Al Badia Community Survey in Syria
Descriptive Statistics

C. Dutilly-Diane, F. Ghassali, N. Batikha, G. Arab, E. Khoudary, C. Saint-Macary, J.A. Tiedeman, and M. Louhaichi

ICARDA

International Center for Agricultural Research in the Dry Areas

Al Badia Community Survey in Syria

Descriptive Statistics

C. Dutilly-Diane[12], F. Ghassali[2], N. Batikha[2], G. Arab[2], E. Khoudary[2], C. Saint-Macary[3], J.A. Tiedeman[2] and M. Louhaichi[4]

1. Centre de coopération Internationale pour la Recherche Agronomique et le Développement (CIRAD), UR 'Livestock Systems', Montpellier, France.
2. International Center for Agricultural Research in the Dry Areas (ICARDA), Aleppo, Syria.
3. University of Hohenheim, Institute of Agricultural Economics and Social Sciences in the Tropics and Subtropics, Stuttgart, Germany.
4. Oregon State University, Department of Rangeland Ecology & Management, Corvallis, USA.

August 2006

Acknowledgments

The survey was executed by ICARDA, in cooperation with the Syrian Ministry of Agriculture and Agrarian Reform, the Steppe Directorate, and the Badiah Rangeland Development Project, with support from the French Ministry of Foreign Affairs.

We would like to thank H.E. Dr Adel Safar, Minister of Agriculture and Agrarian Reform, Mr Imad Kazah, Director of the Badia Project; Mr Ali Hamoud and Mr Tamer Hamid, the current and previous Heads of the Steppe Directorate; Dr Ahmed El Ahmed, Assistant Director General (Government Liaison) at ICARDA; and Mr Nabil Trabulsi, Assistant National Research Coordinator, for their precious support.

Our great appreciation also goes to our colleagues: Mr Walid Hazini, Mr Mouhsen Nahas, Mr Joul Dayob, Mr Faysal Hnedi, Mr Khaled Yousef, Mr Mouhamed Ramadan and M. Fadi Dayob from the Steppe Directorate; and Mr Assad Murad, Mr Abdul Hasseb Ajami, Mr Sabri Alberini, Mr Housam Jarad, and Mrs Laila Abou Zer from the Badia Project, for their participation in data collection.

Finally, we thank Mr Feras Saeed for his contribution as a Masters student and our colleagues at ICARDA – Ms Rima El-Khatib for her invaluable assistance in typesetting and formatting this document and Mr Ali Rajab for his great help in the field.

Contents

I. INTRODUCTION

1.1. Objective of the survey

Strategies for rangeland development must be based on a clear understanding of rangeland processes and ecosystem functioning. The Syrian steppe or Badia, is a complex system where human, animal, soil and plant factors interact with each other. In the last few decades there have been several successes in Badia improvement programs – establishment of government reserves, a ban on cultivation in the steppe, and the establishment of regional and international projects. But the Badia still suffers from mismanagement and overgrazing, which is leading to more degradation.

Surveys are an important tool for rangeland management and development. Previous surveys have contributed significantly to our knowledge of the range environment, but they have not been used as much as they could have been. Data collection methods were not consistent over time; and sampling designs did not easily allow aggregation of data at the national level for assessing rangelands, pastoral production systems, and Bedouin livelihood conditions.

ICARDA, in collaboration with the Steppe Directorate of Syria and the Badia Rehabilitation Project, undertook a comprehensive survey of the Badia in 2005-06. The aim was to integrate production and socio-economic factors, to improve the capacity of stakeholders to develop technical and institutional interventions, and to enhance the sustainability of Bedouin's livelihoods. The specific objectives were:

- To characterize Bedouin communities and the dry rangelands by understanding local institutional arrangements and how they influence range management
- To be able to determine the relationships between rangeland degradation and current management practices
- To determine why some communities have more difficulty in managing rangelands
- To investigate mechanisms for improving management
- To characterize the pastoral strategies of Bedouin communities in the steppe
- To be able to select representative communities and rangeland areas for future studies to assess alternative methods of grazing management.

This report presents descriptive statistics derived from the survey data. It simply describes the situation in the Badia in spring 2005. Further ecological and economical analyses and conclusions will be reported in another document.

The report is organized as follows: a brief overview of the Badia is followed by Chapter 2, describing the survey methodology. Subsequent chapters present results from the rangeland, community and household surveys. Some issues cut across chapters, and information may be repeated (e.g., mobility and livestock production systems are discussed at both community and individual levels). However, at this stage we decided to retain this structure in order to clearly associate results with their respective sources of information.

1.2. The Syrian steppe

Syrian rangelands cover approximately 10.5 million hectares and share the characteristics of steppes in the northern parts of the Arabian peninsula. These rangelands, known as the Badia, are located in settlement zone 5, with annual average rainfall below 200 mm. The Badia suffers from harsh ecological conditions as well as over-exploitation and unsustainable, poorly planned utilization of resources.

Between 900,000 and 1.5 million people in Syria benefit from the rangeland, of which about 500,000 are settled in the Badia (Edwards-Jones, 2002). Until the 1950s, Bedouin practiced the traditional *Hema* system that protected rangelands from degradation (Masri, 1991). The population consisted of nomadic herders (without a permanent home, always on the move) and semi-sedentary herders, i.e. people with a permanent

home, who move with their sheep during part of the year (Métral, 2006). Bedouin moved over large areas, including parts of neighboring countries, ensuring that grazing areas were periodically "rested". In addition, all tribes observed the *Orf* or traditional oral law governing utilization rights to grazing and water. Following political events within the region, Bedouin mobility was gradually limited to Syrian territory. Rapid increase in human and sheep populations, expansion of barley cultivation, and the introduction of vehicles in the rangeland after the 1950s increased the pressure on rangelands – higher stocking rates, longer grazing periods at each site – and initiated rapid degradation. Later, the Badia was declared state property, with open access to grazing resources. This further affected tribal relationships and their ability to manage their land. In 1995, crop cultivation in the Badia was banned. Pastoral populations have adapted to these changes in various ways. Livelihood systems now rely heavily on purchased feed, rented grazing, and subsidized fuel. Off-farm income is also being increasingly used to make up income shortfalls (Findlay, 1996).

Bedouin society is organized in a hierarchical structure: federation of tribes, tribes (there are 31 tribes in the Badia as reported in Lewis, 1987), *Fakhed*, and extended families. Most households in a community are linked by blood, and belong to the same tribe. However, some communities today contain several groups. Rangelands were the major source of feed for livestock; and access to grazing resources depended on tribal membership and tribal networks. Today, Bedouin tribal institutions still play an important role in defining access and use rules for local resources, and negotiating access rights to other tribal pastures (El-Masri, 1991 and Metral, 2000).

More formally, Bedouins are also organized in cooperatives. Cooperative membership is not synonymous with community membership (households from the same community may belong to different cooperatives), but it is strongly linked to tribe. Originally these cooperatives were responsibile for managing specific parcels of land. Their main role was to provide financial assistance and supplemental feed to livestock owners, with a limited role in land management (Mirreh and Razzouk, 1997). Communities are finally grouped into 'mother communities' for administrative and census purposes. In some cases, only the Steppe Directorate – not even the communities themselves – knows which communities comprise which 'mother community'.

In summary, there is much confusion about rights of access to rangeland. Different groups graze on the same communal areas, without considering the carrying capacity of the system and without proper regulation to maintain the quality and quantity of vegetation. For rangelands to be sustainable and productive contributors to food security and economic well-being, proper grazing management system is required, with clear rights of use. Open and uncontrolled access will lead to severe rangeland degradation, to the level where renewable capacity is completely lost (FAO, 2006).

1.3. Climate

Rainfall in the Syrian steppe is generally low and highly variable. Long-term mean annual rainfall is below 200 mm. Rainfall is below average in most years, and extended dry periods are common. For agricultural planning/administrative purposes, Syria is divided into five agro-ecological zones on the basis of annual precipitation or isohyets (Table 1). Areas with precipitation below 200 mm are considered as steppe. This theoretical "200 mm line" was defined at the beginning of the 1940s, and corresponds to the "desert line".

Table 1. Agricultural zones as defined by the Ministry of Agriculture and Agrarian Reform, Syria.

Agricultural zone	Mean annual rainfall
1 a	> 600 mm
1 b	350-600 mm with precipitation higher than 300 mm 2 years out of 3
2	350-600 mm with precipitation higher than 300 mm 2 years out of 3
3	250-350 mm with precipitation higher than 250 mm 2 years out of 3
4	200-250 mm
5	< 200 mm

Source: Statistical Abstract 1994, Central Bureau of Statistics, 1995, Damascus.

Historical weather data indicate that out of 10 years, one will be wet, three average, five rather dry, and one very dry. The rainy season is usually October to April; and particularly the early rains are an important determining factor in rangeland production. Summer is long, dry and hot. However, some heavy storms may occur during July-August, in the northern and north-eastern parts of the project area (Raqqa, Deir-Ezzor, and Hassakeh).

Drylands in Syria are mostly classified as semi-arid, with 100-200 mm annual rainfall, and used mainly for grazing. There is considerable variation within these drylands in terms of vegetation cover and consequently in intensity of land use. These differences are due mainly to rainfall (Fig. 1) but also soil type, geology, and topography.

Summer temperatures are high. The maximum temperature is over 39ºC on average, but may exceed 45ºC in July and August. The effects are aggravated by hot dry winds ("sirocco") which may occur during the growing season. Winters are rather cold – average 2.4ºC in Tadmur and 1.3ºC in Al Karyiateen, but temperatures can fall below –10ºC. Frost may occur on 15-20 days in December and January. Table 2 shows long-term precipitation and temperature data for some sites located in the Badia.

Table 2. Long-term average precipitation and temperature in Al Badia steppe.

Station	Average	Maximum	Minimum	Period (years)
Tadmur	129	259	31	20
Tadmur 2: T4	138	263	44	17
Al Karyiateen	129	196	60	20
Fouroglos	150	350	41	24
Adhame	224	306	195	5
Maragha	196	267	137	5
Dalbouh	118	276	143	5
Ain Zarga	181	265	144	5
As Sebkha	168	195	118	5
Mansoura	173	221	117	5
Wadi Al Azib	185	–	–	5
Shaddadeh	225	361	121	22
Deir-Ezzor	148	289	47	15

1.4. Landscape characteristics and vegetation types

In addition to climate, soils, topography and aspect influence rangeland productivity and species composition. Various soil factors affect biomass production: effective rooting depth, water-holding capacity, texture, organic matter content, fertility, and parent material. Figs. 2 and 3 show slope and hillshade, respectively, in different regions of Syria. The slope map is a measure of change in surface value over distance. Hillshade is derived from the topography thematic layer and can be used to determine the duration and intensity of sunshine at a given location. These factors, in combination, determine the biomass production potential of the soil. In general, deep, fine-textured soils have higher productivity potential than shallow, coarse-textured soils.

Vegetative cover depends on the amount, intensity, and spatial distribution of rainfall. The steppe has poor vegetation cover which consists of low-growing plants. The most common are *Poa bulbosa*, *Anabasis syriaca* and *Artemisia herba-alba*. The main shrub species (e.g. *Anabasis syriaca* and *Noaea mucronata*) are considered unpalatable and used only for fuel.

1.5. Rangeland use

Rapid human population growth in Syria (4 million in 1950, over 18 million in 2005) has fuelled demand for animal products and increased pressure on rangeland. Livestock play an integral role in the Badia farming system. There are an estimated 15 million sheep in Syria, of which 9 million depend on rangeland resources. Badia livestock use a combination of free-range grazing and supplemental feeding. Knowledge of feeding techniques is passed between generations or learned from neighbors. The traditional nomadic system is the most important production system; sheep are raised and extensively managed so as to efficiently utilize the free-grazing natural steppe rangelands in eastern Syria, for 4-6 months of the year.

Sheep graze on two main classes of fodder in the steppe: perennial shrubs and both annual and perennial grasses. The shrubs begin new growth in spring (end of April/May) and complete growth and fruit production by the end of September/October. Perennial grasses tend to flourish after the winter rains (November/December). Traditionally, herders would move their sheep off the steppe around the beginning of May, largely because of lack of water. Livestock would then spend the summer grazing on crop residues in the north and west of Syria, and return to the Badia steppe in autumn (October/November). The woody vegetation in the Badia consists mainly of species of little or no palatability; dwarf shrubs are avoided until nothing else is available. In years with good early rainfall, annual plants and the perennial grass *Poa* spp. are grazed from the time they emerge, while shrubs may not be browsed at all. At such times, e.g. 1997, herdsmen have no preference between plains and valleys, simply moving to places where new growth is sufficient. But in years when the autumn rains fail, the shrubby vegetation in the valleys and on the plains with shallow soils becomes more significant, providing at least some roughage while animals are maintained with supplementary feed. At present, even in good rainy seasons the Badia does not contribute more than 12-17% of animals' annual energy requirements – equivalent to just 2 months of grazing without supplementation (MAAR).

Before hand feeding was introduced in the mid 20th century, the mobility pattern of the pastoralists was perfectly matched with availability and accessibility of forage and water. Migration of herds followed special routes or cycles that were defined for each tribe. Mobility patterns and grazing availability have now changed, with the widespread practice of hand feeding and the availability of trucks and mobile cisterns. Today some Bedouin households spend the entire year in the steppe; others spend the entire year in the cropping zone, outside the Badia.

II. METHODOLOGY

Sustainable rangeland management requires the participation of the Bedouin, and the involvement of all concerned parties including research and development institutions and policy makers. Even if a survey is a pure extractive exercise and participatory methods do not really apply here, this survey tried to involve all community members as well as other actors involved in rangeland management.

2.1. Survey preparation

Several meetings were held between ICARDA staff and representatives from the Syrian Steppe Directorate and the Badia Project, to discuss the objective, criteria for community selection, and the implementation of the survey. It was agreed that in each province, one person from the Badia Project and one from the Steppe Directorate would participate in survey implementation. A training course on survey methodology and household survey testing was organized at ICARDA headquarters in Aleppo from 13 January 13 to 2 February 2005, with all parties participating.

In order to understand rangeland management we have to look at the vegetation, the direct users (the animals), and other beneficiaries (the Bedouin) in any given spatial unit. This requires researchers to work at the community level. Community land is defined as the land where a group of persons, speaking in a single voice, is recognized as having some grazing rights. The community comprises households with access rights to this land – including those who have migrated out and established permanent homes outside the community.

2.2. Sampling

Communities are not officially listed. However a list of 125 official Badia sites is available from the Steppe Directorate (Fig. 4a). We later refer to these sites as 'mother communities'. Each of these communities may include several sub-communities. Twenty five 'mother communities' were randomly chosen among the 125 officially censused in the steppe from six of the nine provinces comprising the steppe. Darra and Sweida were excluded from the survey because of their small steppe area, while Hassakeh was excluded for logistic reasons (proximity to the Iraq border). The selection was sometimes modified in the field as some of the mother communities were essentially unique communities. Ultimately, 29 mother communities were surveyed.

In each mother community (except those without sub-communities), two sub-communities were randomly selected before the survey began. A total of 50 sub-communities in six provinces were interviewed. They account for more than 95% of the total steppe area in Syria (Table 3), and are representative at the national level but not at the province level.

Finally, within each community, a representative household sample was chosen based on three criteria: flock size, community subgroup, and average feed cost per ewe. The size of this sample varied depending on community size and availability of households. It was also limited by the time available (one day per community). In all, 359 households were interviewed, of which 313 owned a flock. Communities may include anywhere from 8 to 1500 households, so it was impossible to interview enough households to ensure a representative sample at community level, although the sample is representative at the Badia level. Also, the possible absence of some households (away from their rangeland site during the survey period, March-April 2005) may have introduced a sample bias.

Table 3. Sample selection by province.

Province	Steppe area as % of national steppe area	Total no. of mother communities	No. of selected mother communities	No. of selected communities	No. of selected households
Homs	35	35	9	14	105
Damascus	14	25	5	10	60
Raqqa	13	30	8	12	83
Dier-Ezzor	30	10	2	4	28
Hama	2	13	3	6	49
Aleppo	1.5	12	2	4	34
Total	**95.5**	**125**	**29**	**50**	**359**

2.3. Survey instruments

Five main survey instruments were used to collect data (Fig 7). Socio-economic survey instruments were used to gather information to characterize the community and their pastoral production and livelihood strategies. This was done at two levels: community and household surveys.

- **Community survey**

The community questionnaire (Appendix 3.1) was administered to the leader of the community and to senior figures in the community who were also livestock producers. They were asked to call as many other producers as was practical, so that an open-ended discussion could evolve. This questionnaire covered the composition of the community and distribution of its assets (land and flocks), the mobility calendar, governance, infrastructure and public services, as well as social capital.

- **Household survey**

Households were organized in small groups and invited to answer one question at a time. Information was sought on household composition, flock size, production costs, feeding calendar, livestock products, and mobility calendar for the past 6 years (Appendix 3.4).

Rangeland survey instruments were used to characterize rangeland productivity and condition. Two types of survey were conducted:

- **Participatory mapping**

First, a map of rangeland type and land use was drawn with the assistance of representatives from each community (Figs 5 and 6). The map included two major land types: previously cultivated land and native (uncultivated) rangeland. Other minor types of rangeland were also included, such as rangeland improved by government/NGO projects and currently cultivated land. In some cases the community identified several kinds of native rangeland based on the dominant vegetation type or major differences in the landscape (e.g. bottom rangeland, sloping rangeland). Survey staff, accompanied by community members, then visited the site to check map locations with a Global Positioning System (GPS) and further discuss key features. The boundary of the community and the location of the settlement were recorded on the GPS.

- **Rangeland community survey**

This survey collected quantitative data on rangeland area and vegetation plant use, as well as qualitative data on Bedouin opinions about rangeland management options (Appendix 3.2).

- **Range field verification survey**

Range site: For every range type identified during the mapping exercise, field verification was done with community leaders to characterize the different types of rangeland and their condition. Based on vegetation

type and topography, these sites were subjectively selected to be representative of the range type polygon. A total of 128 range sites were evaluated. Several indicators of rangeland health at the range site level were used to assess soil erosion and rangeland degradation on a 1-5 scale: 1 = none to very low, 5 = very high. Biomass and forage value were also estimated visually at a sample site for each rangeland vegetation type within the community (Appendix 3.3).

Systematic transect sampling: The sampling was done along transects for 15 plots per community, to quantify degradation in relation to distance from settlements.

2.4. Survey implementation

Prior to the main survey, a preliminary "rapid" survey was conducted in the Aleppo and Hama steppes during 6-30 June 2004. Eleven steppe communities (6 in Aleppo, 5 in Hama) were subjectively selected and surveyed, in order to test the instruments to be used to characterize rangeland vegetation. The results of the survey were of great value to the main survey conducted the following year.

The main survey started at the end of the 2005 winter, with the following schedule:

Province	**Period of visit**
Aleppo	6-8 February
Hama	27 February 27 to 1 March
Damascus	6-10 March
Homs	14-20 March
Deir-Ezzor	21-22 March
Raqqa	29 March to 3 April

On the ground, two teams conducted field work simultaneously in two different communities. Each team consisted of four individuals responsible for:

1. community rangeland questionnaire + vegetation field verification on the site
2. field verification of transect vegetation
3. community socio-economic questionnaire
4. household survey

The survey was designed to be completed in one day at each site.

2.5. Data processing and analysis

Data were entered in SPSS and cleaned. The data are currently organized in several files (Appendix 3) according to the nature of the survey (rangeland, socio-economic) and the level of observation (plot, community, household).

Data were analyzed using simple descriptive statistics. In parallel, GIS analysis was conducted. Spatial interpolation of the main ecological and socio-economic variables has produced very illustrative maps. However, some extensive areas of the Badia were not surveyed; and sample sites were representative of the Badia population but not of the Badia area. Therefore, the results should be interpreted with care.

III. RANGELAND CHARACTERIZATION

3.1. Rangeland area and rangeland type

3.1.1. Community size

The survey showed great variation in total community area (Table 4), ranging from 280 ha to 80,600 ha (average 16,260 ha). Half the communities had less than 5000 ha while 20% had more than 20000 ha. The biggest communities were those furthest from the Badia line (Fig. 8)

Table 4. Land area of communities.

Area (ha)	Frequency	%
0-1000	10	20
1001-5000	13	26
5001-10,000	11	22
10001-20,000	6	12
>20,000	10	20
Total	50	100

3.1.2. Rangeland type

Community land consisted of four main types:

- previously cultivated area, i.e. land that was cultivated before the cultivation ban in 1995
- native rangelands (never cultivated)
- improved rangelands, where government/NGOs had implemented interventions
- currently cultivated land.

Table 79 (appendices) provides details about the 50 communities. Previously cultivated land represented 38% of the total. Spatial interpolation of the data (Fig. 9) showed that communities in the northern Badia were cultivating more than 40% of their land, with the highest rate of cultivation found in the north-eastern corner of the Badia.

On average, 51% of communities' land was classified as native range; 8 communities had no native rangelands, and only 1 community had land that was entirely native rangeland. Seventeen communities had part of their land (12% on average) improved by shrub plantation either through the 10070 project or the Badia Rehabilitation Project. Three other communities were involved in projects on sand dune fixation, water harvesting, and development of natural reserves.

Although the ban on cultivation is enforced by the government, almost half the communities currently cultivate some land (with olive, wheat or barley). On average, 10% of the total area is currently cultivated; this figure was as high as 50% and 85% in two communities.

Table 5. Types of community land.

Area (%)	Native	Previously cultivated	Improved	Cultivated
0	16	3	60	54
1-15	6	29	30	36
16-40	14	30	10	6
41-60	22	16	0	2
61-85	24	6	0	0
86-100	18	16	0	2
Total	**100**	**100**	**100**	**100**

3.2. Vegetation characterization

3.2.1. Life form and ground cover

Biomass composition and ground cover are indicative of both the original potential of the land and the level of degradation (Table 6). As expected, shrubs dominate the biomass composition in native rangelands (43%). The majority of these shrubs (*Anabasis, Noaea*) are considered low palatability, and used mainly for fuel. Annual grasses and forbs are common on previously cultivated land.

Bare ground was the dominant form of ground cover in both previously cultivated land (56%) and native rangelands (36%). But the significant difference in levels suggests that degradation is more severe on land that has been plowed. It is interesting to note that perennial vegetation was less common on cultivated land (more degradation), compared to native rangeland – while rock and gravel was less common too, since previously cultivated sites were located on the best land.

In order to make the statistics comparable (native vs previously cropped), the 12 sites that were rehabilitated through shrub plantation or other improvements were considered separately (Table 6); and only the eight sites improved with shrubs on native rangeland were compared with native rangeland. Surprisingly, shrub content was not significantly different between improved and non-improved sites, probably because these projects are at an early stage and the shrubs are still relatively small. However, we foresee an eventual impact on annual forbs and vegetation because such projects effectively protect the rangelands.

Table 6. Biomass composition and ground cover (126 sites).

	Previously cultivated	Native rangelands	Ttest[1]	With projects	Ttest[2]
Biomass composition (%)					
Shrubs	25.4	42.8	**	26.3	
Perennial grasses	16.4	22.5		19.2	
Annual grasses	25.5	13.3	**	22.1	
Annual forbs	21.9	13.3	*	25.0	*
Perennial forbs	8.8	6.5		7.5	
Ground cover (%)					
Perennial vegetation	16.0	24.0	**	24.2	
Annual vegetation	17.4	13.0		31.7	*
Moss, lichen	0.0	0.6	*	0.0	
Bare ground	55.6	36.4	**	32.9	
Rock, gravel	8.8	24.3	**	10.0	
Litter	2.2	1.7		1.3	
Representativity					
No. of sites (%)	51 (40%)	63 (50%)		12 (10%)	
Total area / 000 ha (%)	224.1 (29%)	507.6 (65%)		47.9 (6%)	

*, ** Mean statistically different at 90 and 99% respectively

[1] Comparison of previously cultivated sites vs native rangeland (without projects)

[2] Comparison of sites with and without projects for sites that have never been cultivated

3.2.2. Dominant species

Of the 95 rangeland species censused during the survey (Table 84), 26 dominated their respective range types (Table 7). *Poa bulbosa* (18% of the surveyed land) and *Carex stenophylla* (17%) were the most dominant species, followed by *Anabasis syriaca* (14%), *Artemisia herba-alba* (12%) and *Peganum harmala* (12%).

Carex stenophylla, a rhizomatous sedge, forms a 10-cm armor immediately below the soil surface, keeping the sand grains in place. This short grass is a valuable feed for sheep especially in early spring as it is the first plant species that starts to grow in the steppe. The nutritive but short-lived plant *Poa bulbosa* is another

important vegetation component. It reproduces through underground bulbs, and can therefore survive heavy grazing and harsh environments.

Anabasis syriaca develops in depressions and plains where there are heavy soils (loamy to silty) and where accumulated run-off lasts for a few days. Despite its dense green vegetation, it yields little palatable forage.

Artemisia herba-alba range type is found mainly in plains and on rocky calcareous hills, and also at some sites on the central mountains. *Artemisia* is a heavily degraded range type, and often covered with white lichen (*Diplochistis steppicus*) on gypsic soils. Some accompanying species are perennials such as *Noaea mucronata, Achillea fragramtissima, Anabasis syriaca, Poa bulbosa* and *Carex stenophylla*; and annuals like *Koeleria* ssp., *Scorzonera papposa, Plantago ovata* and *Erodium glaucophyllum*, etc.

Peganum harmala grows on eroded rangeland, shallow soils with calcareous hardpan, on previously cultivated range, or on gypseous crust. It is has a patchy and very poor vegetation cover.

Table 7. Frequency distribution and percentage of dominant species recorded at 126 sites over 50 communities.

Most abundant species	Area/ha	%	Previous cultivation		Never cultivated		Grazing value
			area/ha	%	area/ha	%	
Achillea conferta	4200	0.53	4200	1.46	0	0.00	Grazing good
Achillea fragrantissima	18,500	2.35	7000	2.44	11,500	2.29	Grazing good
Adonis dentata	27,200	3.45	27,200	9.48	0	0.00	Grazing good
Alhagi maurorum	300	0.04	300	0.10	0	0.00	Grazing good
Ammothamnus gibbosus	1000	0.13	0	0.00	1000	0.20	None
Anabasis syriaca	110,470	14.00	34,000	11.85	76,470	15.23	Grazing poor
Artemisia helba-alba	97,665	12.38	40,065	13.97	57,600	11.47	Grazing good
Artiplex halimus	1000	0.13	1000	0.35	0	0.00	Grazing good
Astragalus spinosus	10,000	1.27	0	0.00	10,000	1.99	Grazing poor
Bromus tectorum	800	0.10	800	0.28	0	0.00	Grazing good
Capparis spinosa	2200	0.28	2200	0.77	0	0.00	Grazing good
Carex stenophylla	132,030	16.74	3000	1.05	129,030	25.70	Grazing good
Chenolea arabica	3500	0.44	0	0.00	3500	0.70	Grazing good
Cornulaca setifera	1000	0.13	1000	0.35	0	0.00	None
Gypsophila pilosa	300	0.04	300	0.10	0	0.00	Grazing poor
Haloxylon articulatum	700	0.09	470	0.16	230	0.05	Grazing good
Haloxylon salicornicum	4400	0.56	4000	1.39	400	0.08	Grazing poor
Hordeum glaucum	61,280	7.77	13,780	4.80	47,500	9.46	Grazing good
Micropus longifolius	1000	0.13	0	0.00	1000	0.20	Grazing good
Noaea mucronata	34,355	4.35	200	0.07	34,155	6.80	Graizing poor
Peganum harmala	91,450	11.59	87,150	30.38	4300	0.86	Graizing poor
Petoranthus triradia	2000	0.25	0	0.00	2000	0.40	Graizing poor
Plantago ovata	40,400	5.12	400	0.14	40,000	7.97	Grazing good
Poa bulbosa	142,620	18.08	59,330	20.68	83,290	16.59	Grazing good
Salsola vermiculata	500	0.06	500	0.17	0	0.00	Grazing good
Tamarix pentandra	15	0.00	0	0.00	15	0.00	None
Total	**788885**	**100**	**286895**	**100**	**501990**	**100**	

3.3. Rangeland use

3.3.1. Overgrazing

Several indicators were recorded in order to assess the level of rangeland utilization by animals. (i) Residual biomass, i.e. plant material remaining after grazing at date of observation. This indicates the season's use and can be used to describe the health or condition of annual rangelands. (ii) Productivity, which indicates energy and nutrient dynamics in the vegetation. (iii) Dunging and trampling indicators. However, these three indicators look only at the vegetation, not the land potential. Therefore, stocking and carrying capacity were also calculated to estimate the occurrence and degree of overgrazing.

Biomass estimation: First, the residual biomass and the current season's vegetation were estimated visually. The forage value was also estimated to distinguish between poor and good grazing species.

Table 8 shows that more than 65% of the sites had low or very low potential biomass production (less than 300 kg/ha). The remaining sites could potentially produce 300-700 kg/ha – but most were producing less than 300 kg/ha at the time of the survey.

Table 8. Estimated residual and potential biomass for 126 sites in 50 communities in the Syrian steppe.

	Residual biomass		Potential biomass	
Category (kg/ha)	**Frequency**	**%**	**Frequency**	**%**
None or very low, 0-100	84	66	37	30
Low, 100-300	39	31	44	35
Medium, 300-700	2	2	41	32
High, 700-1500	0	0	4	3
Very high, >1500	1	1	0	0
Total	**126**	**100**	**126**	**100**

The zones with the highest potential biomass are located in the north (Raqqa, Homs and Hama provinces) and in the south (Damascus province) of the country, in the more elevated areas (Fig. 10a). However, actual biomass production, at the time of the survey, was very homogenous. Biomass production was high only at a few sites in Homs province, the highest point of the Badia.

Comparing the potential forage value of the biomass with the observed biomass at the date of observation (Table 9), we clearly see a strong use of the range as 60% of the potential biomass is composed by more than 50% of forage (against 5% for the residual biomass) and more than 60%of the residual biomass is composed of 20% and less of forage (against 9.4% for the potential biomass).

Table 9. Percent forage value from residual and potential biomass (126 sites).

	Residual biomass		Potential biomass	
% forage	**Frequency**	**%**	**Frequency**	**%**
0	12	9.4	4	3.1
5	10	7.8	0	0
10	33	25.8	12	9.4
15	6	4.7	3	2.3
20	26	20.3	12	9.4
25	2	1.6	2	1.6
30	20	15.6	7	5.5
40	10	7.8	6	4.7
50	5	3.9	42	32.8
60	0	0	29	22.7
70	1	0.8	8	6.3
75	1	0.8	0	0
80	0	0	1	0.8
Total	**126**	**100**	**126**	**100**

These results are explained by the high level of range utilization (Table 10). In spring 2005, 69% of the communities were using the range intensively, i.e. 'high' or 'very high' categories. The communities with the lowest utilization level were located in the north-eastern and south-eastern parts of the Badia (Fig. 11).

Table 10. Rangeland utilization level (126 sites).

Utilization level	Frequency	%
Very low, 0-20%	14	11.1
Low, 20-50%	9	7.1
Medium, 50-70%	16	12.7
High, 70-90%	58	46
Very high, >90%	29	23
Total	**126**	**100**

Dunging and trampling: Dunging is an indication of grazing pressure, but dung observed could be related to a grazing event that took place earlier. Trampling is an indication of sheep stocking. Both indicators were evaluated on a scale from 1 (none) to 5 (very high). Rangeland utilization by animals was high or very high at 45-50% of the sites (Table 11).

Table 11. Dunging and trampling scores.

	Dunging		Trampling	
	Frequency	**%**	**Frequency**	**%**
None to very low	17	13.6	11	8.8
Low	19	15.2	15	12.0
Medium	32	25.6	38	30.4
High	43	34.4	46	36.8
Very high	14	11.2	15	12.0
Total	**125**	**100.0**	**125**	**100.0**

Stocking rate and carrying capacity: Stocking rates were calculated in terms of sheep unit months (SUM), i.e. the sum of small ruminants present in the community over the 12 months of the year. Months were used as the unit of time because flocks do not graze their sites for the whole year. In parallel, we estimated the carrying capacity of each community's land. The carrying capacity is the number of animals a piece of land can support for a specified time period (year, month or season) without causing damage to the range resource. The calculation was based on visual estimation of the potential biomass at each site. For proper (conservative) grazing management, only half the estimated biomass was considered to be available for grazing. This biomass was then divided by 1.5 kg dry matter, the grazing forage requirement for one sheep with an average weight of 45 kg for one day (see Table 82 in appendix).

For proper resource management, the stocking rate should not exceed carrying capacity. Our calculations show that the actual stocking rate exceeded the expected carrying capacity in 74% of the 50 communities surveyed. The median carrying capacity was 14,961 SUM, ranging from 28 to 807,778 SUM. The median stocking rate was 40,512 SUM, ranging from 0 to 475,000. The average overstocking ratio (ratio of stocking rate to carrying capacity) was 3.33 for the 2004 year, ranging from 0 to 754.

Table 12. Overgrazing ratio.

Overgrazing ratio	Frequency	%
0-1	13	26
1.01-5	17	34
5.01-10	8	16
> 10	12	24
Total	50	100

Overgrazing rates were highest in the eastern part of the Badia (Fig. 12) and particularly in a buffer zone with the Badia line of Homs province. Note that Fig. 12 differs from the rangeland utilization levels (Fig. 11), highlighting the importance of identifying the appropriate indicator to measure rangeland health.

3.3.2. Cutting shrubs for fuel

Shrubs and trees are uprooted by local people for fuel and medicinal use. Perennial shrubs are uprooted depending on their value as fuel: *Haloxylon articulatum, Salsola vermiculata, Artemisia herba-alba, Haloxylon salicornicum, Anabasis syriaca* and *Noea mucconata* (Table 13). They are pulled up by their roots, preventing recovery of plant populations and accelerating erosion. The fuel is used for cooking, winter heating, and seasonal milk processing.

Such uprooting is an ancient practice. The amount of shrubs uprooted per capita is generally decreasing due to availability of kerosene, methane and gas, and improved standards of living. However, with increasing population densities, the total quantity uprooted may be increasing. A survey by the Talila project estimated that 4.1 ha of shrubs are cleared per family per year (Jones, 2003).

Our survey found that one-third of communities' fuel needs were met by plants collected from the rangeland (belonging to the community or to neighboring communities), and two-thirds was purchased from the market. Shrub uprooting was highest in Dier-Ezzor province, where 54% of fuel needs came from shrubs, compared with only 16% in Hama province.

3.3.3. Medical and food plants

Rangelands provide numerous valuable medicinal plants for human and animal needs, as well as food plants. Among the 50 communities surveyed, 28 mentioned *Artemisia herba-alba* as an important medicinal plant (Table 13). *Matricaria*, *Teucerium* and *Achillea* were also important. *Peganum harmala* was the only species mentioned for its use in increasing animal fertility.

Table 13. Species mentioned for different uses, and number of times collected per year.

Species	Medicinal Human	# times	Medicinal Animal	# times	Food	# times	Fuel	# times
Achillea fragrantissima	16	47						
Althaea officinalis	1	1						
Anabasis syriaca							8	59
Artemisia heba-alba	28	64						
Artemisia scoparia							1	10
Capparis spinosa	3	13			1	1		
Citrilus colocynthis	3	23						
Cornulaca setifera							2	12
Gundelia tourniefortii					2	11		
Haloxylon articulatum							3	11
Haloxylon salicornicum							11	264
Heliotropium europaeum	2	3						
Kuehneromyces mutabilis					5	27		
Malva aegyptiaca					5	16		
Matricaria aurea	21	157						
Noaea mucronata							16	475
Peganum harmala			11	83				
Terfezia leonis					12	296		
Teucerium polium	20	100						
Thymus syriacus	5	30						
Ziziphora tenuior	6	18						

*One community in Raqqa had different medicinal plants in their rangeland, but never used them

The most important food plant is the Kamma (*Terfezia leonis*). This highly edible truffle is widely used in North Africa and the Middle East, but its use is not recorded elsewhere. The most widely collected one is the desert truffle, or Terfez (*Terfezia leonis* and others), which grows abundantly in sandy soils and is frequently sold in local markets throughout the Golden Crescent, from Morocco to Iraq. Desert truffles are members of the family Terfeziaceae, renowned for their culinary value. *Terfezia* and *Termania* species are mycorrhizal on the roots of *Helianthemum* and other members of family Cistaceae, and are found in arid and semi-arid areas in the Mediterranean basin. They are also found in South Africa in association with other plants (the family Cistaceae does not occur in this region).

Other food plants mentioned by the communities were *Capparis spinosa* (capper), whose flower buds are pickled and used as a flavoring in sauces and salads; and *Gundelia tourniefortii*, whose leaves are cooked.

3.4. Rangeland degradation

Several indicators of soil erosion and rangeland degradation at the 128 sites were estimated on a 1-5 scale, 1 = none to very low, 5 = very high (Table 14).

Root exposure: The base or lateral roots of the plant are partially exposed above the soil surface. Soil particles are removed by water or wind, lowering the overall soil level. About 26% of sites had high or very high root exposure.

Rills and gullies: A rill is a shallow linear depression or channel in soil that carries water after recent rainfall. Rills are usually aligned perpendicular to the slope and occur in a series of parallel rill lines. They are caused by the action of water. Runoff is channeled into depressions which deepen over time to form rills. A gully is a channel that has been cut into the soil by moving water. Gullies generally follow the natural drainage and are caused by accelerated water flow and the resulting down-cutting of soil. We found high or very high presence of rills and gullies at 41% of sites.

Flow movement: Flow patterns are the path that water takes as it moves across the soil surface during overland flow. Overland flow will occur during rainstorms when a surface crust impedes water infiltration, or when the infiltration capacity is exceeded. These patterns are generally evidenced by litter, soil or gravel redistribution, or pedestalling of vegetation or stones that break the flow of water (Morgan, 1986). High or very high flow movements were found at 34% of sites.

Pedestals and terraces: These are important indicators of the movement of soil caused by water and/or wind. They are rocks or plants that appear elevated as a result of soil loss by wind or water erosion. High or very high pedestalling was found at 46% of sites.

Litter movement: Litter refers to dead plant material on the soil surface. The degree and amount of litter movement (e.g. redistribution) is an indicator of the degree of wind/water erosion. Redistribution of litter within a small area on a site is indicative of limited erosion, whereas the movement of litter offsite is indicative of more severe erosion. Only 4% of the sites showed high or very high presence of litter movement.

Soil deposition by wind: Deposition of suspended soil particles is often associated with vegetation that provides roughness, which reduces wind speed and allows soil particles to settle from the wind stream. The taller the vegetation, the higher the deposition rate (Pye, 1987); thus, shrubs and trees in rangeland ecosystems are likely sinks for deposition. Soil deposition by wind was seen at 46% of sites.

Soil compaction: This occurs when soil particles are physically compressed, eliminating the air spaces or pores between them. The increased soil density and decreased pore space limits water infiltration, percolation, and storage, limits plant growth, and limits nutrient cycling. Soil compaction was observed at 30% of sites.

Table 14. Indicators of soil degradation (% sites in each category).

	None to very low	Low	Medium	High	Very high
Root exposure	23.2	22.4	28.8	14.4	11.2
Rills, gullies	8.0	30.4	20.8	20.0	20.8
Flow movement	13.6	32.8	19.2	21.6	12.8
Pedestalling	13.6	21.6	18.4	19.2	27.2
Soil deposit /wind	7.2	19.2	27.2	20.0	26.4
Soil compaction	12.0	26.4	32.0	21.6	8.0
Litter movement	68.8	21.6	5.6	3.2	0.8
Invader plants	59.2	16.8	13.6	7.2	3.2

In addition to soil degradation indicators, we recorded the percentage of ground cover composed of bare ground and the presence of invaders plants.

Bare ground: Bare ground is one indicator of the impact of cropping on land degradation. As Table 15 shows, high degradation (>50% of bare ground) was seen at 52% of previously cultivated sites and 22% of the sites with native vegetation.

Table 15. Extent of bare ground at sites with native vegetation and previously cropped sites.

% bare ground	Native vegetation (%)	Previously cultivated (%)
0-25	42.1	22
26-50	35.5	26
51-75	14.5	22
76-100	7.9	30
Total	**100**	**100**

Invader plants: We recorded plants that are invasive to the area of interest; they may or may not be noxious and may or may not be exotic. Generally they are invaders or have increased their presence at the site. They can, and often do, continue to increase regardless of the management of the site and may eventually dominate the site. Invaders were found at 10% of sites.

As we would expect, all these indicators are interconnected, but the level of correlation is different if we separately consider sites with native vegetation, and previously cropped sites (Table 16). The first six indicators of soil degradation (root exposure, rills and gullies, flow movement, pedestalling, soil deposition, soil compaction) were strongly related irrespective of whether or not the site was previously cultivated.

Litter movement was correlated with none of the other indicators. It is therefore not an appropriate indicator and was excluded from further analysis.

Table 16. Correlation matrices – indicators of land degradation.

	Root	Rills	Flow	Pede-stalling	Depo-sition	Compaction	Bare ground	Litter	Invaders
Native vegetation (75 observations)									
Root exposure	1.000								
Rills and gullies	**0.652**	1.000							
Flow mvt / water	**0.574**	**0.720**	1.000						
Pedestalling	**0.675**	**0.689**	**0.573**	1.000					
Soil deposition/wind	**0.548**	**0.594**	**0.463**	**0.868**	1.000				
Soil compaction	**0.470**	**0.544**	**0.560**	**0.440**	**0.394**	1.000			
Bare ground (%)	0.041	-0.041	-0.095	0.134	0.147	0.119	1.000		
Litter movement	0.104	-0.003	0.117	-0.041	-0.088	-0.005	-0.010	1.000	
Invader plants	0.166	**0.343**	0.100	0.209	0.082	**0.256**	0.041	0.163	1.000
Previously cropped (50 observations)									
Root exposure	1.000								
Rills and gullies	**0.681**	1.000							
Flow mvt / water	**0.704**	**0.781**	1.000						
Pedestalling	**0.872**	**0.697**	**0.750**	1.000					
Soil deposition/wind	**0.743**	**0.693**	**0.666**	**0.847**	1.000				
Soil compaction	**0.342**	**0.470**	**0.431**	**0.322**	**0.391**	1.000			
Bare ground (%)	0.248	0.140	0.204	0.290	0.287	0.372	1.000		
Litter movement	-0.056	-0.065	0.132	-0.031	-0.130	0.060	-0.079	1.000	
Invader plants	0.112	0.174	0.013	0.213	0.186	-0.003	-0.201	0.075	1.000

In bold: correlation is significant at the 0.05 level (2-tailed)

The last two indicators (bare ground and invader plants) were not correlated with each other, and their correlation with other indicators varies depended on whether or not the site was previously cultivated. On native sites, invader plants were associated with rills and gullies and soil compaction. On previously cropped land, bare ground was correlated with pedestalling, soil deposition and compaction.

As the soil degradation indicators were strongly correlated, they were aggregated as a single mean and spatially interpolated (Fig. 13). We can clearly see that this indicator increases along a south/east gradient. This is surprising as most the cultivation is taking place in the north and eastern parts of the Badia and overgrazing in the eastern part. We therefore expect this variable to capture much of the original land potential; but it cannot be used as such to assess land degradation.

3.5. Rangeland management

We recorded communities' opinions about Badia rangeland management, particularly the options they consider relevant for rangeland improvement, including specific resting and rotational options.

3.5.1. Community opinions on land improvement

When first asked how Badia management could be improved, 94% of the communities immediately answered that returning to barley cultivation was the only solution to increase livestock productivity and indirectly improve welfare. Then the question was asked a second time, in order to understand how the Bedouin view rangeland improvement regardless of barley cultivation. The question was asked first for the overall Badia land, then for their community land and finally, for a hypothetical situation where they could control access to their land. Barley cultivation, alley cropping, and tree planting still represented more than 50% of the answers (Table 17).

Supplementary feeding was proposed as a second option in the first two cases (entire Badia and community land). Shrub plantation was proposed by 10% of the communities in the second scenario. Interestingly, management options were mentioned by 10-16% of the communities depending on the situation. The

propositions were: reducing the carrying capacity stocking rates while simultaneously the government provides free or subsidized feed supplements, avoiding early grazing, resting (in two cases they referred to the *Hema* system) or rotating parts of the community land, and calling for a meeting with the cooperative to develop a management plan.

Three communities proposed expanded (year-round) access to government reserves and/or restricting access by neighboring communities. One community felt that government reserves should be removed because they reduce the land available for the community. Other propositions were: growing forage crops, protecting the land from outsiders, or improving infrastructure in the Badia (water points).

Table 17. Management options to improve the Badia, as suggested by communities, for three land tenure scenarios.

	Entire Badia		**Community land**		**Controlled land**	
	Frequency	**%**	**Frequency**	**%**	**Frequency**	**%**
Supplementary feeding	10	20	8	16	1	2
Trees and forage	2	4	4	8	0	0
Intercropping	4	8	3	6	2	4
Barley cropping, at least in lowland Badia areas	21	42	19	38	38	76
Shrubs	2	4	5	10	0	0
Management and protection	5	10	6	12	8	16
Government reserve	3	6	3	6	0	0
Others	3	6	2	4	1	2
Total	**50**	**100**	**50**	**100**	**50**	**100**

It is interesting to note how the type of answers varied between the three scenarios and how cropping was mentioned by 80% of the communities in the (hypothetical) scenario where they could control their borders. It is also in this scenario that management options were most frequently reported.

When asked about the conditions necessary for rangeland improvement, more than half the communities said the government should be involved – irrespective of the type of intervention (barley cultivation, resting, supplementary feeding etc).

3.5.2. Proposed rangeland management

After these open-ended questions, the enumerator stated a hypothesis to explore community opinion regarding resting of rangeland. The hypothesis was: "When grazing is continuous, plants are grazed too often and become very short and weak. The roots do not grow and cannot provide the nutrients and water the plant needs. Then the plant cannot produce much forage or seeds to reproduce. If plants are given short rest periods when growing they will produce more forage." About 76% of the communities agreed with this. Most of those who disagreed said that rainfall was the key factor in regrowth of rangeland plants (Table 18). Other responses were: plants will growth again anyway; or that they were not concerned because this was only true for native rangelands.

Table 18. Responses of communities who did not agree that resting facilitates plant growth.

Response	**Frequency**
Rainfall is limiting factor	8
The plant will be grazed and grow again	2
Agree only for rangeland grasses	2
Total	**12**

Next, communities were asked a series of three questions related to land resting, rotational grazing and reservation of some vegetation for special use. Three communities said they practiced one or two of these management techniques. One community said they implemented rangeland resting and rotation, i.e. animals start grazing in one part of the community land and follow a specific direction. Another community rotated grazing between the southern and northern parts of their land and were able to retain *Artemisia* vegetation until the end of spring. The third community said they kept native vegetation on the hills for producing *ghee* and milk.

Those who answered "No" to the questions, were asked why they did not practice these measures, and what conditions were necessary for the community to adopt them. Only 17 (10) communities were ready to apply rotational grazing (reservation of rangelands for special use) with the help of the government or the cooperative, or under other conditions (Table 19).

Table 19. Conditions for implementing some management practices.

	Frequency	
	Rotation	**Special use**
With help of the government	11	6
With help of government & cooperative	1	0
With a guard	0	1
With agreement of herders	1	1
With feed complement	0	1
Management type	2	1
I can do it	1	0
If the land is bigger	1	0
Total	**17**	**10**

The same question was then put to communities that said they would not implement management plans even if the first constraint were resolved (columns 'if' in Table 20). Results are reported in Table 20.

The first two constraints relate to land characteristics: the community land is too small or the vegetation type does not allow management (lack of perennial vegetation due to extensive cropping in the past). These were mentioned in 15-20% of cases and responses were fairly consistent across different types of management. The fact that the land was already too degraded for effective management was mentioned only in the case of differential grazing for special use (10%).

Open access is the main constraint for any type of management plan. It was mentioned in 50% of the cases for resting and rotational grazing, but this constraint seemed less important for differential grazing for special use (30-40%).

Leadership was a problem for four communities in the case of rotational grazing. Lack of agreement within the community was cited by six communities for differential grazing. Six communities cited another "institutional" reason in the case of rotational grazing: the land was too big, they were unable to control the borders.

Other interesting reasons given for not being able to implement a management plan: no places available outside the community to send the animals; or flock size too heterogeneous for herders to agree on a collective plan.

These results clearly show differences between different communities and between different types of management proposed. This implies that a standardized management plan cannot be applied in the Badia – different management options have to be considered and adapted according to the biophysical characteristics

of the community (size, grazing pressure, state of degradation) as well as institutional factors (leadership, social cohesion, heterogeneity).

Table 20. Reasons for non-management.

	Resting		Rotation		Rotation if		Special use		Special use if	
	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%
Land type										
Land too small (high stocking rate)	5	9.8	3	6.0	4	12.1	3	6.0	3	7.5
No perennials, previously cropped	5	9.8	4	8.0	2	6.1	4	8.0	3	7.5
Too degraded	0	0.0	1	2.0	0	0.0	5	10.0	3	7.5
Institutional										
Outsiders	27	52.9	25	50.0	12	36.4	20	40.0	12	30
No leadership/no advice	3	5.9	4	8.0	4	12.1	3	6.0	2	5.0
No agreement within community	1	2.0	4	8.0	4	12.1	6	12.0	6	15
Land too big / lack of control	3	5.9	6	12.0	3	9.1	3	6.0	3	7.5
Other reasons										
Other	6	11.8	1	2.0	3	9.1	3	6.0	3	7.5
Don't know	1	2.0	2	4.0	0	0.0	2	4.0	2	5.0
No need	0	0.0	0	0.0	1	3.0	1	2.0	3	7.5
Total	**51**	**100**	**50**	**100**	**32**	**100**	**49**	**100**	**37**	**100**

IV. SOCIO-ECONOMIC CHARACTERISTICS OF COMMUNITIES

4.1. Demography

4.1.1. Location and date of establishment

As Table 21 shows, 80% of the surveyed communities are located within a "buffer zone" extending 60 km from the Badia line. The density of communities decreases as we move further from the Badia line. About 80% of the communities were established during the French mandatory period and the first 15 years of the Syrian state, when a policy to weaken the tribes was in place. In addition, population growth and agricultural mechanization led to significant expansion of cultivation between 1940 and 1960 (Wachcholz, 1996). Communities in the north-west region of the steppe were settled from 1850 through the first decades of the 20th century. Settlement in the south-east occurred in the second half of the 20th century (Lewis 1987, Fig. 2.2.). Spatial interpolation of the survey data (Fig. 14) shows good consistency with the historical references.

Table 21. Location of communities in relation to Badia line.

Distance to Badia line (km)	Frequency	%
1-10	11	22
11-30	15	30
31-60	14	28
61-100	2	4
101-200	8	16
Total	**50**	**100**

Table 22. Date of establishment of communities.

Date of establishment	Frequency	%
1850-1919	6	12
1920-1945	20	40
1946-1959	20	40
1960-1984	4	8
Total	**50**	**100**

Locations for establishing communities in the Syrian steppe were chosen according to the availability of water resources and proximity to markets. The first communities were established at a time when Bedouin were looking for a home base to spend the winter. In the second half of the 19th century, the way to define a home base was for a tribe, *fakhed*, or family to appropriate a Roman well or a cistern. The well or cistern was claimed by the ones who discovered and rehabilitated it. Community boundaries were drawn by dividing the distance between two captured Roman cisterns into two equal parts. This can explain part of the great heterogeneity in community land size that prevails today. At that time, Bedouin were simply looking for a water source with an attached area of land where they could spend the winter. When barley cultivation began in the early 1950s, there were disputes between communities about the boundaries, which were not yet well defined. It took a long time before boundaries settled to their present shape – and these are still dynamic as a sub-group of Bedouin can separate from the community on a share of the land.

In our sample, the community boundary has changed since the date of establishment, for 19 communities. The reasons, cited in seven cases, were:

- conflicts with neighbors (boundaries forcibly changed by the community or their neighbors, 1950, 1964) or over land cultivation (1980, 1994)
- changes occurring with the creation of cooperatives (1996)
- changes due to the purchase of land (1968)
- changes occurring with the modification of rangeland property rights (1979).

In addition to their land in the Badia, a quarter of the surveyed communities have some of their members (17% of their residents on average) who own a piece of land in the cropping zone. The plots are mainly located in zones 3 and 4, on average 82 km from the community, and are relatively small, ranging from 1 to 50 ha (average 8 ha).

Table 23. Characteristics of land in the cropping zone.

	Obs.	Mean	Min	Max
Average distance from 'home' community	12	81.73	19.5	220
Area owned per owner (ha)	11	7.86	0	50
Area shared (ha)	12	11.08	0	100
% of community residents who own land in the cropping zone	12	17.54	0	100

4.1.2. Community size

Community size varied significantly depending on definition, i.e. if we consider i) all households (included those who migrated) with traditional grazing rights, ii) households who are using the land (residents and migrants who regularly or occasionally graze their animals on community land), iii) only households whose main residency is on the site. In the first case, 54% of the interviewed communities are relatively small, with fewer than 100 households (

Table 24a). The other half of communities have 100-500 households; two communities in Damascus steppe have 1500 households each. If we consider only resident households (

Table 24b), 80% of communities have less than 100 households. Two communities were totally deserted; one in Damascus province (its households migrated to Saudi Arabia and to Duma city), the other in Homs province (households became nomadic after the ban on cultivation). Nine communities had 100-200 households, and only two communities had more than 200. The number of households in a community is correlated to the number of pioneer households who appropriated a water source (Roman cistern or well) in the past.

Table 24. Community size (number of households) based on (a) all households, (b) residents only.

a) All households			**b) Residents only**		
Community size	**Frequency**	**%**	**Community size**	**Frequency**	**%**
8-30	13	26	0	2	4
31-100	14	28	4-30	19	38
101-200	11	22	31-100	19	38
201-520	10	20	101-200	9	18
1500	2	4	201-300	2	4
Total	**50**	**100**	**Total**	**50**	**100**

Once mapped through spatial interpolation, we see different patterns depending on how we define community size. The communities with the most total households were located near Damascus, while communities with the most residents and land users were located in the south-center of the Badia (Fig. 15).

4.1.3. Population density

If the number of land users is correlated with community area, the spatial distribution of the Bedouin population looks very different (Figs. 16, 17). We obtain a buffer zone of high population density around the Badia line (0.02-0.14 households per ha), while most communities in the core Badia have less than 0.02 households per ha.

4.1.4. Household residence

Households who reside on the site will be referred to as 'residents', while households that have established residency elsewhere will be called 'migrants'. Among the migrants we distinguished the 'cropping zone migrants' who established residency in villages in the cropping zone, 'Badia migrants' who established

residency at another Badia site, 'urban migrants' who established residency in a Syrian city, and 'Saudi Arabia migrants' who migrated to that country. On average, 65% of a community's households had their main residence in the community site. We found 13 communities which had no out-migration; and at the other extreme, two deserted communities (Table 25).

Table 25. Communities classified according to percentage of resident households.

% of resident households	Frequency	%
0	2	4
1-20	7	14
21-40	5	10
41-60	5	10
61-80	11	22
81-99	7	14
100	13	26
Total	**50**	**100**

In 14 communities, less than 40% of the population were residents. These were:

- 4 communities where most households (79-96%) migrated to the cropping zone
- 2 communities where most households (50 and 90%) established residency at another Badia site
- 3 communities where most households (72-82%) migrated to an urban center
- 3 communities where most households (60-65%) migrated to Saudi Arabia
- 2 communities where the households reside at different sites.

The cropping zone is the main destination for migrants (Table 26); 27 communities had households that migrated to the cropping zone and on average 17% of communities' population consisted of 'cropping migrants'. Migration to other Badia site or to urban centers was important in 11 and 12 communities respectively, and involved 6-7% of the community's households. Finally, nine communities had some households who moved to Saudi Arabia.

Table 26. Community households' residence and average distance of residence from community site.

Households' main residence	No. of communities with migration	Household's main residence (%)			Average distance from community to residence site (km)		
		Mean	Min	Max	Mean	Min	Max
Community site		65	0	100	0	0	0
Cropping zone	27	17	0	95	126	14	500
Another Badia site	11	6	0	91	98	45	200
Urban center	12	7	0	82	180	80	400
Saudi Arabia	9	5	0	65	–	–	–

As expected the average distance of establishment of migrants is shorter in the Badia (98 km) than for the cropping zone (126 km) or the cities (180 km).

4.1.5. Community structure

The surveyed communities belong to 10 different tribes. Following the same classification as Lewis (1987), 42% of the communities belong to a traditional nomadic tribe, while 40% belong to a semi-nomadic tribe or a semi-sedentary one. The tribes of the Euphrates valley (12% of the communities) are considered semi-sedentary as they combine irrigation with dryland farming. Three communities do not belong to any of the Badia tribes and were created by farmers who moved from the cropping zone (mountains of Lattakia or Damascus province). One community is composed of Ismailias who migrated from Salamya zone in the mid-19th century (Al-Dbiyat and Jaubert, 2006).

Table 27. Tribes represented in the survey.

	Frequency	%
Nomadic		
Shammar	3	6
Anazah	15	30
Umur	3	6
Semi-nomadic		
Mawali	4	8
Bani Khalid	5	10
Hadidiyin	6	12
Bu Khamis	3	6
Semi-sedentary		
Nu'im	2	4
Euphrates valley		
Baqqarah	2	4
Abu Sha'ban	4	8
Other		
From cropping zone	3	6
Total	**50**	**100**

Most communities were composed of a unique group of households who were all blood-related. However, 40% of the communities were composed of subgroups (*Fakhed* or other structures), and four were even composed of groups of various tribal origin. Communities with 2 to 9 subgroups were found, with one community having 20 subgroups (Appendices). Interestingly, the number of subgroups depended not on the size of the total community, but on the number of pioneer households who originally established the community. The pioneer households were usually closely related (brothers or cousins), and constituted a single group. Cohesiveness would remain strong as long as some of the pioneers were alive, but the original group might divide in subsequent generations. The probability of separation will increase if the community is near a city (labor opportunities, migration etc). If separation does occur, the number of subgroups will depend on the number of pioneers. In a few cases, the pioneer group itself consisted of subgroups, each blood-related (brothers, cousins), with no blood relation between subgroups. These pioneering subgroups became allies in order to protect themselves against others.

Table 28. Number of groups in a community.

No. of groups	Frequency	%
1	30	60
2	6	12
3	2	4
4	4	8
5	4	8
6	1	2
8	1	2
9	1	2
20	1	2
Total	**50**	**100**

4.1.6. Education and off-farm activities

On average, 42% of the heads of resident households were educated. Public schools were the main source of education: public schools, Koranic schools and self-education accounted for 77%, 11% and 12% respectively of educated Bedouin. Public education in the steppe depends on how far the school is. Education would be

weak, especially for girls, if there is no school in the community; and there would be no education at all if there are no schools in the neighboring communities.

Table 29. Education rate in communities (among residents only).

% households educated	Frequency	%
0	1	2
1-25	17	34
26-50	15	30
51-75	10	20
76-99	3	6
100	4	8
Total	**50**	**100**

Communities strongly differ in the degree to which resident households are economically dependent on outside activities. In 2004, 30% of resident households had one member migrating outside the community for seasonal work, while 15% of households had regular non-livestock activities throughout the year.

4.2. Livestock

4.2.1. Flock composition, size and location

Livestock in the Badia consist mainly of sheep. Camels play a minor role today in Syria. With the mechanization of transportation, camel-breeding tribes switched to sheep production (Chatty, 1986). Camels were found only in six communities in Damascus, Homs and Deir-Ezzor provinces (community herd size 8, 20, 60, 100, 125, 600 and 700). Dairy cows, a sign of peri-urban livestock intensification, were found in six communities, of which four were in Damascus province (community herd size 1, 2, 18, 27, 30, 57). Goats represented 5% of the resident small ruminant population, and average community flock size was 360. Migrant goats were found in 21 communities with an average community flock size of 760.

Total community sheep population varied between 100 and 120,000 (Table 30). 80% of the sheep are mainly resident in the community, 10% are located outside but graze on community land and 10% never use community land. The size distribution of resident flocks was similar to the total flock population.

Table 30. Flock size according to (a) total number of sheep, (b) total number of resident sheep.

a) Total community sheep (all flocks)			b) Total community sheep (resident flocks)		
	Frequency	**%**		**Frequency**	**%**
100-1000	5	10	0	2	4
1000-5000	17	34	100-1000	5	10
5000-10,000	5	10	1000-5000	17	34
10,000-50,000	16	32	5000-10,000	9	18
50,000-100,000	4	8	10,000-50,000	15	30
100,000-120,000	2	4	50,000-100,000	2	4
Total	**50**	**100**	**Total**	**50**	**100**

Looking at flock size in relation to location (Table 31), we see that while households who migrated to the cropping zone have fewer sheep, only those who do not use the community land any more, have smaller flocks (statistically different) than the resident households. Similarly for flocks at other Badia sites: only the households not using the community land anymore have flock size statistically different from residents.

Table 31. Average flock size according to residence location.

	No. of obs	Mean	Std. Dev.	Min	Max	Ttest+
Community site						
Residents	48	215	276	27	1888	
Cropping zone						
Flocks using comm. land	18	162	187	15	800	
Flocks not using comm. land	8	67	78	10	216	**
Other Badiah site						
Flocks using comm. land	6	241	94	140	368	
Flocks not using comm. land	7	524	311	19	1000	**

+Equality of mean test with resident flock size
*Significant at 90%, ** significant at 95%, *** significant at 99%

Figs. 18 and 19 show the spatial distribution of sheep population. In absolute numbers, communities with the biggest sheep population are located in the center of the Badia. If we look at average flock size within the community, flocks are largest in the southern part of the Badia, with a peak near Homs.

In order to assess heterogeneity in livestock holding within the community, communities were asked to classify the community's flocks under four size categories (Table 32). On average the residents' flocks are equally represented in each of these categories, whereas the migrants have a greater representation of small flocks (less than 50 head for migrants in the cropping zone) and big flocks (>200 head, for migrants located in the Badia).

Table 32. Distribution of communities' flocks according to their size.

	Residents with flock (%), 48 obs		Migrants with flock (%), 27 obs	
Flock size	**Mean**	**Std. Dev.**	**Mean**	**Std. Dev.**
<50	25.7	25.0	34.7	45.6
50-100	21.0	14.1	21.7	34.0
101-200	23.9	17.4	13.3	22.6
>200	29.5	27.0	30.2	40.4

4.2.2. Flockless households

On average, 15% of the resident households did not own sheep. In 17 communities, all the residents owned sheep, but we found 13 communities where more than 20% of the residents owned no sheep; and three communities where 54, 68 and 85% of the residents owned no sheep. Among non-residents, 51% of 'cropping migrants' and 76% of 'Badia migrants' own a flock (Table 33). Households based in the cropping zone keep a strong grazing link with the community: 70% of the migrants and 76% of their sheep continue to graze on community land. Among Bedouin who established residence in other parts of the Badia, only half use the community land for their animals.

Table 33. Households with sheep according to residence location.

	Community site	Cropping zone	Other Badia	All sites
% households with sheep	85	51	76	69
% households using the community land among households with sheep	100	70	52	88
% sheep using community land	100	76	48	90

Relatively few households have abandoned sheep breeding in the past 5 years (7% on average). Half the communities had no cases of abandonment, but in one community 86% of households have stopped breeding sheep. Among those who abandoned livestock production, 68% stayed in the community instead of migrating.

In general, the households who have the smallest flock sizes are young people who left their parents to establish their own families and received from them a small flock. In the past, this small flock had a chance to grow larger, since the household and flock expenses were small. In the last 15 years, both expenses have increased; and it is mainly these households who abandon sheep breeding.

Table 34. Classification of communities according to abandon rate of sheep breeding.

% households abandoning sheep breeding	Frequency	%
0	26	52
0.1-5	6	12
5.1-10	7	14
10.1-30	5	10
30.1-86	2	4
Total	**46**	**92**

4.2.3 Variation in flock size during the past 20 years

The sheep population of Syria has tripled since 1975, mainly due to the expansion of barley cultivation in the steppe, and access to subsidized supplementary feeds. Since 1990, the trend is no longer monotonous and the population varies around 15 million (Fig. 32 in appendices). We can observe these variations from a quick historical assessment (Table 35).

Table 35. Community flock size variation over the past 20 years.

	Obs.	Mean	Min	Max
Flock size today	49	17,215	190	112,000
Flock size 5 years ago	50	14,395	300	70,000
Flock size 10 years ago	50	17,878	600	100,000
Flock size 20 years ago	49	12,056	600	50,000

4.2.4. Livestock production systems and feeding strategies

Some herders in the Badia practice full fattening. They buy lambs, fatten them, and sell them after a few months. In our sample, eight communities had some households who practiced this.

Several other production systems are also used. Some herders leave their lambs with the rest of the flock without fattening them (no lamb fattening) and spend money to feed ewes. Others take more care of lambs and fatten them (lamb fattening), following different ways with different costs. We distinguished six feeding systems based on these two categories and on feeding costs. Annual feeding expenses varied from 450 to 2500 SP per ewe, on average by community. Around 74% of the households surveyed fatten their lambs, while others were more extensive producers with lower costs (Table 36).

Table 36. Percentage of residents in each fattening system by community.

Fattening system	Obs.	% households (mean)	% sheep (mean)
NLF* cost < 500SP per ewe	50	3.21	2.96
NLF cost 500-1000SP per ewe	50	12.32	11.49
NLF cost >1000SP per ewe	50	10.92	10.45
LF* cost <1000SP per lamb	50	24.73	23.86
LF cost 1000-2000SP per lamb	50	45.30	46.51
LF cost > 2000SP per lamb	50	3.53	4.45

*NLF: No lamb fattening, *LF: Lamb fattening

4.3.5. Flock mobility

Most households stay on their site in winter. In a good spring, they stay to benefit from the best grazing of the year, but if the spring is dry in the community land, they move to other parts of the rangelands to find

better grazing. In summer and autumn, they move to the cropping area where they can find cheap grazing residues. Some of the households with small flocks prefer to stay on the site even in summer and autumn and use low-nutrient feed rather than to move.

The survey results were consistent with figures for the year 2004 (Table 37); 85% of the sheep that still used community land were based on their site in winter, and 73% in spring. In summer, half the sheep population moved to the cropping zone and 45% were still there in autumn. Other sites were marginally used in 2004: 5% of the sheep used neighboring land over the year, 10% were sent to another Badia site in spring; government reserves were used only by 3.5% of the sheep in spring.

Table 37. Flock movement – 2004 year.

		Winter		Spring		Summer		Fall	
Sheep location	**Obs.**	**Mean**	**Std. Dev.**	**Mean**	**Std. Dev.**	**Mean**	**Std. Dev.**	**Mean**	**Std. Dev.**
Community site	49	85.0	26.8	72.8	27.7	36.0	38.6	45.8	31.6
Neighboring site	49	4.3	15.5	5.7	17.7	4.5	16.3	4.4	17.7
Other Badia site	49	6.7	19.1	10.7	21.2	2.1	10.1	3.8	14.1
Reserve	49	0.0	0.0	3.5	11.3	1.0	5.1	1.1	5.3
Cropping zone	49	4.0	12.0	7.4	13.7	56.4	41.4	44.9	33.3

On average, the sheep spent 60% of the year on community land in 2004 (Table 38), 28% in the cropping zone and 10% in the Badia (outside their sites). The figures for households were very similar suggesting that most households follow their flocks.

Table 38. Location of resident households and sheep over the 2004 year.

		% households				% sheep			
Location	**Obs.**	**Mean**	**Std. Dev.**	**Min**	**Max**	**Mean**	**Std. Dev.**	**Min**	**Max**
Community site	49	62.0	24.3	0.4	100.0	59.9	23.9	1.1	100.0
Neighboring site	49	4.8	17.1	0.0	89.2	4.7	16.0	0.0	77.6
Other Badia site	49	4.0	11.3	0.0	75.2	5.8	12.8	0.0	71.6
Reserve	49	1.2	4.0	0.0	25.0	1.4	3.7	0.0	15.1
Cropping zone	49	28.1	21.4	0.0	89.4	28.2	20.8	0.0	78.7
Total		**100.00**				**100.00**			

The migration distance covered by Bedouin during the year varied considerably. Some moved as far as 300 km to another site in the Badia, or 400 km to cropping zone; while others moved much smaller distances. This underlines the fact that mobility behavior is determined largely by the location of the community. However, location does not influence the duration of flock stay in the cropping zone, this being correlated with the percentage of community land that was previously cultivated. This suggests that communities that earlier depended on barley cultivation have today added some grazing pressure to the cropping zone.

Apart from the cropping zone, households and their flocks might move to locations in the other rangelands. The factors that affect the choice of where to move, are the condition of the natural vegetation at that site, the relationship with the owners of the location, and whether they have the means to transport water. When moving to the cropping zone, choice of location is determined by availability and price of crop residues and proximity to drinking water.

Table 39. Distance and number of sites used by communities.

Variable	Obs	Mean	Min	Max
Neighboring site (number)	8	2.3	10	70
Other Badia (km)	16	94.2	10	300
Reserve (km)	5	6.0	00	15
Cropping zone (km)	34	195.1	20	400

The availability of grazing was an important factor in mobility decisions. We asked respondents to qualify rangeland availability (and rainfall) and then to evaluate the period and the number of households that were on the site for the 5 past years (Table 40). Almost every community considered the drought years 1999 and 2000 as very bad for grazing, while 2001 was evaluated as a good year by half the communities, and a medium or bad year by the other half; 2002/03 were considered medium years. Table 41 shows that the presence of households on their community land is strongly correlated to their evaluation of rangeland conditions. During the dry years of 1999 and 2000, 36% and 38.5% of households stayed in their communities on average (but there was considerable variation, from 2 to 96%). This number averaged 55-60% in the following years, although there were some communities where year-round presence was very low.

Table 40. Forage availability and presence on community land in the past 5 years.

	Grazing status (rainfall)				Households on sites (% year)			
Year	Very good	Good	Medium	Bad	Mean	Std	Min	Max
2003	1	11	37	1	59.2	26.1	9.1	100.0
2002	1	6	33	10	55.3	24.8	5.8	100.0
2001	1	27	7	15	57.6	29.4	1.7	100.0
2000	0	0	1	49	38.5	26.5	2.2	95.7
1999	0	0	0	50	36.2	24.9	2.2	95.7

4.3.6. Government reserve

Only seven communities said they had used a government reserve at least once (see Table 41). The main reason given by the other communities for not using a reserve is that they are too distant (82% of non-users). Other reasons were: reserves too crowded (9%), or located in communities where they have no access right (9%).

Table 41. Characteristics of the reserve used by 7 communities.

	Mean	Min	Max
Distance (km)	12.8	0	30
% households using	44.6	5.6	100
% sheep using	56.5	28.8	100
No. of months stayed	2.1	1	4

In normal years (average rainfall), government reserves might be opened for grazing or might not, depending on technical decisions. If they open, it would be difficult for a herder new to the zone to have access, even with the agreement of the Steppe Directorate, because he will face objections from local herders from communities surrounding the reserve. These households consider the reserve their own (exclusive access rights) because it was established on their traditional land. Consequently herders tend to avoid using government reserves if they are not located on their traditional land. The case is different when the spring is very dry. Local Bedouin will forego their traditional rights, out of sympathy, and permit access to the reserve. But the reserves then become crowded quickly and all green vegetation is soon exhausted.

4.2.7. Animal products and marketing

The *jabaan* is a professional cheese maker who usually comes from the cropping zone and not from the rangelands. His experience is mainly inherited from his father and he maintains relationships with specific rangeland communities for several years (up to 30-40 years in some cases). He also has long-term relationships with cheese dealers in the cities, who support him financially and purchase the cheese for resale. The cheese maker supports his Bedouin clients with short-term cash credits, which are repaid during the milking season. He moves with his family, just before the milking season starts, to the location where his Bedouin clients stay; and leaves once the milking season is over. Three-fourths of the 50 communities surveyed – and 88% of the residents in each community on average – dealt with the *Jabban* to transform and sell milk. These communities were located mainly in the central part of the Badia (Fig. 20).

Selling milk products directly on the market: this was done by 22% of the communities for yogurt products and 36% for cheese. The average distance to markets was 42 km for yogurt and 79 km for cheese (Table 42). Communities usually have different market options to sell animal products or buy inputs. Half the communities used more than one market to buy animal feeds, sell or buy animals. The choice of market can be motivated by availability of credit from feed dealers or by the size of the flock to be bought or sold: the nearest market is chosen to sell a few animals, and bigger, more distant markets to sell a batch of lambs at once.

The minimum distance to the market (remoteness of the community from towns or markets) represents the transaction cost faced by herders, whereas the maximum distance is more an indicator of how wealthy the herder is (big herders will cover greater distances).

Table 42. Distance (km) to markets for livestock inputs/products.

Markets	Obs.	Minimum distance			Maximum distance		
		Mean	Min	Max	Mean	Min	Max
Sell yogurt	11	42	9	80	–	–	–
Sell cheese	18	79	9	180	–	–	–
Buy animal feed	49	52	10	160	78	10	200
Sell lambs/ewes	49	83	10	250	119	20	255
Buy lambs/ewes	25	72	23	400	96	25	400

4.2.8. Animal health

Almost all flocks (99%) were reported to be vaccinated and treated against external parasite. These are probably over-estimates, as several diseases are affecting flocks. Enterotoxaemia and pox were the main animal diseases in the past 3 years and were mentioned by 82% of the communities. Next were foot and mouth diseases and pasterollosis, cited by 50% of the communities (Table 43). Other diseases that were mentioned are tape worms, flat worms and mastitis. Parasites were considered a problem in 88% of the communities.

Table 43. Most important animal diseases in the past 3 years.

Disease	No. of communities reporting
Enterotoxaemia	41
Pox	41
Foot and mouth disease	26
Pasterollosis	23
Tape worms	6
Flat worms	5
Mastitis	5

Grazing conditions affect animal health; half the communities reported that parasite occurrence was linked to poor grazing conditions (Table 44), and 88% of communities felt vaccinated animals were not doing well in poor grazing conditions.

Table 44. Grazing conditions and animal health.

If external parasites are a problem is it during	Freq.	%	Do vaccinated animals do well in poor grazing	Freq.	%
Poor grazing	20	45.45	No	44	88
Good grazing	4	9.09	Yes	4	8
Both	20	45.45	No change	2	4
Total	**44**	**100**	**Total**	**50**	**100**

4.2.9. Flock management

Normally, during the mating season, a big percentage of the ewes need to be mated within a very short period. In such cases, herders will borrow rams from other herders; 46 communities reported that households shared rams if one herder did not have enough. But sharing rams on the basis of their performance was not common, and only six communities said households shared rams if one was known to be particularly efficient.

The bone contract system was common some decades ago, but is rarely found nowadays. Investors from cities like Aleppo and Hama would make contracts with Bedouin to breed sheep and share the profits. The investors would provide all the capital and related expenses (including feed costs), while herders would provide labor. The investors would take a share from the selling of lambs, and the flock would be divided in two parts after a certain number of years. But after a succession of dry years, when investors made big losses, these investments stopped. Only three herders, in one community, were involved in bone contracts.

Tajra has replaced the bone contract. *Tajra* occurs only in good years and for a few months. The investor buys either lambs or a whole flock which are maintained in the rangeland, benefiting from free grazing. Before winter, everything is sold and the profits shared. In a bone contract, it will take at least 4 years for the investor to recover his expenses; in *Tajra* profits are realized after 6 months. In 2004, 17 households in four communities were involved in such contracts.

4.3. Institutions

4.3.1. Governance

Two-thirds of the communities surveyed were governed by a leader, 26% by a committee and 4% by both. In one community, decisions were taken collectively by all households (no leadership). Committees are mainly present in the north border of the Badia and in Homs and Damascus provinces (Fig. 21). In the past, the leader had almost unlimited influence: when he took a decision, no community member could oppose it. Today, the leader usually takes decisions after consulting the majority of community members.

The leader is mostly chosen traditionally (Table 45). The commonest type (43%) was a tribal sheikh, but other characteristics are appreciated, such as political background, wisdom or education. In 68% of cases, the leader was the son of the previous one, and communities followed a dynastic tradition. Traditionally, the leader is chosen from the same extended family. When the leader dies, the new leader might be a brother or direct cousin, if there is no son or the son is not able to replace him.

Table 45. How was the leader chosen?

	% of answers
Tribal sheikh	43.08
Political background	18.46
Education	15.38
Wisest	13.85
Most active	7.69
Good relations with people	1.54
Total	**100**

Table 46. Relationship with the previous leader.

	Frequency	%
Father	24	68.57
Same tribe	4	11.43
Same family	2	5.71
Same group	1	2.86
Brother	1	2.86
Other	3	8.57
Total	**35**	**100**

The average age of the leader was 53; 12 of the 36 leaders had no education, while 61% of them could read and write or had an intermediate education level (until Brevet). Most leaders had other responsibilities, e.g. head of the cooperative (50%) or other political responsibilities (23%).

In 37.5% of cases, the leader had a smaller flock than the average household (community residents flock size divided by total residents). Another 37.5% of leaders had flocks more than double the average size.

Table 47. Education level of the leader.

	Frequency	%
No education	12	33.33
Literate	8	22.22
Intermediate	14	38.89
Baccalaureate	1	2.78
University	1	2.78
Total	**36**	**100**

Table 48. Ratio of flock size, leader vs average household.

	Frequency	%
0-1	12	37.5
1-2	8	25
2-3	8	25
>3	4	12.5
Total	**32**	**100**

Fifteen of the 50 communities were led by a committee composed of 6.8 members on average. The committee size ranged from 2 to 15. The members were chosen mainly for their political background (19%), wisdom (19%), education (16%), age (16%), and according to tradition (16%). The age of the members ranged from 20 to 103, but on average, the youngest was around 44 and the oldest around 75 years old.

Table 49. Main criteria for committee membership.

	% of answers
Political background	19.35
Wise	19.35
Tradition	16.13
Education	16.13
Oldest	12.90
Active	6.45
Treats others well	6.45
Religious	3.23
Total	**100**

4.3.2. Leadership activities

In order to assess the roles of leaders and committees, respondents were asked to assess the easiest and more difficult tasks within a list of five main tasks (Table 50). Solving conflicts within the community and with neighboring communities, and influencing their own people, were considered the easiest tasks by 90, 84, and 88% respectively of the communities. Lobbying for public services (electricity, water) and protecting the community boundaries from outsider herders were considered more difficult. Leaders that are successful in

these two activities are the ones with good relations with the authorities, and are respected by other communities as well.

Table 50. Main tasks of the leader/committee.

	Obs.	Mean*
Arrange services	46	0.22
Solve conflicts within the community	49	0.90
Solve problem with neighboring community	49	0.84
Influence his own people	48	0.88
Protect grazing borders	48	0.38

*0 = more difficult, 1 = more easy

It is interesting to note that communities led by a leader generally found tasks easier to accomplish than did communities governed by a committee (Table 51). It might be easier for one man to take decisions than for a committee to discuss, agree, vote etc.

Table 51. Average ease/difficulty rating of tasks rate in communities governed by leaders versus committees.

	Leader	Committee	ttest
Obs.	34	16	
Ease/difficulty score*	0.69	0.56	**

* Each of the 5 tasks was rated on a 0-1 scale. Ease/difficulty score is average of these five scores

To examine whether the communities were well represented at official government level, the leaders/committees were asked if they attended the Homs conference which was organized by the Syrian Ministry of Agriculture in January 2004; 25% of the communities were represented at that meeting.

4.3.3. Projects

Rangeland projects

Seventeen communities were involved in rangeland rehabilitation/preservation projects, e.g. the WFP 10070 project or the IFAD rangeland rehabilitation project. Section 3.1 described the area of operation and potential impact of these projects. This section focuses on their functioning.

Within the community, the beneficiaries (households with grazing rights to the shrub plantation) are either the residents with sheep or the residents plus migrants who still use community land. In two cases, the actual beneficiaries were a sub-group of the above. In one community, the beneficiaries included all 100 households, although only 36 owned sheep. Looking now at the actual users of the plantation, we found that six plantations were open for grazing in 2004, three of which were used by a very small group among the potential beneficiaries. This could be explained by several reasons: the reserve was open while most households were outside the community land, a group of powerful households dominated access, or many potential beneficiaries did not use the reserve because they were not convinced of the benefits.

In most cases (79%), the reserves are protected by a guardian, paid by the project. They are opened for grazing usually 2 years after shrubs are planted, after a technical decision – and subsequently used open-access or according to a management plan elaborated by official supervisors and the community (Table 52). It is difficult to evaluate the impact with so few observations (8 plantations currently in use). However, the land in the three reserves that provide open-access grazing has not improved; but it has improved in cases where the reserve is grazed for restricted periods.

Table 52. Reserve management and land quality.

	Grazing today			
Condition today	**No**	**Conditional**	**Open**	**Total**
Worse	0	1	0	**1**
Same	6	1	3	**10**
Better	1	3	0	**4**
Total	**7**	**5**	**3**	**15**

Other projects

Besides plantation of shrubs, these two projects propose other activities, like improving infrastructure (roads and drinking water), basic literacy, education in land management, and income generation (sewing training courses for women). Other development projects also operate in the Badia, e.g. Agha Khan association, Annebeh cooperative, farmer/women's unions and the Syrian Cultural Center (Table 53).

Table 53. Development projects in the Badia.

Name of organization	**No. of projects**	**Activities**
Rangelands rehabilitation project	9	Adult alphabetization, sewing training for women, Roman cistern rehabilitation, nursing, paved road
Agha Khan Foundation	2	Sheep breeding, mushrooms, looking for underground water
Annebeh cooperative	1	Lobbying for infrastructure
FAO	1	Education, sewing training
Farmers union	1	Adult alphabetization
Steppe directorate	1	Training in pasture management
Syrian Cultural Center	1	Adult alphabetization
Women's union	1	Sewing training
Total	**17**	

4.4. Rangeland resources and property rights

Before the introduction of hand feeding in the mid-20th century and of the mechanization of transport, the mobility pattern of the pastoralists was perfectly matched to access and availability of forage and water. Today, animal mobility is less dependent on these resources, although they still play a critical role in herders' production strategies.

4.4.1 Grazing linkages

Every community in the rangelands has its own traditional boundaries, which were established and evolved according to the agreements reached among the tribes in the past. Reciprocal grazing agreements were also created to facilitate 'opportunistic grazing' given the variable climatic conditions. Also, 40 out of the 50 surveyed communities have some grazing linkages with other communities in the Badia or in cropping zones.

Communities commonly share grazing resources with a neighboring community: 68% of the communities with at least one link had grazing linkages with 3.8 neighbors on average. But sharing was more common among communities which belonged to the same tribe and had good relations. The relations are mainly reciprocal (Table 54).

Relations were more limited with distant communities: 23% of the 40 communities were connected with other Badia communities, 28% with the traditional lands (large area belonging to the tribe, that is not necessarily composed of communities) and 30% with villages in the cropping zone (Table 55). Interestingly, relationships with other communities and villages are unilateral: either the community sends its animals there or it receives animals from them (Table 56). Links with the traditional land are either reciprocal or unilateral (the community sends its animals there).

Table 54. Type of grazing relations with other communities (40 communities).

	Mean	Std Dev
Type of communities		
Neighbors	67.5	47.4
Other Badia communities	22.5	42.3
Traditional land	27.5	45.2
Cropping zone villages	30.0	46.4
Unwelcomed	60.0	49.6
Type of link		
Welcomer	50.0	50.6
Sender	42.5	50.1
Reciprocal	52.5	50.6

Finally, even if communities' boundaries are not officially recognized, many communities try to protect their grazing area during good and medium years, but not in dry years. Successful protection of the land depends on how strong the community is; 20% of the surveyed communities felt they were able to exclude outsiders, while 60% of the 40 communities with grazing linkages received unwelcome flocks on their lands in the past 10 years. The major reason for the inability to protect their lands is the current Badia tenure (open access). One community said the police sided with the trespassers, another said it was too weak to control its land.

Table 55. Type of 'partners' and grazing relation (observations=linkages).

	Neighbours		**Other communities**		**Traditional land**		**Cropping zone**		**Unwelcomed**	
	Freq.	**%**	**Freq.**	**%**	**Freq.**	**%**	**Freq.**	**%**	**Freq.**	**%**
Welcomer	8	20.0	5	**45.5**	0	0.0	6	**46.2**	37	**100.0**
Sender	6	15.0	4	**36.4**	11	**52.4**	4	**30.8**	0	0.0
Reciprocal	24	**60.0**	1	9.1	9	**42.9**	1	7.7	0	0.0
Missing	2	5.0	1	9.1	1	4.8	2	15.4	0	0.0
Total	**40**	**100.0**	**11**	**100.0**	**21**	**100.0**	**13**	**100.0**	**37**	**100.0**

Apart from outsider flocks grazing on community land for a certain period, every community's land (except one) is regularly crossed by external flocks. Rough estimates suggest that more than half the surveyed communities are crossed by 20,000 sheep on average per year.

Table 56. Number of animals crossing community land every year.

	Frequency	**%**
0	1	2.2
<1000	4	8.9
1000-5000	4	8.9
5000-10,000	4	8.9
10,000-20,000	7	15.6
>20,000	25	55.6
Total	**45**	**100**

4.4.2. Water

Access to water sources is a critical factor in the Bedouin's strategies. Communities accessed water from two sources on average (with a maximum of 5 sources). The main water points found in our survey were wells, present in 92% of the communities (Table 57). Roman cisterns were found in 30% of the communities. These cisterns were dug during Roman times to collect rainwater, and were rehabilitated and used by the Bedouins. Other sources of water are surface water from lakes or the Euphrates river or the irrigation channels of the Euphrates government irrigation projects, for communities situated nearby.

Table 57. Type of water point accessed by communities.

Type of water point	Water points		Communities	
	Frequency	%	Frequency	%
Wells	76	68.5	46	92.0
Roman cistern	16	14.4	15	30.0
Lake/river	11	9.9	11	22.0
Others	8	7.2	8	16.0
Total	**111**	**100.0**		

How hard is it to access this water, how much does it cost, and what is the quality of the water? These factors make drinking water a key problem in the Bedouin production system. Water is transported from distance up to 75 km. Some Bedouin have to fill their tank several times a day in order to water their flock. The cost of water depends on distance from source, and the largest components are fuel expenses and tractor maintenance cost. Water from government wells is free whereas water from a private well costs 25 SL/m^3. In our sample, 29 communities had a water point on their site and 12 of them had enough water *in situ*. For the others, the minimum distance to water points was 18 km on average (maximum 65 km). The furthest water points accessed by herders were 31 km from the site on average (maximum 75 km). Most communities used government water points (70%), or water points owned by individuals (60%). Water points owned by a group or by a community were scarcer (8% and 18% respectively).

Table 58. Minimum and maximum distance of water point from community site.

(km)	Minimum distance		Maximum distance	
	Frequency	%	Frequency	%
0	29	58	12	24
0-10	10	20	10	20
10-30	10	20	12	24
30-50	1	2	10	20
50-75	0	0	6	12
Total	**50**	**100**	**50**	**100**

We calculated an index of water scarcity[1] based on the distance and the number of months without water in the water point, and classified the communities accordingly. The results showed that 56% of our sample did not have problems of accessing water, 38% could access it quite easily, while 6% of communities had a serious problem.

Table 59. Water scarcity index.

	Frequency	%
Abundant	28	56
Available	19	38
Less accessible	1	2
Rare	2	4
Total	**50**	**100**

Finally, it was reported that sulfuric and salty water is a problem in many wells, both government and private. In addition, the harvested rainwater is polluted.

1. *Water scarcity index* = $\frac{\Sigma\,(\text{distance of water point} * \text{no. of months without water})}{\text{No. of water points in the community}}$

4.5. Well-being indicators

4.5.1 Community assets

Transportation in the rangelands is an essential asset, since public transport does not exist. Households need a vehicle mainly to transport drinking water, and also to transport purchased feed, lambs to market, or to transport the family and goods when they move from one place to another. On average, 20% of households owned a tractor, 21% a lorry, and 15% a car. A water tank is also an important capital item. Only 18% of the households owned a mobile tank, but 65% had a fixed tank. Very few communities share these assets between households. Tractors were shared in six communities, mobile tanks in two communities, and fixed tanks in four communities. This kind of sharing is generally on specific occasions and occurs mainly among brothers.

Table 60. Assets per household by community (% households with assets).

Variable	Obs	Mean	Max
Tractors	49	20	100
Mobile tank	49	18	100
Fixed tank	49	65	111
Lorry	49	21	100
Car	49	15	117
Motorcycle	49	17	100
Satellite dishes	49	5	46

4.5.2 Infrastructure and services

In terms of infrastructure, 20 communities had electricity and 19 communities had a paved road passing through their site. The other communities were mostly situated 1 to 20 km from the paved road, and in one exceptional case, 90 km from a paved road. Note that the existence of a paved road close to a community, does not mean this road reaches the different locations (water sources, markets etc) where the Bedouin need to go.

Table 61. Distance to paved road.

	Frequency	%
0	19	41.30
0-10	21	45.65
10-25	5	10.87
90	1	2.17
Total	**46**	**100**

Providing for households needs like food, fuel and other items of daily consumption, consumes considerable time and expense, since markets are far away; 23% of the communities did have 1 or more shops, but on average the communities were 48 km from the nearest Souk, and about the same distance from the nearest town. Schools were located *in situ* in 70% of the surveyed communities. The 14 communities without a school were 22 km on average from the closest school. Health facilities were located in the closest town, on average 53 km, and veterinarians within 42 km.

Table 62. Distance to services.

		Minimum distance (km)			Maximum distance (km)		
Distance to	Obs.	Mean	Min	Max	Mean	Min	Max
Souk to buy items	47	48	9	100	65	90	200
Closest town	50	52	9	100	–	–	–
School	14	22	1	70	–	–	–
Health center	50	53	3	140	61	3	200
Veterinarian	43	42	7	90	46	7	130

4.5.3 Financial indicators

Most households were cash-constrained. In order to overcome this problem, they obtained credit, in cash or inputs, from different sources – the cooperative, the cheese maker, feed dealer, cheese dealer, money lenders, grocers, sheep dealers, and others. The communities were classified according to the financial status of their households. The results show that 78% of households were indebted in 2004 (in most communities, over 80% of households were in debt), and on average, 36% of them could not pay back their debts in the same year (Table 63).

Table 63. Classification of communities according to the financial situation of their households.

a) % of indebted households in 2004			**b) % of indebted household who could not pay back**		
(%)	**Frequency**	**%**	**(%)**	**Frequency**	**%**
0-20	1	2.04	0-20	1	2.08
20-40	1	2.04	20-40	4	8.34
40-60	4	8.16	40-60	5	10.42
60-80	5	10.2	60-80	8	16.67
80-100	38	77.55	80-100	30	62.5
Total	**49**	**100**	**Total**	**48**	**100**

Households start to get loans in late autumn and pay back by the middle of summer. The most critical period for cash is in winter, when expenses for the flock and the house are highest, and when there is no output. If the household runs out of credit during this period, the only way to get cash is to sell some ewes with their lambs – lambs alone cannot be sold since they are not yet separated from their mothers. Selling ewes with their lambs is undesirable, and herders try their best to avoid this. However, in 30 communities more than 80% of the residents were forced to do it. In 20 communities, 14.7% of residents were about to lose their flocks at the time of the interview.

Table 64. Percentage of residents who were about to lose their flock.

(%)	**Frequency**	**%**
0	29	59.18
0-20	18	36.73
20-50	2	4.08
Total	**49**	**100**

4.6. Social cohesion

4.6.1. Conflicts

Conflicts about rangeland resources are an important factor to consider when addressing rangeland management. However, they are very difficult to assess. Only six communities shared with the survey team the conflicts they experienced. Three cases were related to grazing by outsiders. When the range is of good quality, the community will receive a number of outside flocks, and clashes might result. In one case, the protected community shrub plantation was invaded. Two other conflicts were related to land boundaries, and whether land titles were valid after the cropping ban. An old case (1962) concerned barley grazing by villagers from the cropping zone, and ended in one death.

4.6.2 Social cohesion

Most of the communities established themselves in the Syrian rangelands in the past based on tribal and blood relationships. In Bedouin communities, cohesion is highest when the relationship is close (brothers or cousins), but it gets weaker as the relationship becomes extended. Communities were asked to assess the cohesion within different social units. As Table 65 shows, cohesion levels in group, community, *Fakhed* and tribe, were rated 3.06, 3.10, 3.04, and 3.00 respectively, which is good. There are no large differences between the different social levels, suggesting that cohesion is more dependent on other factors, e.g. the

number of households (small or large community), the blood relation among households within the community, existence of subgroups, the geographic location of the different communities which belong to a *Fakhed* or tribe (far away or nearby), and whether or not sheep breeding is the main source of income for most households in the community (if the importance of sheep breeding decreases, cohesion also decreases).

In the case of the mother community, cooperative, and Federation, the average cohesion level was 2.96, 2.76, and 2.47, which is between medium and good. This is slightly lower than the cohesion at other social levels, because mother communities and cooperatives are often composed of communities that do not share blood relationships. Cohesion levels varied from bad to very good due to factors like historical relationships (bad or good), belonging to different tribes or Federation, competition for water and grazing resources, etc.

Table 65. Cohesion level within different social structures.

Social unit	Obs	Mean*	Min	Max
Group	36	3.06	2	4
Community	49	3.10	2	4
Mother community	49	2.96	1	4
Cooperative	46	2.76	1	4
Fakhed	45	3.04	2	5
Tribe	44	3.00	2	4
Federation	17	2.47	2	3

*1=Bad, 2=Medium, 3=Good, 4=Very good, 5=Best

The Federation had the lowest cohesion level, because the many tribes that compose a Federation spread out over wide geographical area, and in most cases, do not share blood relationships. The Federation has lost its importance once the government made rangelands open-access. Cohesion varied from medium to good depending on grazing benefits and whether or not they could be exchanged.

4.6.3 Networks

Within the community, we looked at who undertook the main activities (Table 66). Most activities were undertaken with the brothers or the neighbors – particularly flock movement, herding, milking and milk processing, purchases from market, sharing feed transport expenses, sharing water purchases, vaccination, getting cash and feed credits, paying the sheep tax. Other interesting cases were:

Water transport: households will cooperate first with their neighbors and, then decreasing progressively from brothers, to group, community and *Fakhed*.
Shearing: when it is still done collectively it is a community activity, where brothers, neighbors, and the group will also be associated.
Weddings and funerals: the community comes first, then friends, neighbors, brothers, the *Fakhed*, the group, and the tribe. The differences among the categories are small, i.e. social relationships are still strong even with the tribe.
Deyeh: this tradition of paying blood compensation still exists. It earlier occurred at tribe level, but is now mainly applied at the *Fakhed* level. In some communities, the brothers or the group will pay the compensation.

Table 66. Level of cooperation according to activities undertaken (% of communities where activity was undertaken in cooperation with the respective person or group)

	Brother	Group	Community	Neighbor	Fakhed	Friends	Tribe
Flock movement	79.59	55.10	57.14	61.22	28.57	0.00	0.00
Herding	34.69	22.45	22.45	28.57	10.20	0.00	0.00
Water transportation	61.22	46.94	40.82	67.35	22.45	0.00	0.00
Milking and processing	59.18	40.82	34.69	57.14	18.37	0.00	0.00
Shearing	24.49	16.33	30.61	18.37	2.04	0.00	0.00
Souk	71.43	48.98	51.02	53.06	14.29	2.04	0.00
Feed expenses	40.82	36.73	34.69	40.82	10.20	0.00	0.00
Water expenses	2041	16.33	12.24	20.41	8.16	0.00	0.00
Vaccination	67.35	51.02	44.90	63.27	16.33	2.04	0.00
Credit	77.55	53.06	55.10	63.27	22.45	2.04	0.00
Sheep tax	30.61	26.53	16.33	24.49	14.29	2.04	0.00
Wedding	69.39	61.22	87.76	71.43	65.31	87.75	28.57
Funeral	75.51	65.31	93.88	77.55	67.35	79.59	32.65
Deyeh	20.41	22.45	22.45	10.20	71.43	0.00	20.41

When these activities are aggregated, we see that most activities are undertaken with brothers, with neighbors and with members of the community. The groups are represented in 40% of activities (49% for communities composed of several groups).

Table 67. Importance of each actor in collaboration.

% of activities undertaken with	Obs	Mean	Std. Dev.	Min	Max
Brother	49	51.29	*28.00*	0.00	92.86
Group	49	39.43	*30.57*	0.00	92.86
Community	49	42.29	*24.67*	0.00	85.71
Neighbor	49	46.00	*22.75*	0.00	85.71
Fakhed	49	26.00	*24.87*	0.00	85.71
Friends	49	12.29	*5.73*	0.00	28.57
Tribe	49	5.71	*7.70*	0.00	21.43
Father	49	0.14	*1.00*	0.00	7.14

V. HOUSEHOLD CHARACTERISTICS

In this section, we present the main characteristics of the Bedouin households and their sheep production system. Data were collected from 313 livestock producer households and 38 households without sheep.

5.1. Household composition

The average age of the household head was 50 years for households with sheep and 43 years for households without sheep. This age varied from 16 to 105, but was 35-55 years in 41% of cases. Households contained 10 members on average, (11 for households with sheep, 7 for those without) of whom 4.8 were children less than 10 years old. Women represented almost half the number of adults in households with sheep and 43% in households without sheep (Table 68).

Education is a crucial issue in the Badia. The lifestyle of the Bedouin and their isolation make it difficult to reach these households. Education is given either in the community (70% of communities), if it is big enough to have a school, in cities, or other communities – which can be quite far away (from 1 to 70 km). On average, the proportion of educated members over ten years old was 38% for households with sheep and 28% for households without sheep. Of the households interviewed, 25% had no educated adult members.

Table 68. Descriptive statistics on family composition.

	Mean				
	Households with sheep	**Households without sheep**		**Min**	**Max**
Age of household head	50.2	42.6	**	16	105
Family size	11.1	6.8	**	1	42
No. of children under 10	4.2	2.4	**	0	22
% of women among adults	50.1	42.7	**	0	100
% of educated member	38.5	27.7	*	0	100
No. of observations	313	37			

*, ** Mean statistically different at 95% and 99%

5.2. Activities and assets

Off-farm activities represent good opportunities to manage risks, particularly for the Bedouin, who are highly subject to climate fluctuation. However, only 35% of our sample, and 29% of the sheep breeders, were involved in off-farm activities. This can be explained by the lack of opportunities in the Badia, being remote from cities. Communities close to the Badia line, near the cropping zone and cities, are more likely to get such opportunities. Off-farm activities include agricultural labor (36% of the households with off-farm income), other labor (50%), sheepherding (8%), government employment (teachers) or transport services.

About 23% of the households practiced cropping. While only 5% of households owned a piece of irrigated or rainfed land in the cropping zone (a single case of share-cropping was found), 17% owned a piece of irrigated land in their community in the Badia.

Almost all households owned one (73%) or several houses (17% of households had 2 to 7 houses). This reflects a strong trend toward sedentarization of the Bedouin over the past 50 years. Nomadic Bedouin (without a fixed home) are more and more rare, even if 67% of Bedouin still use a tent when they move. Other assets were also reported: 40% of households owned water tanks, 34% owned tractors, 30% had a vehicle, and 20% had a motorcycle.

Table 69. Activities and assets indicators.

	Households with sheep	Households without sheep	
Activities			
Off-farm work	29.4	78.9	**
Cultivation (on-site)	18.2	7.9	*
Cultivation (off-site)	5.4	5.3	
Equipment			
House	89.1	89.5	
Tent	72.2	23.7	**
Tractor	36.1	7.9	**
Water tank	46.6	10.5	**
Vehicle	32.9	7.9	**
Motorcycle	20.7	21.1	

5.3. Flock size history

The average flock size in the Badia was 200 heads of ewes in 2004. However, 30% of herders had less than 50 sheep and half of them less than 100 sheep.

Table 70. Flock size distribution (2003).

Flock size	Freq.	%
1-49	90	29
50-99	65	21
100-199	58	19
200-350	51	16
>350	49	16
Total	**313**	**100**

Table 71. Max/min flock size ratio according to minimum flock size, 1993-2004 period.

Min flock size	Ratio max/min
1-49	4.9
50-99	3.9
100-199	3.1
200-350	3.0
>350	2.6
Average	**3.9**

Flock sizes fluctuated between 160 and 425 over the past 10 years (Table 70) and on average, the maximum was four times the minimum over the past 10 years (Table 72). This ratio varied according to minimum flock size; but large flocks (over 350 head) have multiplied 2.6-fold.

Table 72. Flock sizes, 1993-2004 period.

	Mean	Std. Dev.	Min	Max
Flock size Dec. 2003	218.1	378.2	1	4000
Maximum flock size	424.2	613.5	5	4000
Minimum flock size	162.3	308.6	0	4000

Flock size varies according to climatic conditions. We can clearly see the impact of the 1999-2000 drought: one-third of the Bedouin reach maximum flock size in the years 1998-99. However, one-fourth reached maximum flock size during the year of the survey. This group was composed of young herders who entered the activity recently, and herders who were not very vulnerable to climatic shocks.
Surprisingly, 50% of herders reached their minimum flock size (over the past 10 years) during the year of the survey. These herders had on average 2.5 times less animals than herders who experienced flock reduction in 1999-2000, suggesting that they might not have been able to restock since that time.

5.4. Livestock production system

The main income-generating activity of the Badia herders is the sale of lambs and milk products. Lambs are fattened by different methods, which have different costs. Male lambs are generally weaned after 3 months and fed away from their mothers. 53% of the herders fattened part or all their lambs in 2004. We classified production systems according to lamb fattening and feeding costs as shown in Table 73.

Table 73. Classification of households according to livestock production system.

Production system	Frequency	%
NLF* <500 SP	2	0.6
NLF 500–1000 SP	38	12.1
NLF >1000 SP	105	33.5
LF* <1000 SP	108	34.5
LF 1000–2000 SP	53	16.9
LF >2000 SP	7	2.2
Total	**313**	**100.0**

*NLF: No Lamb Fattening, cost to feed ewes. LF: Lamb Fattening, cost to fatten lambs

Most of the herders who did not fatten their lambs had high feeding costs for their ewes, around 1500 SP on average. Herders who fattened their lambs generally had fattening costs below 1000 SP per lamb and a feeding cost per ewe of 1600 SP on average. In addition to feeding expenses, production costs include water, veterinarian, and sheepherder cost if there is one. As shown in Table 74, annual costs per animal are variable, but 1000-3000 SP in 80% of the cases.

Table 74. Annual production costs per animal, household level.

Costs (SP)	Frequency	%
500-1000	24	7,7
1000-2000	160	51,3
2000-3000	99	31,7
3000-5000	26	8,3
>5000	3	1,0
Total	**312**	**100.0**

The aggregated feeding cost per ewe at the community level is mapped in Fig 23. Costs are highest in two zones: Aleppo province and the center of the Badia.

Another practice is to buy young lambs, fatten them and sell them on the markets after a few months. Eighteen households in our sample practiced full fattening; one among them did not have a regular flock.

5.5. Feeding calendar

To understand Bedouin's breeding strategies, it is useful to look at the feeding calendar, which summarizes the animal diet every month. Aliments were separated into seven types, but there was confusion between the different types of grazing, so we finally merged them into four types: i) grazing in the Badia, ii) grazing post-harvest crop residues in cropping zones, mainly barley and cotton stubble, iii) high-energy concentrates (e.g. barley broken, cotton seed cake) that are relatively expensive, iv) low-quality concentrates (straw), that are less expensive. Concentrates are used when grazing is poor, generally during the dry months; or to improve the productivity of the flock.

Fig. 24 clearly shows the seasonal pattern in sheep alimentation in the Badia. During winter, there is no grazing, and there are no more residues on the cropped lands, therefore flocks rely on concentrate for the full 3 months. With spring and the regeneration of vegetation in the Badia, grazing of native rangelands is the most important source of alimentation from March to May. As we will see later, some households continue to use concentrates in spring, when grazing is at its best. Then comes summer, which is the driest part of the year. Bedouins move into the cropping zone, after barley harvesting, and stay there for several months. From June to August, crop residues constitute the main alimentation. However, some households stay in the Badia and use supplementary feed. Then, during autumn, residues become rare (except cotton residues) and herders increase the use of concentrates.

Even if the results are not representative at the province level, it is still interesting to observe results by province, as shown in Fig. 25, while interpreting the results with caution. Some differences appear in the feeding patterns that can be explained by two factors. First, geographical location: communities in Aleppo, Hama and Raqqa provinces are closer to the Badia line than others, and find it easier to go to the cropping zone to access crop residues during dry seasons. This is why crop residues are more important in those areas than in Homs and Deir-Ezzor provinces. Moreover, communities residing near the Badia line were more dependent on cultivation (before the ban on cultivation) compared to other communities, and they might have retained close relationships with the cropping zone.

Deir-Ezzor province is situated on the Euphrates river and in the fertile *Al Jezireh* area within the Fertile Crescent. These communities were more dependent on cultivation than in Homs for example (on average, 66% of areas visited in this region were previously cropped, Table 75). Furthermore, we observed during the interviews that some lands are still cultivated in this region. This explains why herders in Deir-Ezzor are more dependent on crop residues than in Homs. In Homs and Damascus, households depended more on grazing, and interestingly, previously cropped areas were less important (24% and 22% respectively).

Table 75. Percentage of communities' previously cropped area (average by province).

	Obs.	Mean	Min	Max
Aleppo	4	**66**	30	100
Hama	6	**58**	0	95
Damascus	10	**22**	0	51
Homs	14	**24**	4	51
Deir-Ezzor	4	**65**	29	100
Raqqa	12	**62**	1	100
Total	**50**	**43**	**0**	**100**

5.6. Mobility

Questions were asked about the duration of residence in the site in the past six years. Fig. 26 shows the average residence duration in the site for the whole sample, and a clear seasonal trend of mobility. Mobility depends heavily on climatic conditions; herders generally spend the winter on the site even if grazing is not yet available, mainly because they have nowhere else to stay. They also stay most of spring when grazing is best. They then leave the community land gradually in summer and autumn. Besides the seasonal variations, patterns also change between years. The years 1999 and 2000 were very dry, while 2003 and 2004 were considered as good rainfall years. Fig. 27 shows that households spent more time on their site in good years than during bad years.

It is also interesting to observe mobility patterns between provinces. In Aleppo for example, variation of stay was higher between years than in other regions (Fig. 28). In contrast, herders from Damascus province seem less sensitive to climatic conditions. Communities near the Badia line have more opportunities than others in case of poor grazing. Another explanation is that Bedouin still follow traditional mobility patterns. Traditions vary among tribes, depending on former activities and other factors. Some tribes were mainly camel breeders, others specialized in sheep breeding, others invested in cultivation (semi-nomads) (Métral, 2006). Communities therefore had different migration patterns, and this could explain the differences we find between the regions today.

If we compare mobility patterns during good and bad years (Figs 26 and 27), we observe how herders react to climatic variations between the regions. The greatest variations are generally in spring and summer. As explained above, herders depend more on grazing in spring; and in bad years, they have to leave earlier to find other sources of feed. Once again, we observe that herders from Aleppo have very different strategies from other herders and have higher variability in mobility. In Hama and Raqqa provinces, Bedouins have similar behavior; most of them spend winter on the site, but leave during summer, in both good and bad years.

In the same way, we observe similarities between Deir-Ezzor and Homs provinces, which are both situated far away from the Badia line. Herders in these provinces spend more time in the Badia than others (except those from Damascus) and are more likely to stay on the site all the year if the previous year was good. They are thus more dependent on Badia resources. The difference in strategy between good and bad years was the smallest in Damascus province.

5.7.1. Meat off-take

The average off-take rate was 83% for of male lambs and 20% for female lambs; 61% of households sold on average 6.5% of their ewes. Two households sold their entire flock in 2004.

Table 76. Marketed off-take rate, 2004.

	Mean	Min	Max
Male lambs sold (%)	83.0	0	100
Female lambs sold (%)	19.5	0	100
Household sold ewes (dummy)	0.61	0	1
Ewes sold (%)	6.5	0	100

The average price for a male lamb was 3900 SL, varying between 1000 to 6000 depending on age, weight and general condition, as well as location of the market. Fig. shows that prices are highest in Aleppo and Hama provinces and in the center-south of the Badia; and lowest in Deir-Ezzor province. Note that this map correlates closely with average feeding cost per ewe.

5.7.2. Milk off-take

It was difficult to evaluate milk production. On average the ewes produced 43 liters of milk products, but the figure is highly variable and must be taken with caution. The marketing period lasts 3 months on average and is strongly correlated with the fattening activity: the marketing period for milk products is longer for Bedouin who fatten their lambs.

5.7.3. Wool off-take

Almost all households exploited the wool from their ewes (Table 77); 61% of households sheered their ewes for self-consumption and 68% sold the wool, for an average price of 32 SP/kg. On average, households that sheer ewes for markets extracted three times more wool per ewe than self-consumption sheerers. If self-consumption is evaluated at the community average price, we find that households in the Badia received on average 2200 SP for wool production in 2004.

Table 77. Wool exploitation.

	Frequency	%
No wool exploitation	6	1.9
Wool self-consumed	97	31.0
Wool sold	118	37.7
Wool sold and self-consumed	92	29.4
Total	**313**	**100.0**

5.7.4. Animal productivity

As a preliminary analysis, several indicators of flock productivity were aggregated using a principal component analysis in order to create a comparative index (Table 78). A high productivity index is associated with a high lambing rate and a low mortality rate.

Table 78. Results of factor analysis for productivity index.

Productivity measure	Mean	Weight coefficients
Milk productivity per ewe and per year	38.03	–0.013
Lambing rate (born lambs alive/ no. of productive ewes)	0.88	0.579
Lamb mortality rate	0.11	–0.364
% of ewes that gave birth twice	0.02	0.045

Eigenvalue 1.49, Variance explained 97%

The average was computed at the community level and then spatially interpolated over the Badia (Fig. 30). Productivity index was lowest in the north of the Badia and highest in the center of the Badia.

These preliminary results will have to be further analyzed in order to better understand the underlying factors affecting sheep productivity; particularly the linkage with rangeland conditions.

VI. CONCLUSIONS

This report gives an up-to-date and representative overview of socio-ecological conditions in the Syrian Badia. A complete survey was implemented in spring 2004, by collecting multi-level socio-economic and ecological information (vegetation spot, household and community levels), with the aim of helping policy makers and development projects plan for the future management of these resources. The first results of the survey are presented in this report.

6.1. Main conclusions

6.1.1. Property rights

Although the steppe belongs officially to the state, implying open access for all sheep owners, it is clear from this survey that traditional access rights and traditional community boundaries are strongly maintained. These rights are firmly linked to the social organization of tribal groups. To understand how the rangelands are exploited and managed it is crucial to recognize and characterize these groups (communities). Without detailed information and reliable statistics about Bedouin communities and their land, any management plan will fail.

6.1.2. Badia heterogeneity

At this preliminary stage of analysis one clear conclusion can be reached: the Badia is a diverse ecological zone, composed of very heterogeneous communities in terms of size, population, livestock production practices and livelihoods strategies. This implies that development plans will first need to consider how the communities interact, how they use rangeland resources, and what underlying incentives will drive potential management plans. This is a prerequisite to promoting effective, efficient and equitable management of the Badia. Furthermore, different rehabilitation techniques should be considered, e.g. reseeding with appropriate species, rangeland resting, rotation or protection – depending on range condition and current grazing pressures.

6.2. Methodological lessons learned

This survey represents a 'first' in terms of survey methodology applied in rangelands. Therefore, several lessons were learned in the process of designing the survey, implementing it, and analyzing the data.

6.2.1. Representativeness

When trying to reconcile ecological and socio-economic factors through spatial and statistical analysis, conflicting interests arose in designing the survey sample. To be spatially representative, communities should have been chosen according to a spatial grid. The sample would have then been composed of communities more distant from the Badia line – but it would have been biased in terms of population representation. Because we decided to focus on management of the Badia (and therefore on the actors of such management), we chose a sample representative of the population.

6.2.2. Cross-sectional and longitudinal analysis

In such a variable climatic environment, it is difficult to capture the Badia ecology and the Bedouin behavior in a one-shot picture. The logistics could not allow us to build a panel dataset. Therefore, for some questions, we asked for a historical date, i.e. we asked respondents to answer the same questions for the past 5 years. This is a good alternative, particularly to assess flock mobility over a period containing dry, medium and good rainfall years. Comparing data across years allowed us to characterize the overall Bedouin strategies. Also, we would recommend including historical perspectives for key variables in the questionnaires.

6.2.3. Household survey

Household surveys are time-consuming. Given the limited resources, we decided to limit the questionnaire to a few questions and pre-tested it on groups of households. Once the interviewees were identified, each person in the group, in turn, was asked the same questions. This method reduces the interview time and also

allows for peer-control of the answer – in some cases if a herder underestimated his flock size, his neighbors would remind him that he had more. The disadvantage is that herders tend to copy their colleague's answers. Overall, we found the survey did not perform well for questions on flock productivity.

In addition, when implementing household surveys, is it always necessary to have a broader perspective and collect a complete set of information, as most socio-economic variables are interconnected. Even if the main objective was to collect data on flock productivity and livestock inputs, we may have missed some variables important to the households' economy (e.g. some prices).

6.3. Perspectives

This report is a preliminary output, presented in order to highlight areas where deeper analysis is needed. First, more analysis will be needed to better characterize land status (degradation), and the Bedouin's production and livelihoods strategies – descriptive statistics are not enough. More data crossing and aggregation of variables will have to be conducted in order to extract distinguishable types. Expected typologies are:

- Mobility and feeding strategies of the Bedouin. This analysis has already been conducted by Camille Saint-Macary (2005).
- Pastoral strategies of the communities. Preliminary work has been conducted (Dutilly-Diane et al., 2006).
- Exogenous characteristics of the community and level of degradation of overall community land (Tiedeman et al., 2006; forthcoming work on the interpolation of the 'sites' vegetation data).

Even if every community and every Bedouin household is unique in its decision making, this typology might help future development projects put their target areas in the context of the overall Badia environment.

Further studies will address the main objective of the survey, i.e. land degradation will be linked to community characteristics and to the pastoral strategies of the Bedouin. In particular, we will try to better understand the determinants of degradation and the impact of degradation on individual livelihoods. With regard to land management, we have seen interesting and diverse responses to potential scenarios. A proper understanding of the reasons underlying these responses will help design more effective management plans.

REFERENCES

Bhatnagar, A., and M. Bhatnagar. 2005. Microbial diversity in desert ecosystems. Current Science 89 (1).

Blench, R. 1995. Rangeland degradation and socio-economic changes among the Bedu of Jordan: results of the 1995 IFAD survey.

Al-Dbiyat, M. et R. Jaubert. 2006. Le repeuplement sédentaire des marges arides à l'époque contemporaine (1848–1960). In: Jaubert, R. et B. Geyer (eds.) *Les marges arides du croissant fertile. Peuplements, exploitation et contrôle des ressources en Syrie du Nord*. TMO 43. Maison de l'Orient et de la Méditerranée – Jean Pouilloux, Lyon.

Draz, O. 1985. The *hema* system of range reserves in the Arabian peninsular: its possibilities in range improvement and conservation projects in the Near East. FAO, Rome.

Dutilly-Diane, C., J. Tiedeman, N. Batikha, F. Ghassali, E. Khoudary, G. Arab, and C. Saint-Macary. 2006. Livestock production strategies as related to community characteristics. The case of the Syrian Badia. Forthcoming. Proceedings of the 8th ICDD, Beijing, China Feb 2006.

Edwards-Jones, G. 2002. Final Report on agricultural policy and the environment in Syria: an examination of impacts and suggestions for policy reform. June 2002. (Chapter 5)

FAO. 2006. A case study on rangeland rehabilitation and establishment of a wildlife resource in sustainable rangeland management in Al Badia Region. International Conference on Agrarian Reform and Rural Development (ICARRD) Porto Alegre, Brazil, 7-10 March 2006. [http://www.icarrd.org/en/icard_doc_down/case_Syria.doc]

Findlay, A. M. 1996 Population and environment in arid regions. International Union for the Scientific Study of Population, Policy Paper 10, IUSSP: Liege, 21p.

IFAD. 1997. Steppe development in the Badia, Phase I. Formulation Report, Working Paper II. Rangeland Development.

Jaubert, R. et B. Geyer. 2006. Les marges arides du croissant fertile. Peuplements, exploitation et contrôle des ressources en Syrie du Nord. TMO 43. Maison de l'Orient et de la Méditerranée – Jean Pouilloux, Lyon.

Jones, G.E. 2003. Agricultural policy and environment in Syria: the cases of rangeland grazing and soil management. FAO Agricultural Policy and Economic Development Series No. 8 Syrian agriculture at the crossroads. Edts. Fiorillo and Jacques Vercueil.

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

MAAR. Ministry of Agriculture and Agrarian Reform. Syria

Masri, A. 1991. The tradition of Hema as a land tenure institution in arid land management. FAO, Rome.

Métral, F. 2000. Managing risk: sheep-rearing and agriculture in the Syrian steppe. In: M. Mundy amd B. Musallam (eds). *The Transformation of the Nomadic Society in the Arab East.* Cambridge University Press.

Métral, F. 2006. Transformations de l'élevage nomade et économie bédouine dans la première moitié du vingtième siècle. In: Jaubert, R. et B. Geyer (eds.) *Les marges arides du croissant fertile. Peuplements, exploitation et contrôle des ressources en Syrie du Nord*. TMO 43. Maison de l'Orient et de la Méditerranée – Jean Pouilloux, Lyon.

Mirreh, M., and T. Razzouk 1997. Survey of the cooperatives. FAO/GCP /SYR/ 003/ITA.

Morgan, R.P.C. 1986. Soil erosion and conservation (D.A. Davidson, ed). Longman Scientific & Technical, Wiley, New York.

Pye, K. 1987. Aeolian dust and dust deposits. Academic Press. San Diego, California, USA.

Saint-Macary, C. 2005. An assessment of pastoral strategies in the Syrian steppe. Training report. CERDI, ICARDA.

Tiedeman, J., C. Dutilly-Diane, N. Batikha, F. Ghassali, E. Khoudary, G. Arab, C. Saint-Macary and M. Louhaichi. 2006. Rangeland degradation related to social and ecological characteristics in the Syrian steppe. Forthcoming. Proceedings of the 8th ICDD Beijing, China Feb 2006.

Appendix 1: Maps and Statistical Tables

Table 79. Main characteristics of the surveyed Badia communities.

Com-munity code	Rangeland type (%)								Population (%)		
	Total area (ha)	Native range-lands	Previously cultivated	Improved with shrubs	Other improved	Presently cultivated	Note/ improvement*	Note/ culture**	Total hh	Residents	Total sheep
1	5000	70.0	30.0	.	.	.			61	13.1	3700
2	600	66.7	33.3	.	.	.			29	51.7	2250
3	280	0.0	100.0	.	.	.			8	100.0	1200
4	1800	0.0	100.0	.	.	.			520	34.4	9720
5	8500	52.9	44.7	.	2.4	.	WH (ICARDA)		276	27.5	552
6	900	22.2	77.8	.	.	.			12	91.7	313
7	430	55.8	37.2	.	.	7.0		O	39	89.7	4155
8	400	5.0	77.5	.	.	17.5		O	42	100.0	1625
9	2500	12.0	88.0	.	.	.			24	95.8	2034
10	7000	100.0	0.0	.	.	.			112	70.5	15472
11	8515	23.5	70.5	5.9	.	0.2	10070	RB	16	56.3	1575
12	6410	90.5	9.4	.	.	0.2		O	192	15.6	22214
13	1820	68.7	17.6	.	.	13.7		RB	1500	3.3	42600
14	2500	48.0	28.0	.	.	24.0		RB	1500	1.5	42700
15	8500	94.1	0.0	.	.	5.9		RB	23	100.0	3677
16	10030	99.7	0.0	.	.	0.3		W+RB	255	19.6	32000
17	3000	91.3	3.3	.	.	5.3		O+Ap+M+RB	50	62.0	7030
18	800	50.0	25.0	.	.	25.0		RB	28	100.0	3990
19	11600	51.7	43.1	5.2	.	.	10070 (N)		183	0.0	0
20	20000	95.0	0.0	5.0	.	.	10070 (N)		27	100.0	9535
21	55000	72.7	27.3	.	.	.			475	63.2	75000
22	40000	55.0	37.5	7.5	.	.	10070 (C)		330	0.0	104000
23	70500	39.7	31.2	0.7	28.4	.	11070 (N) + NR		265	80.4	70000
24	20000	90.0	10.0	.	.	.			90	66.7	13388
25	20000	85.0	10.0	5.0	.	.	10070 (N)		130	88.5	18350
26	80000	65.0	35.0	.	.	.			87	100.0	20000
27	51500	46.6	48.5	1.9	.	2.9	10070 (N)	V+RB	49	100.0	16547
28	70015	57.1	42.8	.	.	0.2			250	40.0	13300
29	80010	96.2	3.7	.	.	0.1			145	96.6	13000
30	10000	75.0	15.0	10.0	.	.	BP (N)		200	70.0	22100
31	2010	89.6	10.0	.	.	0.5		O+Al	8	100.0	15100
32	4050	91.4	7.4	1.2	.	.	BP (N)		12	100.0	4730
33	8500	23.5	25.9	41.2	.	9.4	BP (N)	W+RB	214	68.7	18950
34	5060	75.1	13.8	9.9	.	1.2	BP (N)	W+RB	75	60.0	18000
35	3450	0.0	79.1	.	14.5	6.4	SD	W+RB	98	79.6	1075
36	350	0.0	14.3	.	.	85.7		W+B	31	100.0	2039
37	28010	71.4	28.6	.	.	0.4			30	100.0	2140
38	7330	51.8	32.7	13.6	.	1.8	BP (N)	W+B	180	35.0	5285
39	6000	0.0	50.0	.	.	50.0		W+B	155	77.4	6300
40	5010	39.9	39.9	20.0	.	0.2	BP (N)	W+B	56	98.2	5100
41	2900	34.5	62.1	.	.	3.4		O	255	58.8	12600
42	5000	40.0	60.0	.	.	.			150	100.0	9140
43	25410	0.0	98.4	1.6	.	0.4	BP (C)	RB	112	88.4	16550
44	3200	31.3	31.3	37.5	.	.	BP (N)	O+RB	24	100.0	1939
45	850	70.6	23.5	.	.	5.9		O+RB	367	4.6	3880
46	1340	0.0	89.6	.	.	10.4		O+RB	164	3.0	902
47	86010	58.1	1.2	40.7	.	0.1	BP (N)		50	54.0	4925
48	20000	85.0	10.0	5.0	.	.	BP (N)		19	21.1	1350
49	430	7.0	93.0	.	.	.			54	63.0	433
50	300	0.0	100.0	.	.	.			42	78.6	547
Mean	16256.4	51.0	38.3	12.5	15.1	10.3			180.3	64.6	14060.2
Median	5530.0	54.0	31.2	5.9	14.5	3.4			88.5	70.3	5792.5
std	23729.6	32.9	31.0	13.5	10.6	18.3			294.6	34.5	20389.3
Min	280.0	0.0	0.0	0.7	2.4	0.1			8.0	0.0	0.0
Max	86010.0	100.0	100.0	41.2	28.4	85.7			1500.0	100.0	104000

* 10070 = Shrubs plantation with project 10070, BP=shrubs plantation Badia project, WH=water harvesting, NR (natural reserve), SD=Sand dune fixation, (N)=improvement of native rangeland, (C)=improvement of previously cultivated land

** Ap=apricot, Al=almond B=barley M=medic, O=olives, RB=rainfed barley, V=vetch, W=wheat

Table 80. Carrying capacity calculation, 126 sites [1].

Community code	Vegetation type	Area (ha)	Biomass today	Biomass typical year	Total forage / typical year*	SUM (carrying capacity)**
		(A)	(B)	(C)	(D)	(E)
1	*Noaea mucronata*	1000	200	500	500000	5556
1	Previously cultivated	1500	50	200	300000	3333
1	Native	2500	50	200	500000	5556
2	*Noea mucronata*	400	200	500	200000	2222
2	Previously cultivated	200	50	50	10000	111
3	Previously cultivated	280	50	200	56000	622
4	Previously cultivated	1000	50	200	200000	2222
4	*Achillea fragrantissima*	800	50	500	400000	4444
5	*Capparis spinosa*	1500	200	500	750000	8333
5	*Noaea mucronata*	4500	50	200	900000	10000
5	Previously cultivated	2500	50	50	125000	1389
6	Native	200	50	200	40000	444
6	Previously cultivated	700	50	50	35000	389
7	Previously cultivated	160	50	50	8000	89
7	Native	210	50	50	10500	117
7	*Artemisia herba-alba*	30	50	200	6000	67
8	Native	20	50	200	4000	44
8	Previously cultivated	310	50	50	15500	172
9	Previously cultivated	2200	50	200	440000	4889
9	Native	300	50	500	150000	1667
10	*Anabasis syriaca*	2000	200	500	1000000	11111
10	*Noea mucronata*	4000	50	200	800000	8889
10	*Haloxylon articulatum*	1000	500	500	500000	5556
11	Previously cultivated	6000	200	500	3000000	33333
11	Native	2500	50	200	500000	5556
11	Badia project	500	200	500	250000	2778
12	Previously cultivated	6000	50	500	3000000	33333
12	*Artemisia herba-alba*	2000	50	50	100000	1111
12	*Anabasis syriaca*	3800	50	50	190000	2111
13	Native	1180	200	1100	1298000	14422
13	*Anabasis syriaca*	70	200	500	35000	389
14	*Anabasis syriaca*	1600	50	50	80000	889
14	*Artemisia herba-alba*	300	200	500	150000	1667
15	Native	8000	50	200	1600000	17778
16	*Tamarix pentandra*	15	200	1100	16500	183
16	*Pitoranthus triradiata*	2000	200	200	400000	4444
16	*Artemisia herba-alba*	3500	50	200	700000	7778
16	*Noaea mucronata*	4515	200	500	2257500	25083
17	Previously cultivated	100	50	50	5000	56
17	*Artemisia herba-alba*	2740	50	200	548000	6089
18	Previously cultivated	200	50	50	10000	111
18	*Artemisia herba-alba*	400	50	200	80000	889
19	Previously cultivated	5000	200	200	1000000	11111
19	Native	6000	200	200	1200000	13333
20	Native	1000	200	500	500000	5556
20	*Artemisia herba-alba*	5000	200	500	2500000	27778
20	*Astragalus spinosus*	10000	50	50	500000	5556
20	*Haloxylon salicornicum*	4000	50	50	200000	2222
21	Previously cultivated	5000	50	500	2500000	27778
21	*Artemisia herba-alba*	40000	50	500	20000000	222222
21	*Achillea fragrantissima*	10000	50	500	5000000	55556
22	Previously cultivated	15000	50	200	3000000	33333
22	Native	22000	50	50	1100000	12222
22	steppe project	3000	50	200	600000	6667
23	Previously cultivated	22000	50	50	1100000	12222
23	Native	28000	50	200	5600000	62222
23	*Anabasis syriaca*	200	50	500	100000	1111
23	*Achillea fragrantissima*	300	50	50	15000	167
24	Previously cultivated	2000	50	200	400000	4444
24	Native	17600	50	50	880000	9778
24	*Tamarix pentandra*	400	50	200	80000	889

*D=A*C; ** E=(D/2)/45

Table 81. Carrying capacity calculation, 126 sites [2].

Community code	Vegetation type	Area (ha)	Biomass today	Biomass typical year	Total forage / typical year*	SUM (carrying capacity)**
		(A)	(B)	(C)	(D)	(E)
25	Previously cultivated	2000	200	500	1000000	11111
25	Native	17000	200	1100	18700000	207778
25	*Anabasis syriaca*	800	200	500	400000	4444
25	*Achillea fragrantissima*	200	200	500	100000	1111
26	Previously cultivated	28000	200	500	14000000	155556
26	*Anabasis syriaca*	52000	1000	500	26000000	288889
27	Previously cultivated	25000	50	200	5000000	55556
27	Native	24000	50	200	4800000	53333
27	Badia project	1000	50	200	200000	2222
28	Previously cultivated	30000	50	50	1500000	16667
28	Native	40000	200	500	20000000	222222
28	*Haloxylon articulatum*	15	50	200	3000	33
29	Previously cultivated	3000	50	50	150000	1667
29	Native	77000	50	200	15400000	171111
30	Previously cultivated	1500	50	50	75000	833
30	Badia project	1000	200	500	500000	5556
30	Native	7500	200	500	3750000	41667
31	Previously cultivated	200	200	200	40000	444
31	*Artemisia herba-alba*	1800	200	500	900000	10000
31	*Anabasis syriaca*	10	50	500	5000	56
32	Previously cultivated	300	200	500	150000	1667
32	Native	3700	200	500	1850000	20556
32	Badia project	50	50	200	10000	111
33	Previously cultivated	2200	50	50	110000	1222
33	Badia project	3500	50	200	700000	7778
33	Native	2000	50	50	100000	1111
34	Badia project	500	50	50	25000	278
34	Previously cultivated	700	50	50	35000	389
34	Native	3500	50	50	175000	1944
34	*Artemisia herba-alba*	300	50	200	60000	667
35	Previously cultivated	2700	200	200	540000	6000
35	Steppe project	500	50	50	25000	278
36	Previously cultivated	50	50	50	2500	28
37	Previously cultivated	20000	50	200	4000000	44444
37	Native	8000	50	200	1600000	17778
38	Previously cultivated	2400	50	200	480000	5333
38	Badia project	1000	200	500	500000	5556
38	Native	3800	50	50	190000	2111
39	Previously cultivated	3000	50	200	600000	6667
39	*Peganum harmala*	3000	200	500	1500000	16667
40	Steppe project	1000	200	500	500000	5556
40	Previously cultivated	2000	50	50	100000	1111
40	Native	2000	200	500	1000000	11111
41	Previously cultivated	1800	50	50	90000	1000
41	Native	1000	50	200	200000	2222
42	Previously cultivated	3000	50	50	150000	1667
42	Native	2000	50	50	100000	1111
43	Previously cultivated	25000	200	500	12500000	138889
43	Badia project	400	200	500	200000	2222
44	Previously cultivated	1000	50	50	50000	556
44	Badia project	1000	50	200	200000	2222
44	Native	1000	50	50	50000	556
45	Previously cultivated	200	200	500	100000	1111
45	Native	600	50	500	300000	3333
46	Previously cultivated	1200	50	200	240000	2667
47	Previously cultivated	1000	50	200	200000	2222
47	Native	50000	500	1100	55000000	611111
47	Badia project	35000	200	500	17500000	194444
48	Previously cultivated	2000	50	50	100000	1111
48	Native	16000	200	500	8000000	88889
48	Badia project	1000	200	500	500000	5556
48	*Ammothamnus gibbosus*	1000	50	200	200000	2222
49	Previously cultivated	400	50	200	80000	889
49	Native	30	50	200	6000	67
50	Previously cultivated	300	50	50	15000	167

*D=A*C; ** E=(D/2)/45

Table 82. Sheep monthly presence on site (2004).

Community code	Dec 03	Jan 04	Feb 04	Mar 04	Apr 04	May 04	Jun 04	Jul 04	Aug 04	Sep 04	Oct 04	Nov 04
1	1200	1200	1200	1550	1550	1550	0	0	0	0	1200	1200
2	1650	1650	1650	1650	1950	1950	0	0	1650	1650	0	1650
3	1200	1200	1200	1200	1200	200	200	200	200	200	200	1200
4	8720	8720	8720	8720	8720	9220	700	700	700	700	700	0
5	552	552	552	552	552	552	552	552	552	552	552	552
6	313	313	313	313	313	313	313	313	313	313	313	313
7	4155	4155	4155	4155	4155	0	0	0	0	0	0	4155
8	1625	1625	1625	825	825	0	0	0	0	0	150	1625
9	2034	2034	2034	1114	2034	0	0	0	0	0	0	2034
10	15472	15472	15472	15472	15472	15472	0	0	0	0	0	0
11	1575	1575	1575	1575	1575	1575	1575	1575	1575	1575	1575	1575
12	8214	8214	8214	16514	16514	16514	4514	4514	4514	4514	4514	8214
13	10931	10931	10931	10931	10931	10931	10931	23136	2181	2181	2181	10931
14	10395	10395	10395	10395	10395	10395	10395	22700	3000	3000	3000	10395
15	3677	3677	3677	3677	3227	3227	3227	3227	3227	3227	3227	3227
16	10000	10000	10000	30000	30000	30000	30000	30000	30000	10000	10000	10000
17	7030	7030	7030	7030	3440	3440	385	385	385	385	385	7030
18	3990	3990	3990	0	0	3990	2680	2680	2680	2680	2680	3990
19	0	0	0	0	0	0	0	0	0	0	0	0
20	9535	9535	9535	9535	9535	9535	9535	9535	9535	9535	9535	9535
21	50000	50000	50000	75000	75000	75000	18000	8000	8000	8000	8000	50000
22	2000	2000	2000	2000	2000	0	0	0	0	0	2000	2000
23	67000	67000	67000	70000	70000	9250	6250	6250	6250	6250	6250	67000
24	13388	13388	13388	13388	13388	13388	400	400	400	400	400	13388
25	15350	15350	15350	18350	18350	18350	5350	5350	5350	5350	5350	15350
26	20000	20000	20000	20000	20000	5000	5000	5000	5000	5000	5000	20000
27	16547	16547	16547	12047	12047	12047	5547	5547	5547	5547	5547	16547
28	13300	13300	13300	13300	2500	400	400	400	400	400	400	400
29	13000	13000	13000	13000	13000	13000	0	0	0	0	0	13000
30	20700	20700	20700	20700	20700	20700	3500	3500	3500	3500	3500	3500
31	15100	15100	15100	15100	15100	15100	15100	15100	15100	15100	15100	15100
32	4730	4730	4730	4730	4730	4730	4730	4730	4730	4730	4730	4730
33	18950	18950	18950	18950	9450	9450	1500	1500	1500	1500	1500	18950
34	6000	6000	6000	13000	13000	13000	13000	13000	13000	13000	13000	6000
35	1075	1075	1075	1075	1075	1075	1075	1075	1075	1075	0	0
36	2039	2039	2039	867	867	867	2039	2039	2039	2039	2039	2039
37	2140	2140	2140	2140	2140	2140	1140	1140	1140	1140	1140	2140
38	5285	5285	5285	5285	5285	5285	5285	5285	5285	5285	5285	5285
39	6300	6300	6300	1800	1800	1800	500	500	500	500	500	500
40	5100	5100	1000	1000	1000	5100	5100	50	50	50	50	5100
41	12600	12600	12600	7000	7000	7000	200	200	200	200	200	12600
42	9140	9140	9140	9140	9140	9140	400	400	400	400	9140	9140
43	6550	6550	6550	6550	6550	6550	200	200	200	200	200	200
44	1809	1809	1809	1939	1939	1939	900	900	0	0	0	1809
45	3880	3880	3880	1380	1380	1380	200	200	200	200	200	3880
46	602	602	602	602	602	602	0	0	0	0	0	602
47	4925	4925	4925	2300	2300	2300	2300	2300	2300	2300	2300	4925
48	1350	1350	1350	1350	0	1350	0	0	0	0	0	1350
49	433	433	433	433	433	433	433	433	433	433	433	433
50	547	547	547	547	547	547	65	65	65	65	65	65
Total /1000	**442**	**442**	**438**	**478**	**454**	**376**	**174**	**183**	**143**	**123**	**133**	**374**
Average	8842	8842	8760	9564	9074	7516	3472	3662	2864	2464	2651	7473
Maximum	67000	67000	67000	75000	75000	75000	30000	30000	30000	15100	15100	67000
St Dev	11900	11900	11941	14774	14758	11775	5725	6508	5153	3522	3627	12004

Table 83. Carrying capacity, stocking rate, and overgrazing ratio.

Community code	SUM	Stocking rate	Ratio community (SR/SUM)	Total ratio* (Srtot / SUM)	Outsider rate
1	14444	9450	0.65	0.72	0.11
2	2333	15450	6.62	7.48	0.13
3	622	8400	13.50	13.50	0.00
4	6667	55320	8.30	8.51	0.03
5	19722	6624	0.34	1.35	3.02
6	833	3756	4.51	7.39	0.64
7	272	24930	91.58	91.58	0.00
8	217	8300	38.31	42.00	0.10
9	6556	11284	1.72	2.64	0.53
10	25556	92832	3.63	4.30	0.18
11	41667	18900	0.45	0.45	0.00
12	36556	104968	2.87	3.86	0.34
13	14811	117127	7.91	9.26	0.17
14	2556	114860	44.95	49.76	0.11
15	17778	40524	2.28	2.45	0.07
16	37489	256800	6.85	6.85	0.00
17	6144	43955	7.15	7.15	0.00
18	1000	33350	33.35	33.35	0.00
19	24444	0	0.00	0.00	.
20	41111	114420	2.78	6.07	1.18
21	305556	475000	1.55	1.66	0.07
22	52222	14000	0.27	0.75	1.79
23	75722	448500	5.92	6.45	0.09
24	15111	95716	6.33	10.30	0.63
25	224444	143200	0.64	0.66	0.03
26	444444	150000	0.34	0.65	0.93
27	111111	130064	1.17	1.66	0.42
28	238922	58500	0.24	0.75	2.05
29	172778	91000	0.53	0.58	0.11
30	48056	145800	3.03	3.29	0.09
31	10500	181200	17.26	17.92	0.04
32	22333	50510	2.26	2.53	0.12
33	10111	121150	11.98	13.47	0.12
34	3278	128000	39.05	45.15	0.16
35	6278	10750	1.71	2.67	0.56
36	28	20952	754.27	754.27	0.00
37	62222	20680	0.33	0.43	0.30
38	13000	62420	4.80	9.19	0.91
39	23333	27300	1.17	1.26	0.07
40	17778	28700	1.61	1.90	0.17
41	3222	72400	22.47	22.90	0.02
42	2778	74720	26.90	31.22	0.16
43	141111	40500	0.29	0.29	0.01
44	3333	14853	4.46	5.21	0.17
45	4444	20660	4.65	4.65	0.00
46	2667	4214	1.58	7.54	3.77
47	807778	38100	0.05	0.05	0.12
48	97778	8100	0.08	0.65	6.89
49	956	5196	5.44	7.01	0.29
50	167	3672	22.03	31.03	0.41
Average	**64445**	**75342**	**24**	**26**	**1**
Min	28	0	0	0	0
Max	807778	475000	754	754	7

*Ratio total = overgrazing ratio + estimation of the overgrazing from outsiders

**Outsider rate = SUM community / SUM outsiders

Table 84. List of species found in 126 sites in the Badia.

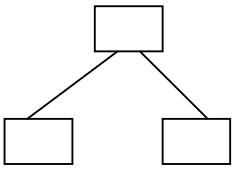
Species	Local name	Genus / Species	Local name
Achillea conferta	Al Quisema	*Halogeton alopecuroides*	Al Hamed
Achillea fragrantissima	Al Qissum	*Haloxylon articulatum*	Al Naiton
Achillea membranacea	Al Harbaq	*Haloxylon salicornicum*	Al Rumth
Adonis dentata	Al Afaina	*Haplophyllum filifolium*	Al Zafra
Aegilops spp.	Hashishat AL Maaz	*Helianthemum salicifolium*	Jardet Al Kama
Alhagi maurorum	Al Akoul	*Helianthemum sessiliflorum*	Al Hashma
Allium cepa	Thoum Bari	*Heliotropium europaeum*	Al Zuraika
Althaea officinalis	Khetmia	*Herniaria hemistemon*	Om Labade
Alyssum meniocoides	Al Dorihama	*Hordeum glaucum*	Khafor
Ammothamnus gibbosus	Firash AL Arais	*Iris spp.*	Al Sawsan
Anabasis syriaca	Al Ashnan	*Koeleria phleoides*	Al Kolirea
Andrachne telephioides	Bezer Al Dod	*Koelpinia linearis*	Al Kalabea
Anthemis deserti-syriaci	AL Arabian	*Kuehneromyces mutabilis*	Fetter
Arnebia decumbens	Al Kahal	*Lactuca orientalis*	Al Ashkhise
Artemisia herba-alba	Al Shih	*Lotus spp.*	Sham Hawa
Artemisia scoparia	Al Salmas	*Malva aegyptia*	Khabazea
Asphodelus microcarpus	Aissalan	*Matricaria aurea*	Babonaj
Astragalus butleri	Al Khafa Alwatwatia	*Matthiola oxyceras*	Shokara
Astragalus cruciatus	Al Khafa Al mutasaliba	*Micropus longifolius*	Al Kutaina
Astragalus spinosus	Al Katad	*Moltkia spp.*	Al Kohaila
Atriplex halimus	Al Ragal Al Melhi	*Noaea mucronata*	Al Sor
Atriplex leucoclada	Al ragal Al Souri	*Onobrychis ptolemaica*	Al Kutb
Avena barbata	Al Shofan	*Peganum harmala*	Al Harmal
Bromus danthoniae	Al Shwira	*Pteranthus triradiata*	Al Kazah
Bromus tectorum	Al Shwiera	*Plantago ovata*	Al Rabl
Capparis spinosa	Al Kapar	*Poa bulbosa*	Kaba
Carex stenophylla	Al Nomais	*Prosopis stephaniana*	Al Khrainibea
Centaurea dumulosa	Al Kumaila	*Salsola inermis*	AL Nadawa
Centaurea laxa	AL Mirar	*Salsola spinosa*	Al Souraira
Ceratocephala falcata	AL Khoshaina	*Salsola vermiculata*	Al Rutha
Chenolea arabica	Al Flafla	*Salsola volkensii*	Al Khazraph
Citrullus colocynthis	Al Hanzal	*Scabiosa palaestina*	Al thalaija
Cornulaca setifera	Al Haze	*Schismus arabicus*	Munshakat Al Osafea
Cynodon dactylon	Najil	*Scorzonera papposa*	Al Sibah
Cyperus conglomeratus	Al Assal	*Scrophularia hypericifolia*	Al Khanaziria
Dactylis glomerata	Al Asbaie	*Seidlitzia rosmarinus*	Al Doiad
Dianthus multipunctatus	Kurenfal Bari	*Silene coniflora*	Al Dabika
Eremopyrum orientalis	Hashishat Al Kamehy	*Sisymbrium bilobum*	Al Shalwa
Erodium cicutarium	Al Bukhetri	*Stipa tortilis*	Al Sama
Erodium glaucophyllum	Al Kuronwa	*Tamarix pentandra*	Al Tarfa
Eryngium desertorum	Al Shandab	*Taraxacum spp.*	Akhawan
Euphorbia spp	Halablob	*Terfezia leonis*	Kamaia
Fagonia bruguieri	Al Shokaa	*Teucrium polium*	Al Jaadea
Gagea reticulata	Lahiat Al Tais	*Thymus syriacus*	Al Zaater
Girgensohnia oppositiflora	Al Shawaika	*Torularia torulosa*	Al Hasar
Gundelia tournefortii	Al Kaob	*Trigonella spp.*	Al Halba
Gymnarrhena micrantha	Khouf Al Kalba	*Ziziphora tenuior*	Al Noinae
Gypsophila pilosa	Al Gebsia		

Appendix 2: Community Structure in the Badia (numbers refer to community codes)

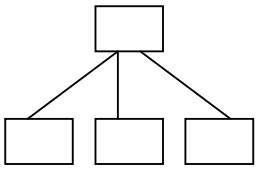
1. One group

1, 3, 7, 11, 12, 14, 15, 16, 20, 21, 22, 25, 26, 27, 28, 29, 30, 31, 32, 35, 36, 37, 39, 40, 44, 47, 48, 49, 50

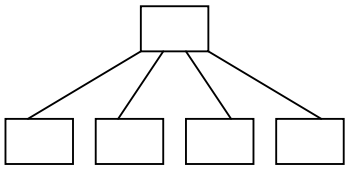
2. Hierarchical relationships



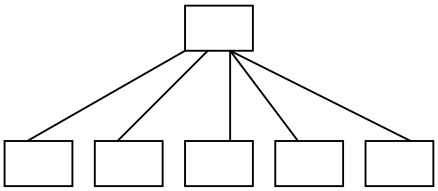
2, 9, 17, 34, 41



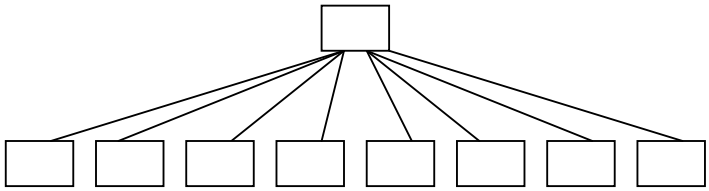
42, 46



8, 10, 24



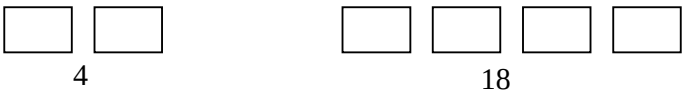
4, 19, 38, 43, 45



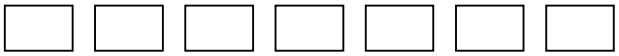
33

3. No blood relations

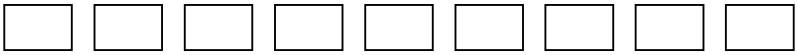
No family relation, strangers from different communities decided to mix to be stronger.



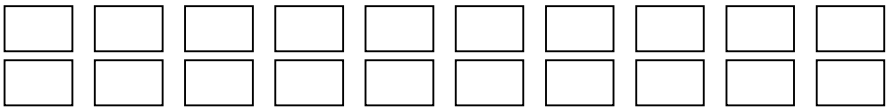
4 18



13



23



7

Appendix 3. Survey Questionnaires

Appendix 3.1. Community survey: socio-economic questionnaire

COMMUNITY RANGELAND MANAGEMENT IN SYRIA 2005 - PART I: SOCIO-ECONOMICS

Community Name: _____ No. community : _____
Province : _____ Montika: _____
Nahia: _____
Mother community name: _____
Enumerator : _____ Date: _____
Name of contact in the community : _____

Checking list:

Rangeland questionnaire:	Household questionnaire:
___ Total flock size	___ Representativity / sub-groups
___ Rangeland projects	___ Representatitvity / production system
	___ Representativity / flock size

Notes:

A. DEMOGRAPHY

A.1. Households residence

1. Number of households, residents and migrants ? **<u>Enumerator</u>: please check that SC=total flock size observed during rangeland mapping exercise.**

	Location	Distance (km)	# households	# sheep
COMMUNITY RESIDENTS				
(I) With sheep	Site	0		
(II) Without sheep	Site	0		0
CROPPING ZONE MIGRANTS				
(III) With sheep still using the community land *				
(IV) With sheep that are not using community land *				
(V) Without sheep				0
BADIAH MIGRANTS				
(VI) With sheep still using the community land *				
(VII) With sheep that are not using community land *				
(VIII) Without sheep				0
URBAN CENTER MIGRANTS				
(IX) Cities residents				0
TOTAL TT = I+II+III+IV+V+VI+VII+VIII+IX TC/SC = I+II TG/SG = I+III+VI TS/SS = I+III+IV+VI+VII			 TT= TC= TG= TS=	 SC= SG= SS =

* in the past 5 years.

TT = Total community members (residents + migrants) with and without sheep
TC = Residents community members with and without sheep
TG = Community members (residents + migrants) with sheep who are using the community range
TS = Community members (residents + migrants) with sheep

2. Number of households that stop breeding sheep in the past 5 years?_____
How many of them stayed in the community ?_____
How many migrated? _____

A.2. EDUCATION AND LABOR (<u>TC ONLY = RESIDENTS)</u>

3. Number of head of households with education ? _____
Koranic _____
Public _____
Self-taught_____

4. Number of households with at least one member who migrated seasonally for labor last year?_____
5. Number of households that have regular non-sheep breeding activities?_____

A3. COMMUNITY STRUCTURE

6. Date of establishment: _____

1. List Federation/tribe/fakhed names: _____
2. Date of current boundaries? _____
3. Why last change? _____
4. Describe relationships between sub-groups listed in table 11 (relation tree):

5. List family names and group them according to the hierarchical structure of the community :

Groups / Sub-groups names	# hh (**among TT**)	Land (cropping) rights **among TT**				Grazing in the community during 5 past years (**TS only =** migrants+residents with sheep)					
		# hh with land rights	Land share (%)	Min share (ha) / hh	Max share (ha) / hh	Use every year		Use some year		Never use	
						# hh	# ewes	# hh	# ewes	# hh	# ewes
Group A:											
Group B:											
Group C:											
Group D:											
Group E:											
Group F:											
Group G:											
Group H:											
Group I:											
Group J:											
Group K:											
TOTAL						T1=		T2=		T3=	

Enumerator: Check that T1+T2+T3=TS

B. LIVESTOCK

B1. Flock size (<u>TS = residents + migrants with sheep</u>)

6. Calculate flock size by groups of households today

Groups / Sub-groups names	# hh with ewes	Min Flock size	Max Flock size	# hh with < 50	# hh with 50-100	# hh with 100-200	# hh with >200	Total # sheep	Total # Goats	Total # Bovines	Total # Camels
Group A:											
Residents											
Migrants											
Group B:											
Residents											
Migrants											
Group C											
Residents											
Migrants											
Group D											
Residents											
Migrants											
Group E											
Residents											
Migrants											
(SUB) TOTAL											

Groups / Sub-groups names	# hh with ewes	Min Flock size	Max Flock size	# hh with < 50	# hh with 50-100	# hh with 100-200	# hh with >200	Total # sheep	Total # Goats	Total # Bovines	Total # Camels
Group F											
Residents											
Migrants											
Group G											
Residents											
Migrants											
Group H											
Residents											
Migrants											
Group I											
Residents											
Migrants											
Group J											
Residents											
Migrants											
Group K											
Residents											
Migrants											
TOTAL								**SS=**			

7. What was the total flock size of the community:

5 years ago : _____

10 years ago (before ban of cultivation): _____

20 years ago (before 1984's drought): _____

B2. Livestock production systems and feeding strategies (<u>Group I : residents with sheep</u>)

8. Do some households do full fattening (use concentrate without grazing)? Yes___ No___

If yes: How many households do full fattening while: They also have their own flock? _____

They don't own a flock aside? _____

How many lambs have been full fattened in total last year: From own flocks? _____

From bought flocks? _____

Who are the investors?_____

9. Complete the table for each production system for the year 2004 (except for full fattening):

SYSTEMS		Annual feed cost per ewe or per lamb* (SL)	Describe fattening system	# hh (flocks)	Total # ewes
No lamb fattening	Low (<500 SP)				
	Medium (500-1000 SP)				
	High (>1000 SP)				
Lamb fattening	Low (<1000 SP)				
	Medium (1000-2000 SP)				
	High (>2000 SP)				
TOTAL				T=	

* Feed cost per ewe if system of no lamb feeding, feed cost per fattened lamb if lamb feeding system.

Enumerator: check that T=I

B3. FLOCKS MOBILITY IN THE PAST 12 MONTHS (<u>TG ONLY = RESIDENTS + MIGRANTS WITH SHEEP</u>)

16. Where were located the community flocks in the last 12 months ? *<u>Enumerator</u>: Please, 1) use Syrian map to locate areas grazed in Badia and 2) make sure that sum of # animals by line equals total number of animals in the community.*

	Community	Neighboring sites	Other rangelands		Reserves (IFADS, 10070, gvt)		Cultivated zone	
MONTH	# sheep / # hh	# sheep / # hh / # sites	# sheep / # hh	Where (km)	# sheep / # hh	Where (km)	# sheep / # hh	Where (km)
Dec 03	/	/ /	/		/		/	
Jan 04	/	/ /	/		/		/	
Feb	/	/ /	/		/		/	
March	/	/ /	/		/		/	
April	/	/ /	/		/		/	
May	/	/ /	/		/		/	
June	/	/ /	/		/		/	
July	/	/ /	/		/		/	
August	/	/ /	/		/		/	
Sept	/	/ /	/		/		/	
Oct	/	/ /	/		/		/	
Dec 04	/	/ /	/		/		/	

17. How many households from the community (TG) stayed on the site (community rangeland) during the past 5 years (if sub-groups are identified, specify each of them):

Year	2003	2002	2001	2000	1999
Good year?					
# Households (i)					
Period (m-m) (i)					
# Households (ii)					
Period (m-m) (ii)					
# Households (iii)					
Period (m-m) (iii)					

Good year? 1=very good, 2=good, 3=medium, 4=bad

18. Did you ever use a government reserve ? Yes____ No____
If no, why? _____

Name	Distance (km)	Last time accessed	# hh from community accessed	# sheep	Period (m – m)	Cost	# communities that accessed it.

B4. Livestock products and marketing (<u>Group I = residents with sheep</u>)

19. Does the community use the services of "Jaabans"? Yes___ No___
If yes, Every year ? Yes___ No___
How many households used it last year ?_____

20. Where do people go to sell livestock products and buy inputs.

	Name	Distance (km)
Sell milk (beside Jaaban)	- -	- -
Buy animal feeds (outside cooperative)	- -	- -
Sell yogurt	- -	- -
Sell cheese	- -	- -
Sell lambs/ewes	- -	- -
Buy lambs/ewes	- -	- -

B5. HEALTH (GROUP I =RESIDENTS WITH SHEEP)

21.Mention the most important diseases or poor health, which affected your flock in the last 3 years:

Diseases	Season	Year

Season : 1=spring, 2=summer, 3=fall, 4=winter

22.Are external parasites a problem to some community flocks? Yes ____ No_____
23.If external parasites are a problem, is it during :
poor grazing _____ , good grazing _____ , both_____ ?
24.How many households treated their animals for external parasite? _____
29. How many households vaccinate their animals this year? _____
30. Do vaccinated animals do well in poor grazing? Yes ____ No ____

B6. FLOCK MANAGEMENT (GROUP I = RESIDENTS WITH SHEEP)

31. Does it happen that you share rams within communities flocks when a herder don't have enough ram ? Yes___ No___
If yes, how many cases observed last year?_____
32. Does a herder share his ram with other flocks if this one is particularly good/efficient ? Yes___ No___
If yes, how many cases observed last year?_____
33. How many households gave their animals in a "bone contract" ? _____ Total # ewes ? _____
34. How many households took animals in a "bone contract" ? _____ Total # ewes ? _____
35. How many households gave their animals in a "Tadjara contract" ? _____ Total # ewes ? _____
36. How many households took animals in a "Tadjara contract" ? _____ Total # ewes ? _____

C. INSTITUTIONS
C1. GOVERNANCE

37. Who represents the community? Leader___ Committee___ Both___ Other___
If other, how do you take your decisions? _____

If leader
38. For how many years has he been the leader?_____
39. How has he been chosen (background)?_____
1= tribal cheick, 2=political background, 3=religious, 4=wisest, 5=education, 6=most active (networks), 7=others_____
40. Relation with previous leader?_____
1 = father, 2=brother, 3=same family, 4=same tribe, 5=no relation, 6=other _____
41. Age of current leader ?_____
42. Education level ?_____
43. Other responsibilities ?_____
1= political, 2=religious, 3=cooperative, 4=_____
44. Flock size of leader (socio-economic status)_____

If committee
45. Current number of members _____
46. Representativity level of members (specify sub group: A, B, C…) _____
47. Age of members? Youngest: _____ Oldest :_____

48. When a member is not available, does he designate a representative? Yes__ No___
49. Criteria to be part of the committee (several answer possible): _____

1= tradition, 2=political background, 3=religious, 4=wisest, 5=education, 6=most active (networks), 7=others_____

C2. REPRESENTATIVITY

50. According to you, these tasks are more or less easy to accomplish?

	More easy	Less easy	Why?
Arranging services in the community (water, roads)			
Discuss & solve conflicts within community			
Discuss & solve problem with neighboring communities			
Influence his own people (convincing ways)			
Protect grazing borders			
Other			

51. Was your community represented at the Homs meeting in January 2004? Yes___ No___

If yes, by who? _____

1=Leader of your community, 2=leader of your mother community, 3=other_____

C4. Projects

52. List rangelands projects that are (have been) implemented in your community since 10 years.

Project Name / Supporting institution	Activity	Date beginning project	Date end of project	Area treated (ha)	# beneficiaries households	# hh used the reserve in 2004	When in 2004 (m-m)	Guardian	Situation today	Land condition today

Activity 1=shrub plantation, 2=rangeland resting, 3=other_____
Guardian: 0=no guardian, 1=guardian paid by project/government, 2=guardian paid by community, 3=other_____
Situation now 1= non-grazed, 2=grazed when it's open, 3=openly grazed 4= other_____
Land condition now compare with when the reserve was established: 1=worst, 2=same, 3=better

C5. OTHER INSTITUTIONS/ORGANIZATIONS

53. What are the other organization/institutions present in the community and their purpose?

Name	Purpose

D. PROPERTY RIGHTS

	Names /number*	Specify relation	Distance (km)	Property rights	Same tribe ? (number*)	Area with access (ha)	Over the last 10 years		Last year	
							# years you went there	# years they came	# animals you send there	# animals that came
Neighboring communities*										
Other communities in the Badiah	- - - -									
Traditional land in Badia	- - - -									
Villages in cropping zone	- - - -									
Unwelcome communities	- - - -									

Property rights: 1=open access land, 2=uncontrolled by other tribe/community, 3=controlled by other tribe/community, 4=your community own rights

D1. Grazing linkages with other communities

D2. Grazing restrictions

54. Can the community restrict access to unwelcome herders ? Yes___ No___
    If no, why ?_____

55. Number of animals crossing land community in transition within a year ?_____
    1=less than 1000, 2=1000-5000, 3=5000-10000, 4= 10000-20000, 5=more than 20000

D3. Cropping zone (Group TT= everybody)

56. Do some members of the community own private cropland or practice share-cropping outside the Badia?
    Yes___ No___

Village	Province	Distance (km)	# hh residents	# hh migrants	Total area owned (ha)	Total area share-crop (ha)	Irrigated?

E. WATER

57. What are the water points you are accessing inside and outside the community?

Name	Distance (km)	Property rights	# months with water
Wells			
Roman cistern			
Others			

Property? 1=individual, 2=group, 3=community, 4=government, 5=other_____

F. WELL-BEING INDICATORS

F1. Financial indicators (<u>Group TC= residents</u>)

58. How many households got in debt this year ? _____
    Out of them how many could not pay back?_____

59. How many households sold their ewes (with lamb) last winter time? _____

60. How many households are about to loose their flocks ? _____

F2. Community assets (<u>Group TC = residents</u>)

61. How many tractors in the community? _____
    Out of them, how many are shared?_____

62. How many mobile tank in the community? _____

Out of them, how many are shared?_____

63. How many fixed tank in the community ? _____

Out of them, how many are shared?_____

64. How many household with a lorry ? _____
65. How many cars in the community ? _____
66. How many motos in the community?_____
67. How many satellite dishes ? _____
68. How many shops ?_____
69. Is electricity available in the community ? Yes___ No___
70. How many km until paved road ? _____

F3. DISTANCE TO SERVICES (GROUP T ONLY)

71. Where does the members go for:

	Localities	Distance
Souks (buy necessary items)	- -	- -
Veterinarian services	- -	- -
Schools	- -	- -
Health centers and private doctor	- -	- -
Closest towns	- -	- -

G. CONFLICTS & NETWORKS

G1. Conflicts (Group TT=all community members)

72. List the conflicts the community has been facing until now with other communities and with administration:

	When was that?	Is the conflict solved now?	Conflicts description	Community/people involved
Water				
Land boundaries				
Livestock/rangeland				
Barley cultivation onsite				
Cropping zone				
Other				

G2. Networks (Group TC =residents)

73. In which situation can we see all the community members cooperate together vs groups members?____

Code: 1=always, 2=public infrastructure, 3=protecting land rights, 4=social event (wedding, funeral), 5= never, groups work for themselves, 6=other_____

74. Is there some groups that do not ask the help of others because of conflicts? Yes___ No___
If yes, specify which groups and the source of conflict_____

75. Rate the cohesion level in these different structures:

	Bad	Medium	Good	Very Good	Best one?
Sub-group					
Community					
Mother community					
Cooperative					
Fakhed					
Tribe					
Federation					

76. With who are the community households more likely to jointly undertake the following activities?

Activity	Brothers	Group	Community	Neighbors	Fakhed	Other	Under which conditions
Flock movement (walking / truck)							
Herding							
Transportation of water							
Milking & dairy processing							
Shearing							
Purchases (souk)							
Expenses – feed							
Expenses – water							
Vaccination							
Money (credit)							
Sheep tax (pay for the absent)							
Wedding (invited)							
Funerals (who comes)							
Deyeh							
Other							

Appendix 3.2. Rangeland community questionnaire

COMMUNITY RANGELAND MANAGEMENT IN SYRIA 2005

Part II : Rangeland

Community Name: _____ No. community :_____
Enumerator : _____

A. MAP

1. Draw a sketch of your community land, specify grazing areas according to vegetation and land type patterns. As well as the different group boundaries if existing. Mark distance from the 'village' and different permanent settlement to the boundaries and location of water. GPS the boundaries and the settlements.

2. Recapitulate rangeland areas (ha):

	Non-improved	10070	Badiah P. shrubs	Badiah P. resting	Other _____	Total
Native						
Previously cultivated						
Total						S=

Enumerator= check S is the same horizontally and vertically

3. Has some of your land been taken away for:
   Government shrub plantation _____ha
   Natural reserve _____ha
   Other _____ _____ha

4. Number of ha presently cultivated? _____ ha
5. Report in the table GPS points from community boundary

Description of the point	Way point number	Latitude	Longitude
Village /main settlement			

B. RANGELAND TYPES

6. Report grazing areas specified in the map in this table and answers the following questions.
INCLUDE PROTECTED / IMPROVED LAND OWNED BY THE COMMUNITY.

Grazing area name	Map ID	Area (ha)	Description		Grazing 2004 **without concentrate**		Grazing 2004 **with concentrate**	
			Native	Improved	(m-m)	# animals*	(m-m)	# animals*

Native: 0=previously cropped, 1=yes ; **Improved**: 0=no, 1=10070, 2=Badiah project shrubs, 3=Badiah project resting, 4= Other_____

* Take into account non-community animals as well

C. OTHER USES OF RANGELAND

7. What are the others uses that can be made from rangelands ?

Use type	Specify usage form	From where MAP ID	Period available m-m	Period harvested m-m	# time spent collecting	# hh collecting	Marketed ?	Rules ? (specify type of rule)
Medicinal plants for humans								
Medicinal plants for animals								

Use type	Specify usage form	From where MAP ID	Period available m-m	Period harvested m-m	# time spent collecting	# hh collecting	Marketed ?	Rules ? (specify type of rule)
Food plants								
Truffles								
Other uses								
Cut and carry forage								
Fuel								

8. For the fuel, specify community fuel provision from:
Plant collection in community land: ___% Plant collection outside your land: ___% Bought fuel (gaz): ___ %

D. MANAGEMENT OPTIONS

9. What do you think about the management of the Badiah and what could be done to improve it ? (*Enumerator: If return of cultivation is answered, write the answer and ask again the question*)?_____
Under which conditions? _____

10. What do you think about the management of your community rangeland and what could be done to improve it under today conditions? (*Enumerator: If return of cultivation is answered, ask again the question*)?_____
Under which conditions? _____

11. If you were in full control of your land, how would you improve your rangelands ?_____
Under which conditions? _____

Enumerator: Please, state this sentence before continuing further.

12. "When grazing is continuous, plants are grazed too often and become very short and weak. The roots do not grow and cannot provide the nutrients and water the plant needs. Then the plant cannot produce much forage or seeds to reproduce. If plants are given short rest periods when growing they will produce more forage."

12a. Do you agree with this sentence? Yes __ No__ If no, why ?_____

12b. On your rangeland did or do you give the plants short rest as described above(several weeks) so more forage is produced?
Yes __ No__ If yes, how ? _____ If no, why ? _____

13. Did or do you divide the rangeland into parts and graze it in rotation cooperatively? Yes___ No___
If yes, when and how?_____ If no, why ? _____
Could you do it today? Yes_____ No_____ If yes, how?_____ If no, why? _____

14. Did or do you reserve some range areas for special use (milk, fattening, lambing, fuel, medicinal/food plants)? Yes__ No__
If yes, when, how and for which uses?_____ If no, why ? _____
Could you do it today? Yes_____ No_____ If yes, how?_____ If no, why ? _____

15. Any other comments on the rangelands management?
_____

Appendix 3.3. Range field verification questionnaire

Range Field Verification
(One form for each type of rangeland)

Community Name_____ No. Community_____
Map Id_____ Grazing Area Name_____
GPS: UTM_____n. UTM_____e. Elevation _____
Way Point No._____ Date:_____
(Sample area must be uniform for > 50 meters all directions from the way point)

A. QUESTIONS FOR FARMER (circle answers):

1. Is the amount of this type changing (past 20 years) relative to other types mapped? (Native veg. types only) : **Decreasing, Increasing, Same**
2. Is the type degrading in the past 20 years ? **No Yes**
3. When is this type used in typical yr.: **Spring, Summer, Autumn, Winter**
4. If this is not the best time for its use, when should it be used and why not?
Spring, Summer, Autumn, Winter
Why not?_____
5. What is the forage value of this type? **Low, Medium, High**

B. DOMINANT SPECIES

6. List main species for a typical year :

Dominance	Species	Local Name	Use	Abundance	Notes
1st					
2nd					
3rd					
4th					
5th					
6th					
Other useful plants					

Use, reported by farmer: 1= Grazing good, 2=Grazing Poor, 3=None, 4=Medicine human, 5=Medicine Animal, 6=Human Food, 7=Fuel fire, 8=Cut
Abundance, estimated for the growing season: 5=Most dominate (only one species can be 5), 4=Abundant, 3=Common, 2=Few, 1=Rare). You can use Annual Grass or Annual Forbs for species if not known. Ask farmer to help in this.

C. BIOMASS AND COVER

7. Estimated annul biomass for type in typical year (check):
None-very low (0-100kg/ha) ___ Low (100-300kg/ha)___
Medium (300-700kg/ha)___ High (700-1500kg/ha)____ Very high (>1500kg/ha)____
What % is forage ____%

8. Estimated residual biomass today (check) :
None-very low (0-100kg/ha)___ Low (100-300kg/ha)___
Medium (300-700kg/ha)___ High (700-1500kg/ha)____ Very high (>1500kg/ha)____
What % is forage _____%

9. Utilization level now (check):
None-very low 0-20%____ Low 20-50%____ Medium 50-70%____
High 70-90%___ Very high > 90%_____

10. Vegetation Biomass Composition this year's total growth must equal 100%
_____% Shrubs
_____% Perennial grass
_____% Annual grass
_____% Annual forb
_____% Perennial forb

11. Ground Cover today (100%)
_____% Perennial veg.
_____% Annual veg.
_____% Moss/lichen
_____% Bare ground
_____% Rock or gravel
_____% Litter

D. SOIL

12.Soil texture: Sandy ___ Loamy _____ Clayey _____. % Gravel ____
13.Soil type: Calcar. ___ Shallow ___ Deep___ Salty ____ Gypsic ___ Stony ___
14.Landscape type: Depression (fuadah)__ Flat __ Slope< 20%__ Steep >20%___
15.Soil surface: Loose ____ Firm_____ Very hard sealed_____
16.Evidence of past cultivation: No _____ Yes _____

E. EROSION AND DEGRADATION

17. Erosion and degradation indicators

Indicator	None to Very low	Low	Medium	High	Very High
Root exposure					
Rills, gullies					
flow movement (water)					
Pedestalling of plant or stone or Terracettes					
Soil deposition by wind near plants or objects					
Soil compaction					
Trampling					
Dung					
Litter movement					
Invader plants					

Comments:

Appendix 3.4. Household questionnaire

COMMUNITY RANGELAND MANAGEMENT IN SYRIA 2004
Part III : Livestock productivity (household level)

Community name: _____ No. community : _____ Enumerator : _____

Recapitulate :

Production Systems last year		Total # households	# households surveyed
No lamb fattening (annual feed cost /ewe)	Low (<500 SP)		
	Medium (500-1000 SP)		
	High (>1000SP)		
Lamb fattening (annual feed cost /lamb)	Low (<1000SP)		
	Medium (1000-2000 SP)		
	High (>2000 SP)		
TOTAL			

Groups	Total # households	# households surveyed
A		
B		
C		
D		
E		
F		
G		
H		
I		
J		
K		
Total		

Flock size	Total # households	# households surveyed
0		
1-50		
50-100		
100-200		
>200		
Total		

Sampling: be sure to interview 3 households minimum per production system, one household minimum from each group, one household minimum from each flock size categories, and 10 households minimum in total.

Table 1: Households characteristics

ID	Household name	Group (a,b,...)	age head	# children <10 years	# women >10	# men >10	# adults educated	souk expenses /month
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								

Table 2: Activities and assets

	Off-farm 2004			Cropland					Assets					
ID	Type*	(M-M)	Income 2004	Ha own in situ	Ha own crop zone irrigated	Ha own crop zone rainfed	Ha share-cropped	Net profit 2004	Tractor	Water tank	House	Tent	Car / truck	Moto
1														
2														
3														
4														
5														
6														
7														
8														
9														
10														
Type: 1=agricultural labor, 2=other labor, 3=transportation, 4=migration, 5=trade, 6=other_____														

Table 3: Flock size, productivity rate from December 2003 to December 2004.

ID	# goats in Dec 2003	# kids 2004	# productive ewes in Dec. 2003	# other adults in Dec. 2003	# male lambs 2004	# female lambs 2004	# ewes gave birth twice	# dead lambs 2004	# fattened lambs 2004
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									

Table 4: Flocks movement (bought + sold) and price from December 2003 to December 2004.

			Movement bought				Movement sold					
ID	# ewes bought	Av. price ewes	# male lambs bought	Av. price male lambs	# female lambs bought	Av. price female	# ewes sold	Av. price ewes	# male lambs sold	Av. price male lambs	# female lambs sold	Av. price female
1												
2												
3												
4												
5												
6												
7												
8												
9												
10												
*Put Cost/ewes only if fattening and cost/(ewe+lamb) if no fattening, ** Put cost/lamb if lamb fattening only												

Table 5: **Costs flocks production from December 2003 to December 2004**.

ID	Cost water in situ	Cost water outside	Veterinarian & medicine	Sheepherder	Annual feed cost/ewe* (SP)	Annual feed cost/lamb**(SP)
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						

*Put cost/ewes only if fattening and cost/(ewe+lamb) if no fattening, ** Put cost/lamb if lamb fattening only

Table 6: Milk production from December 2003 to December 2004.

	Milk production (day/month)		Milk and milk product (kg)						Wool production		
ID	Home consumption	Souk	Quantity Fresh milk*	Quantity Yogurt*	Quantity cheese*	Transf. ratio	Quantity ghee *	Transf. ratio	Self consumption	Sold (kg)	Price/kg
1											
2											
3											
4											
5											
6											
7											
8											
9											
10											

*Evaluate quantity sold + household consumption in kg.

Table 7A. Feeding resources used from December 2003 to December 2004.

ID	Dec 03		Jan 04		Feb		March		April		May		June		July		August		Sept		Nov 04	
	T	%	T	%	T	%	T	%	T	%	T	%	T	%	T	%	T	%	T	%	T	%
1																						
2																						
3																						
4																						
5																						
6																						
7																						
8																						

Type of feed: 1=quality hand feeding (high energy concentrate) 2 = low quality hand feeding (straw, hulls), 3= grazing residues (cropping zone), 4= grazing forage (cropping zone), 5= home grazing, 6= reserve , 7=other Badiah grazing

Table 7B. Feeding resources used from December 2003 to December 2004.

ID	Dec 03		Jan 04		Feb		March		April		May		June		July		August		Sept		Nov 04	
	T	%	T	%	T	%	T	%	T	%	T	%	T	%	T	%	T	%	T	%	T	%
9																						
10																						
11																						
12																						
13																						
14																						
15																						

Type feed: 1=quality hand feeding (high energy concentrate) 2 = low quality hand feeding (straw, hulls), 3= grazing residues (cropping zone), 4= grazing forage (cropping zone), 5= home grazing, 6= reserve , 7=other Badiah grazing

Table 8: Historical information

ID	# months staying on the site						Flock size during past 10 years			
	2004 (m-m)	2003 (m-m)	2002 (m-m)	2001 (m-m)	2000 (m-m)	1999 (m-m)	Max		Min	
							# sheep	year	# sheep	year
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										

Al Badia Community Survey in Syria

Descriptive Statistics: Figures and Charts

I. INTRODUCTION

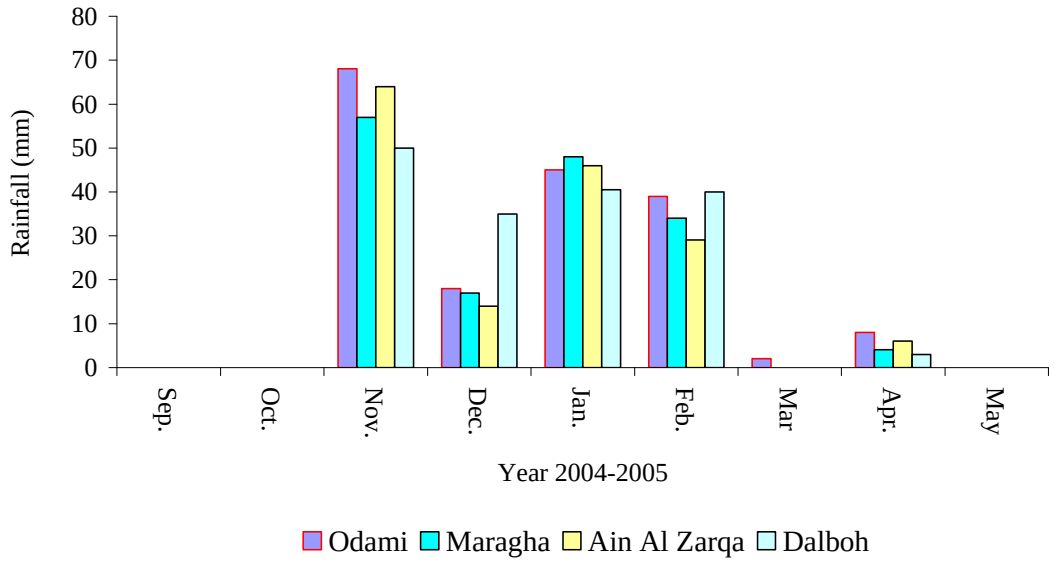


Figure 1. Monthly precipitation at four weather stations in Aleppo steppe, 2004-05 (source: MAAR, Steppe Directorate 2006).

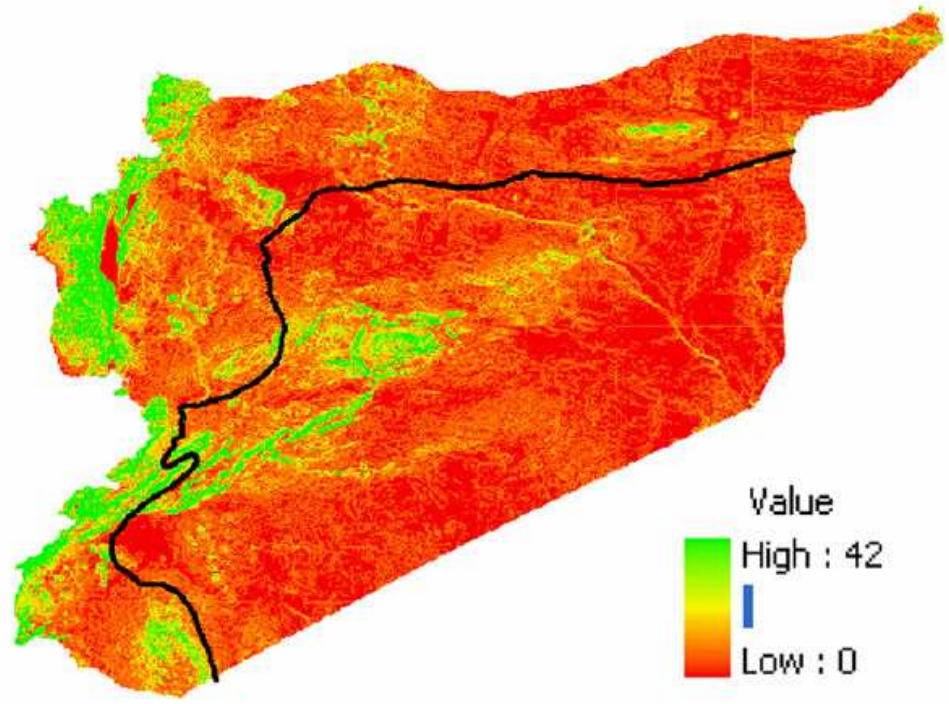


Figure 2. Slope map of Syria.

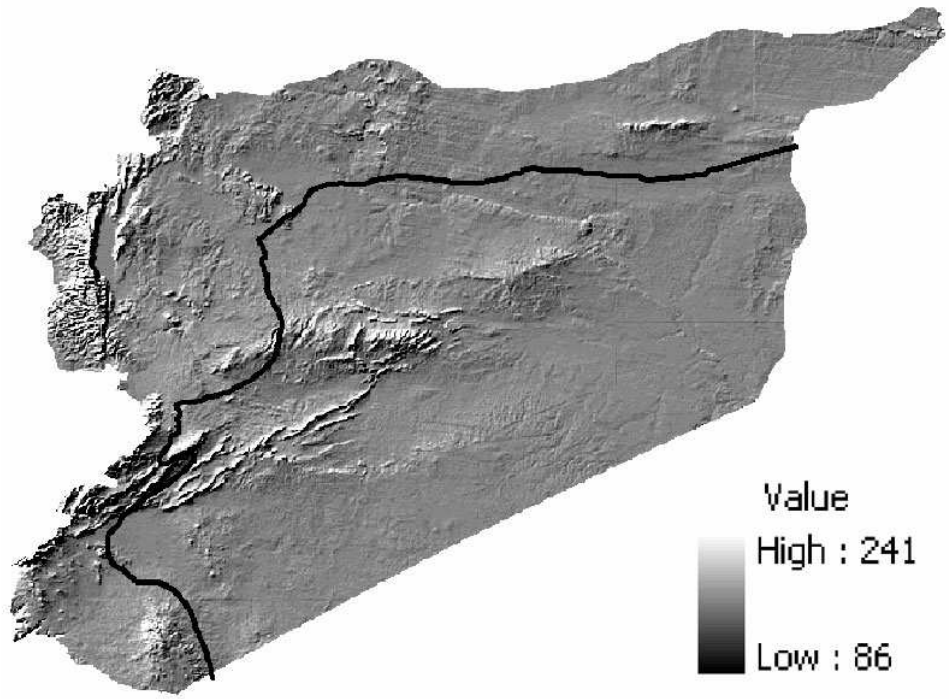


Figure 3. Hillshade map of Syria.

II. METHODOLOGY

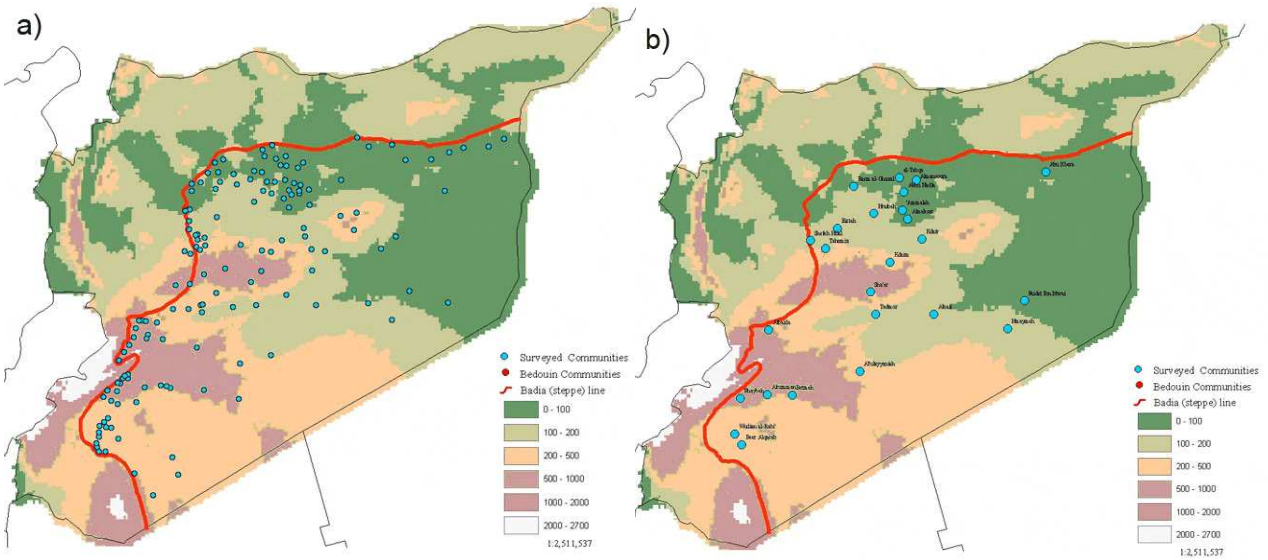


Figure 4. Map of Syria, showing (a) all Badia mother communities, (b) mother communities selected by the project.

Figure 5. Household and socio-economic survey.

Figure 6. Community boundary as defined by the local population.

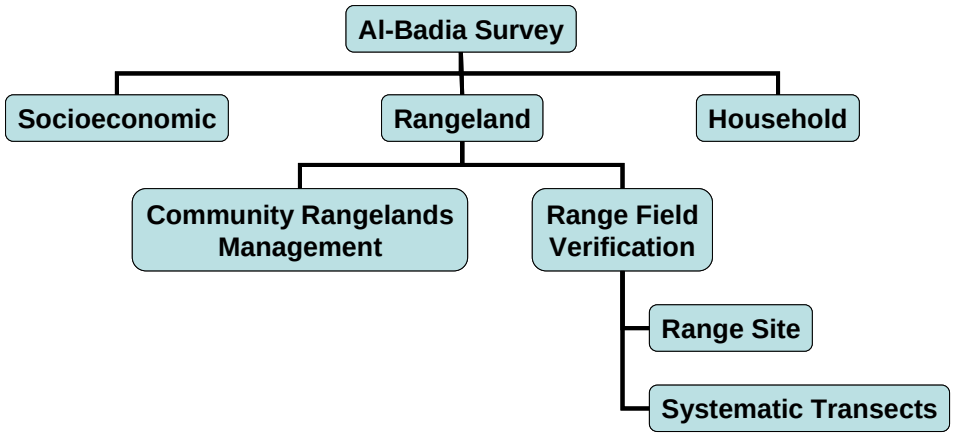


Figure 7. Badia survey structure.

III. RANGELAND CHARACTERIZATION

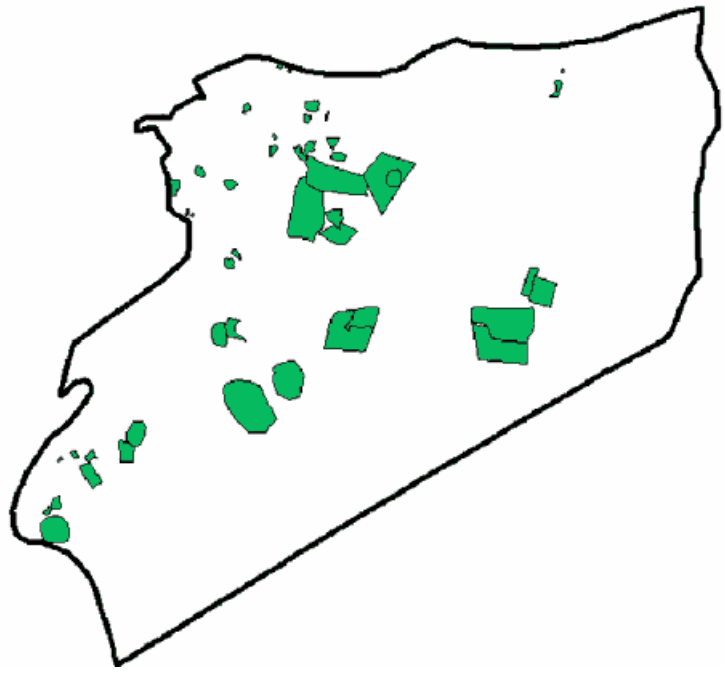


Figure 8. Location of communities.

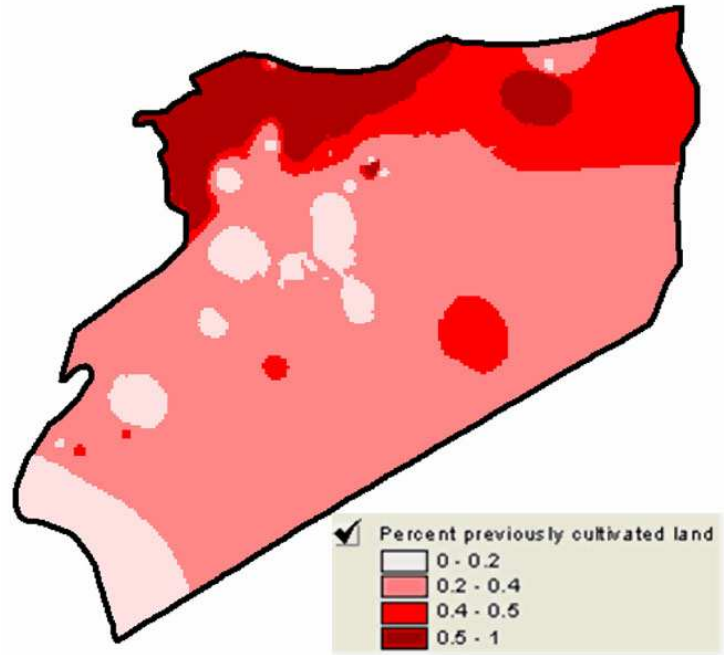


Figure 9. Percent of communities' land that was formerly cultivated.

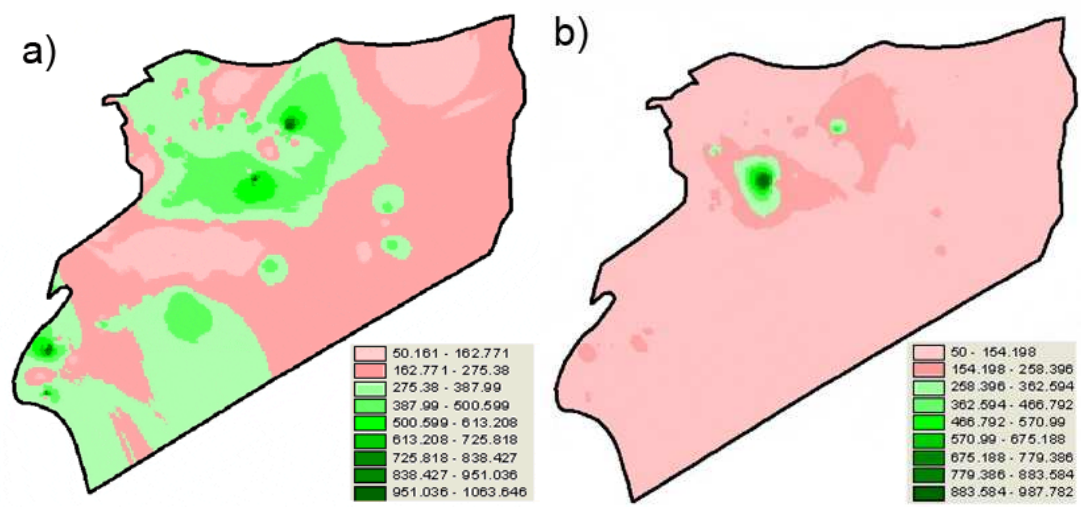


Figure 10. Biomass estimation: a) potential biomass, b) biomass at time of survey.

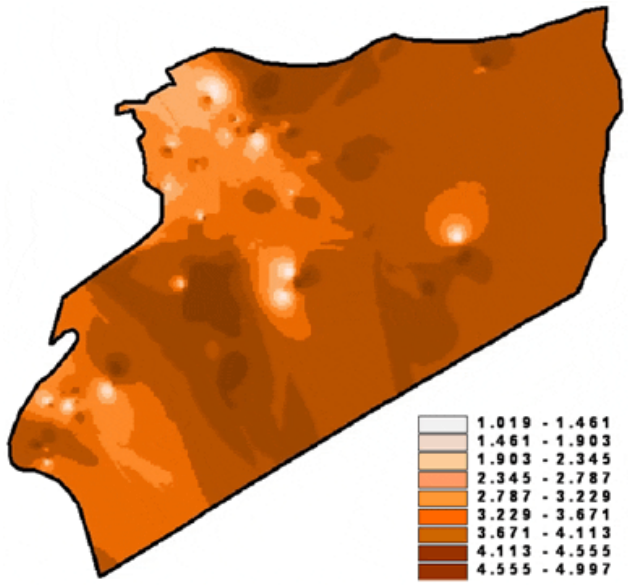


Figure 11. Rangeland utilization levels.

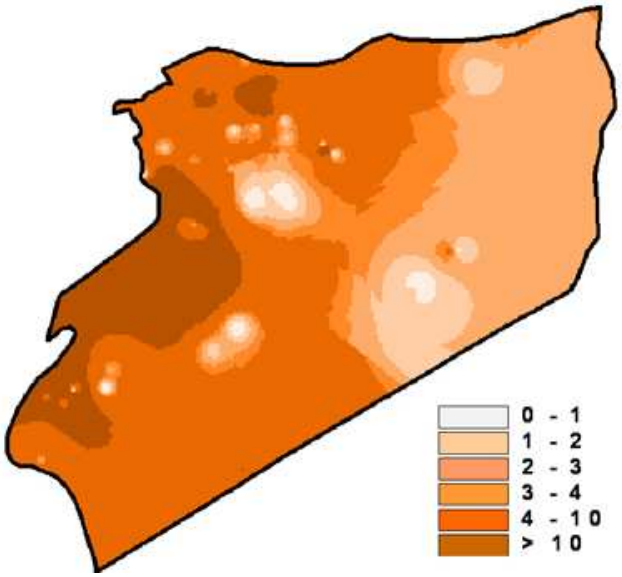


Figure 2. Overgrazing ratio (stocking rate divided by carrying capacity).

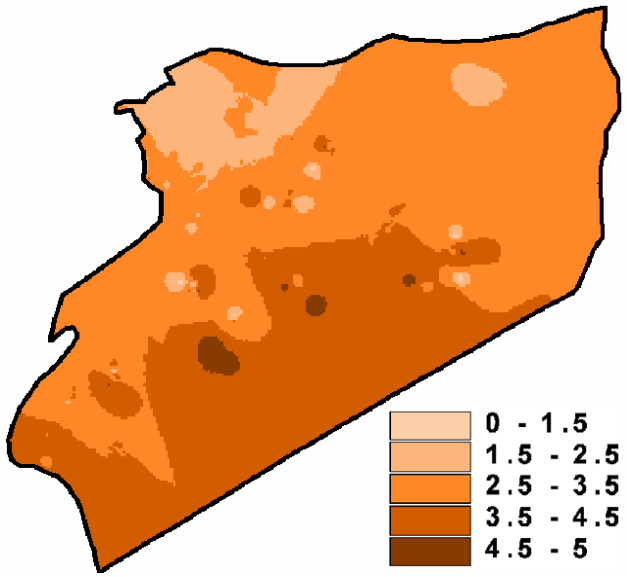


Figure 11. Soil degradation indicator.

IV. SOCIO-ECONOMIC CHARACTERISTICS OF COMMUNITIES

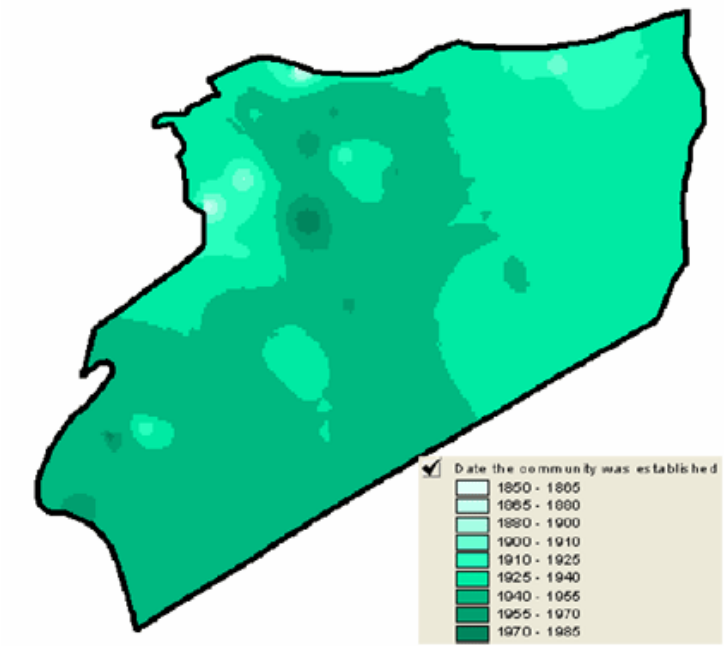


Figure 12. Date of communities' establishment.

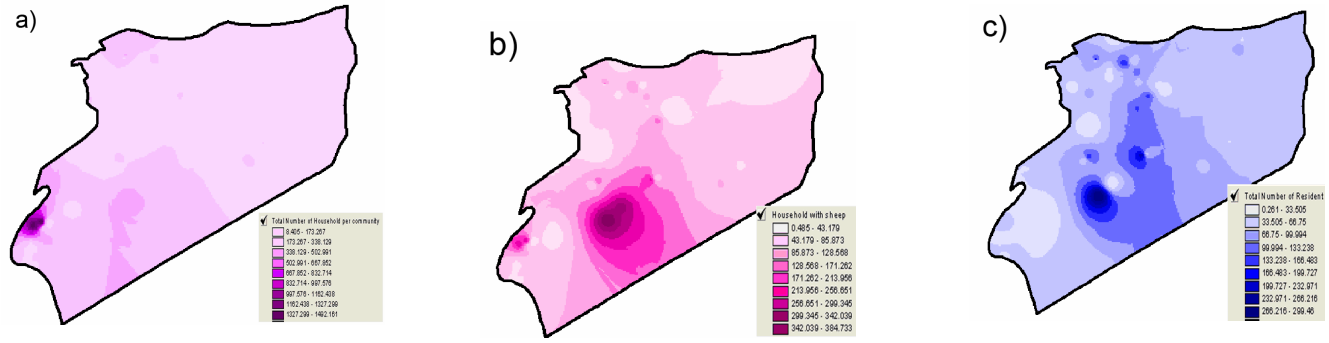


Figure 13. Community size: a) all households, b) households who are using the land, c) residents.

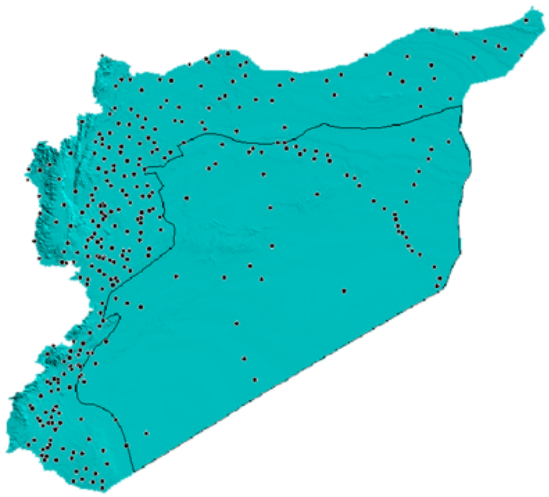


Figure 14. Syrian population density

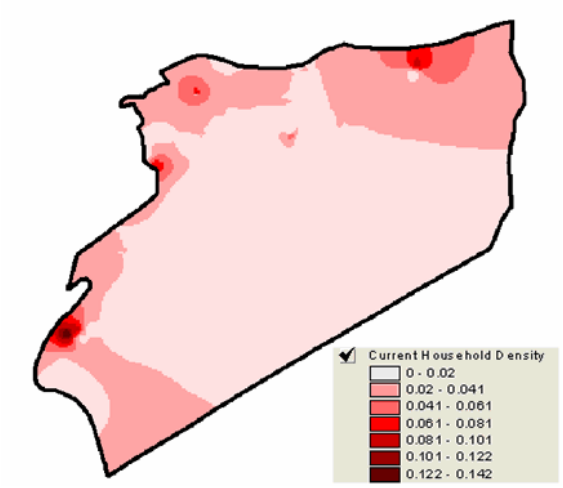


Figure 15. Population density (land users) of Badia communities.

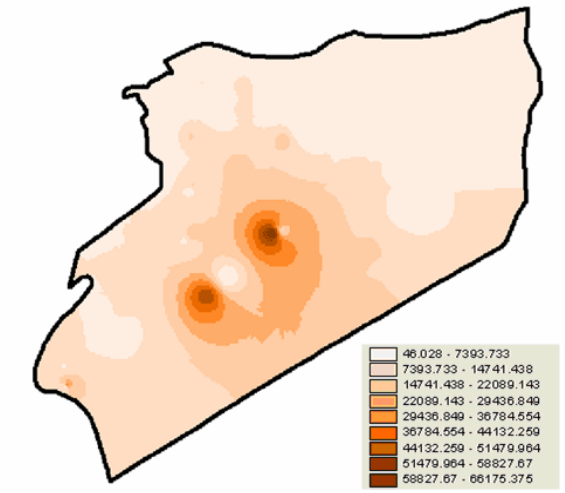


Figure 16. Community flock size (sheep still using the land).

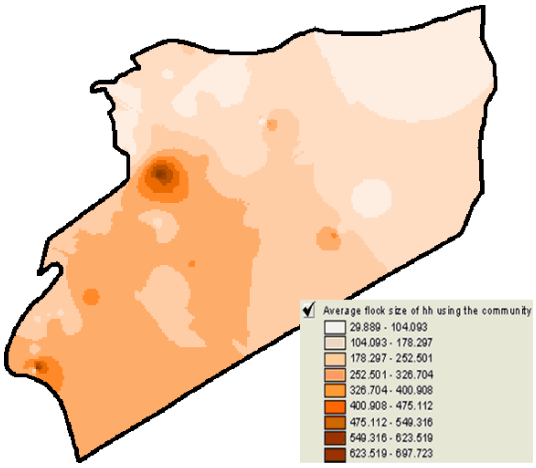


Figure 17. Average flock size (sheep still using the land).

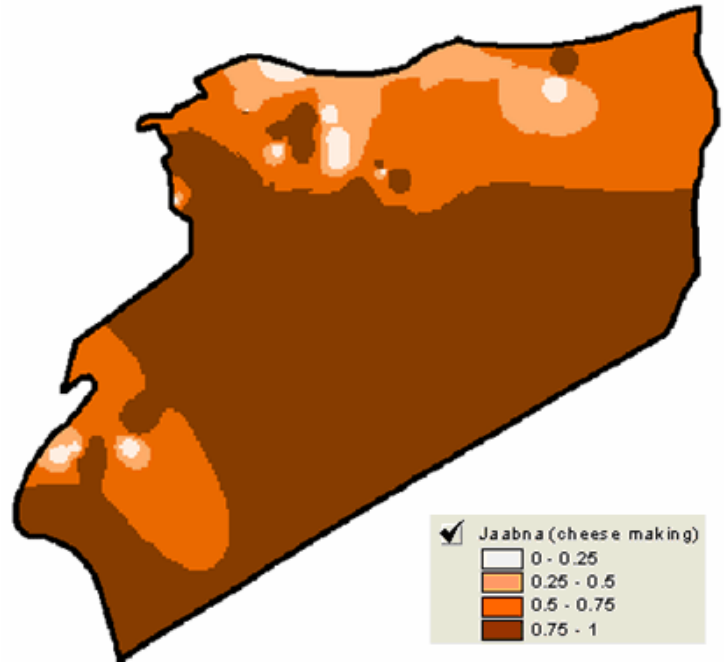


Figure 18. Community use of *Jabaan*.

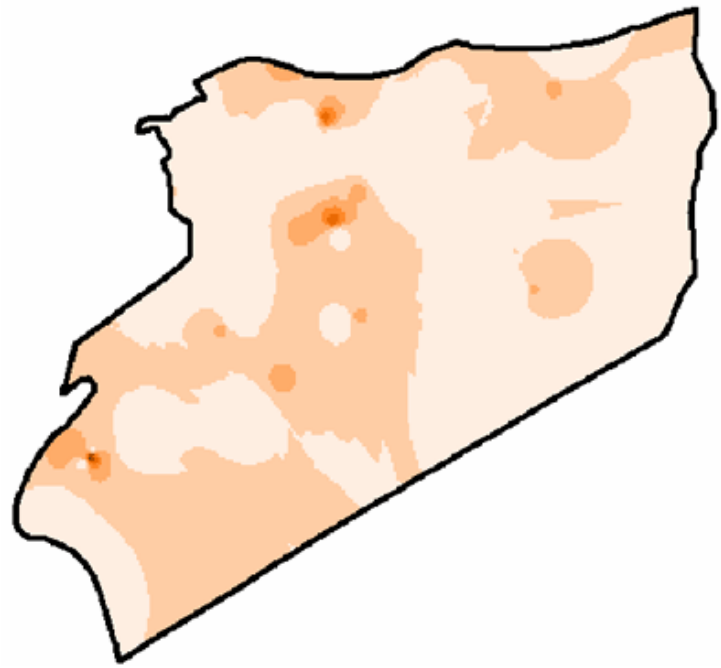


Figure 19. Leadership (light color=leader, dark color=committee).

V. HOUSEHOLD CHARACTERISTICS

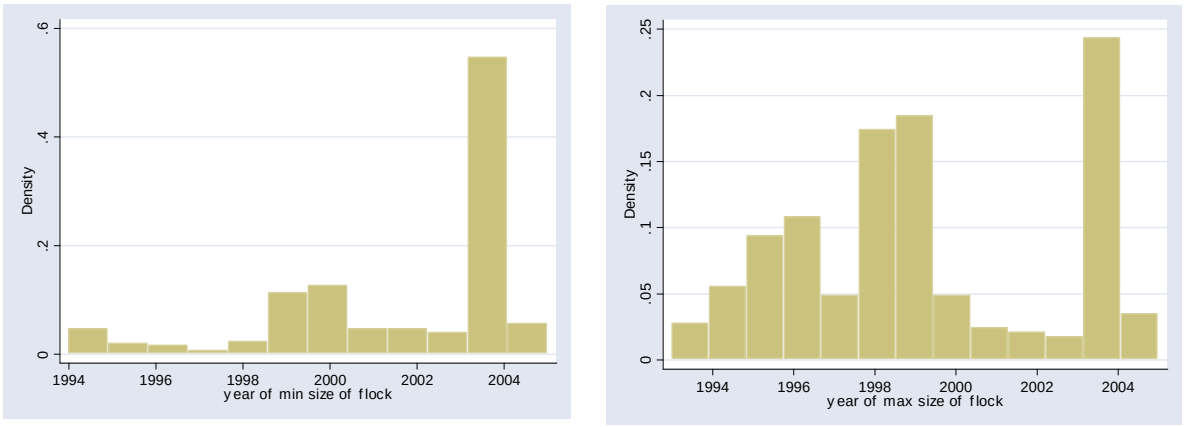


Figure 20. Frequency of year households had the smallest (left) and biggest (right) flock size.

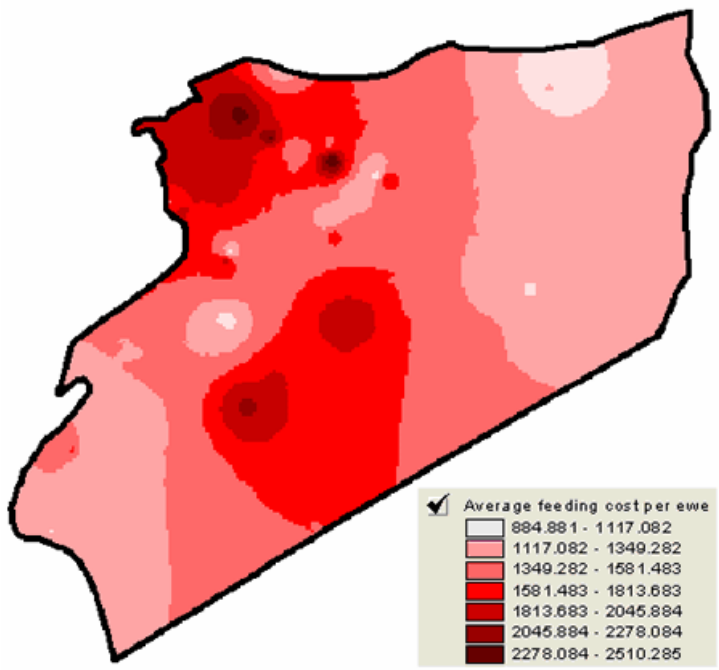


Figure 21. Average feeding cost per ewe (from household data).

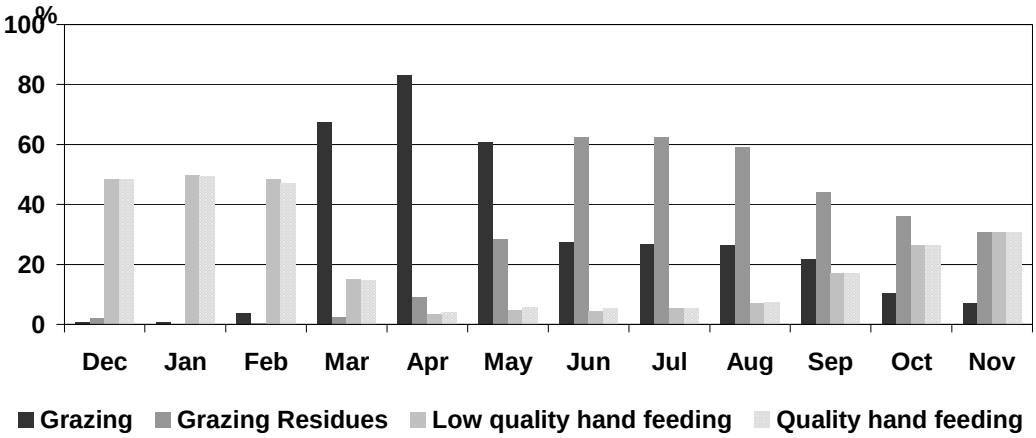


Figure 22. Feed calendar, whole sample.

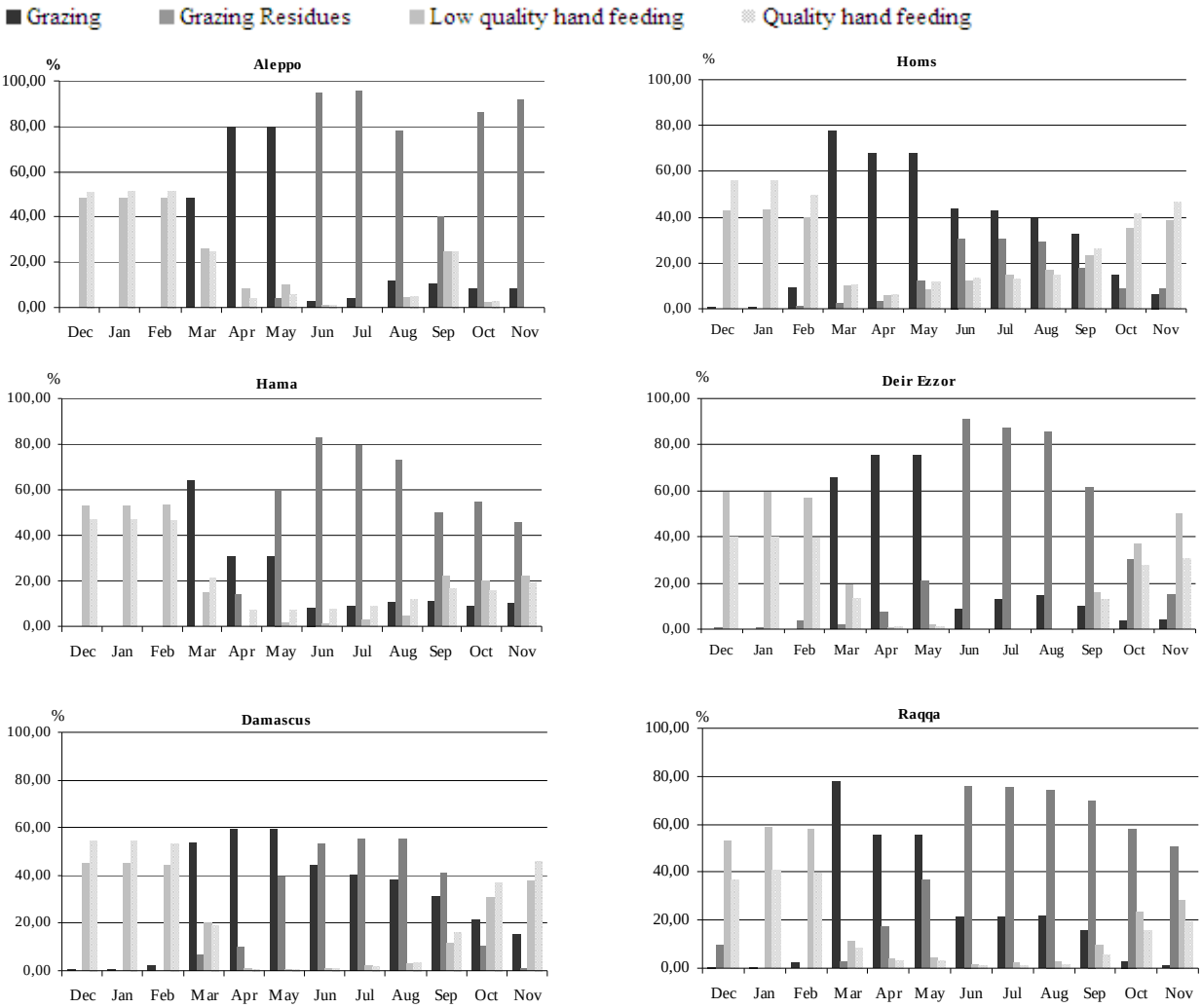


Figure 23. Feeding calendar in different provinces.

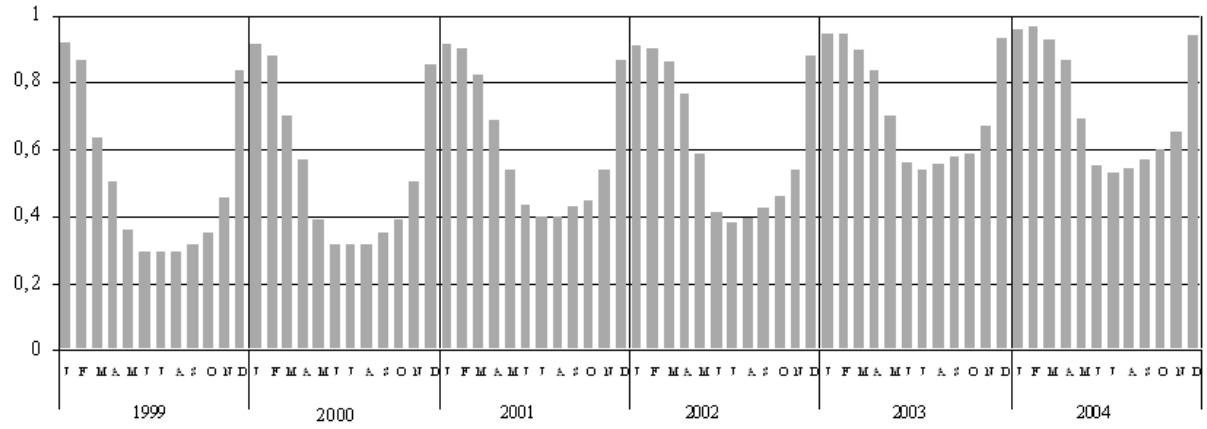


Figure 24. Percent households who stayed on the site during the past 6 years, by month.

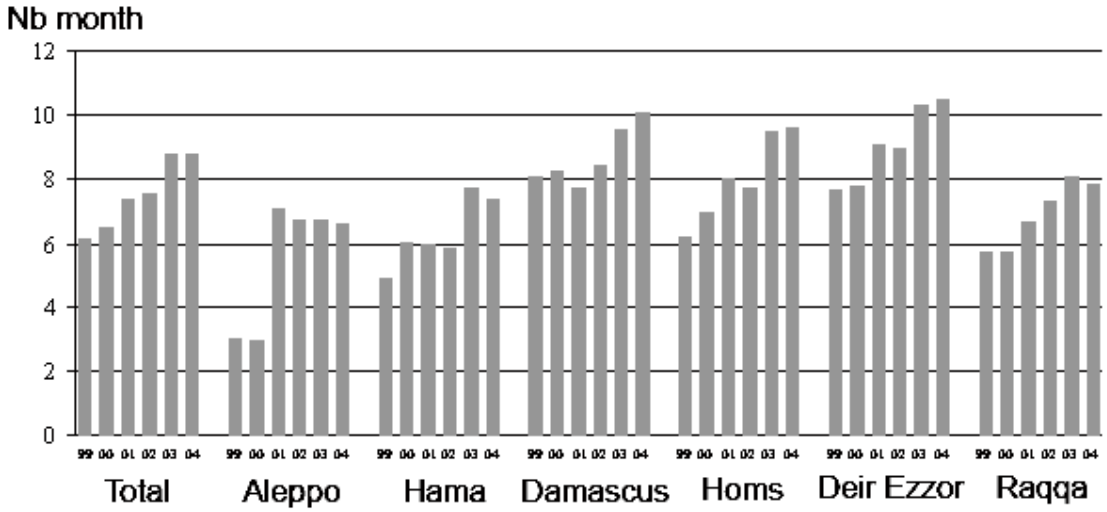


Figure 25. Average time spent on the site, by year and by province.

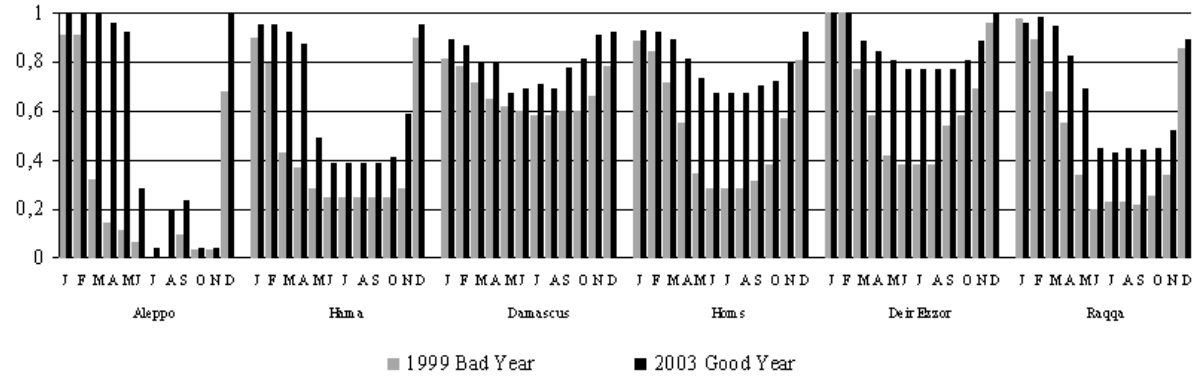


Figure 26. Proportion of households who stayed on the site in 1999 and 2003, by province.

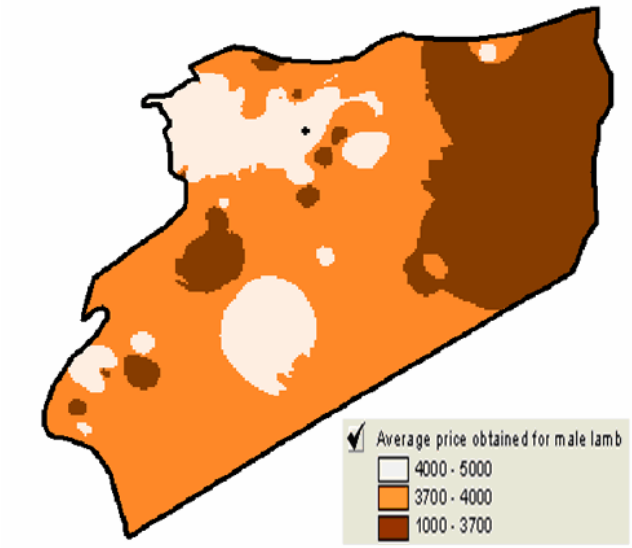


Figure 27. Average lamb prices (from household data, high prices in light color).

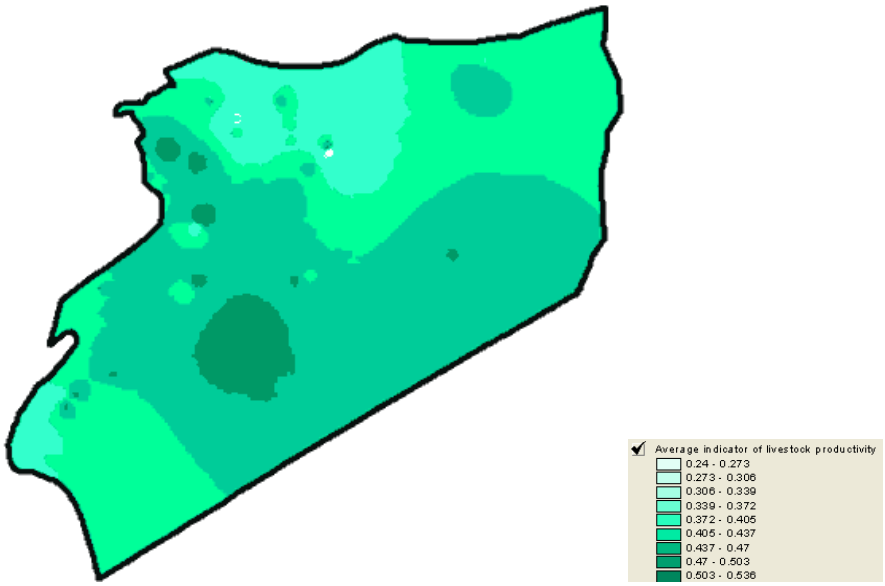


Figure 28. Index of livestock productivity

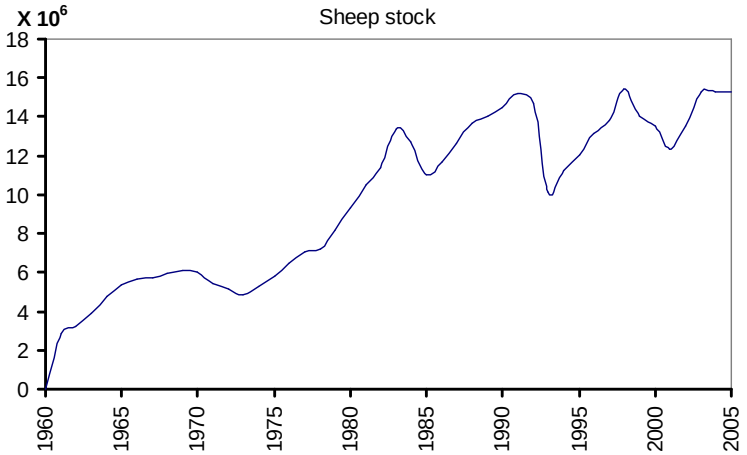


Figure 29: Sheep population trends in Syria, 1960-2005

APPENDIX 1

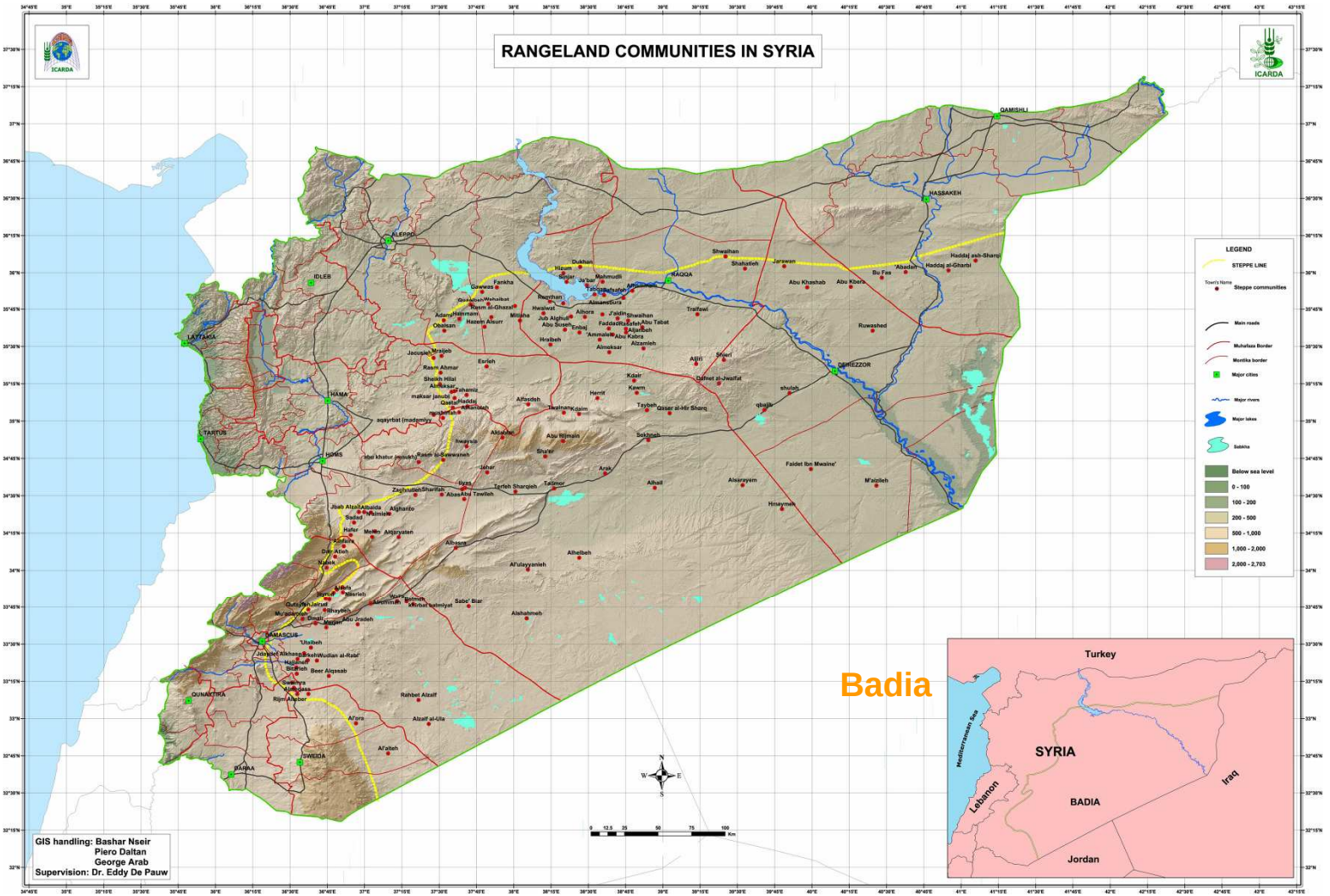


Figure 30. Badia boundary and Badia communities.