Metral, F. eds. *Steppes d'Arabies, Etats, pasteurs, agriculteurs et commerþants: le devenir des zones sèches.* Cahiers de l'IUED. Geneva.

Lancaster, W. 1981. *The Rwala Bedouin today.* Cambridge University Press.

Lewis, N. 1987. *Nomads and settlers in Syria and Jordan, 1800-1980.* Cambridge University Press.

Leybourne, M. 1993. *Links between the Steppe and Cultivated areas through migration: the socio-economic organization of production of the semi-nomadic agro-pastoral society of the Syrian steppe.* Diplôme de Recherche, L'Institut Universitaire d'Etudes du Developpement.

Long, R.E. 1957. *Bioclimates of Eastern Jordan.* FAO, Rome.

Marx, Emmanuel 1978. The ecology and politics of nomadic pastoralists in the Middle East. In Weissleder, Wolfgang. *The nomadic alternative.* The Hague: Mouton.

Masri, A. 1991. *The tradition of Hema as a land tenure institution in arid land management, the Syrian Arab Republic.* FAO, Rome.

Mountfort, G.R. 1965. *Portrait of a desert*. Collins, London.

Musil, A. 1928. *Manners and customs of the Rwala Bedouin.* American Geographical Society, New York.

Nabulsi, H., Harb, M. & Ababneh, M. 1993. *Jordan Agricultural Sector Review: Integrated Livestock.* USAID, Amman.

Nesheiwat, K.S. & Mohammed, J. 1987. *A study about socio-economic and farming systems in Ma'in pilot area*. Report to Forestry Department, Ministry of Agriculture, Jordan.

Nesheiwat, K.S. 1991. *Socio-economic aspects of the traditional Hema system of arid land management in Jordan*. FAO, Rome.

Nesheiwat, K.S. 1994. *Rangeland Rehabilitation and establishment of a wildlife reserve in the Syrian steppe: Socio-economic component*. Department of Steppe, Ministry of Agriculture, Syrian Arab Republic & FAO, Rome.

Omar, S.A.S. 1991. Dynamics of range plants following 10 years of protection in arid rangelands of Kuwait. *Journal of Arid Enviromments*, 21:99-111.

Park, P. 1955. *Technical report on Range improvement, development and management for the Hashemite Kingdom of Jordan*. Report to Ministry of Agriculture, Amman, Jordan.

Shehadeh, N. 1985. The climate of Jordan in the past and present. Pp. 25-37 in *Studies on the History and Archaeology of Jordan, II.* ed. Adnan Hadidi. Amman, Jordan.

Swenne, A. 1992. *Feeding/herding behaviour and feeding/herding opportunities of sheep and goats in the Shaubak area.* GTZ report, Veterinary Epidemiology Project, Ministry of Agriculture, Amman.

Treacher, T. 1992. *Is the Syrian steppe becoming and open-air feed-lot?* Seminar paper given at ICARDA, Aleppo, February 18, 1992. [Reference in Leybourne, 1993. See also Treacher, 1993.]

Treacher, T. 1993. Gestion des systèmes d'élevage en Syrie: complémentarités entre la steppe et les zones cultivées. in Bocco, R. Jaubert, R. and Metral, F. eds. *Steppes d'Arabies, Etats, pasteurs, agriculteurs et commerþants: le devenir des zones sèches.* Cahiers de l'IUED. Geneva.

Tuttle, V.F. 1971. *Range management programme for Jordan*. Report to Ministry of Agriculture, Amman, Jordan.

Wattenbach, H. & Ströbel, H. 1991. *Case Studies on the Economics of Small Ruminant Production Systems in Jordan.* Report by Triesdorf Consult to GTZ.