

RANGELAND MANAGEMENT OPTIONS AND SHEEP FEEDING STRATEGIES IN SYRIA

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INTRODUCTION

In recent years, there has been a heightened interest for the development of rangelands and the promotion of participatory approaches to involve local communities in the improvement and conservation of their resources. These efforts have usually been confronted with many challenges inherited from distorted agricultural policies that previously promoted rangelands cultivation. For the past 30 years, the government of Syria introduced many institutional options to foster stewardship on privately licensed ranges and promote collective action through rangeland cooperatives. Unfortunately, most of these efforts did not succeed in striking a balance between crop production and environmental conservation. As the result, the Syrian Government (GOS) banned cultivation of rangelands in 1994. The ban on cultivation was an important instrument for the government to reassert its control over rangelands and revert rangelands to grazing. The underlying premise was that reverting rangelands into their traditional utilization would stop resource degradation and land appropriation.

One may expect that the ban of cultivation would also reverse the rangeland into common use. However, the reversal process of rangelands from individually controlled sites to common use faces many challenges because of the reluctance of site holders to lose their claims on the lands that they have been cultivating for along time. They will continue to observe the *status quo* that prevailed during the time when these lands were being cultivated by respecting each other's boundaries.

The present paper explores some of the institutional options that have been experimented in Syria and uses a case study of a community, which rangelands have been

divided into 26 grazing sites and depended a great deal on the cultivation, to assess the feeding strategies of the Jub-Jamaa community members. The paper is organized into four sections. After the introduction, the second section examines GOS rangeland policies and the different institutional options that were proposed to improve range productivity. The third section presents the Jub-Jamaa community and evaluates the tradeoffs between the different feed resources. Finally, the conclusion looks at the way forwards

EVOLUTION OF BEDOUIN PRODUCTION SYSTEMS IN SYRIA

Traditionally, rangelands were the major source of feed for Bedouin livestock production systems (Zacaria, 1947; Nordblom and Shomo, 1995). Access to grazing resources depended on tribal membership and on tribal networking. As such, Bedouin tribal institutions played an important role in defining access and use rules for their local resources as well as negotiating access-rights on other tribal pastures (El-Masri, 1991; Nesheiwat, 1991; Metral, 2000). The main rangeland management option was tribal common property on their local rangeland resources. Transhumance started in mid-May from the rangelands to cropping areas and returned in September-October to the rangelands (Bahhady 1980; Zacaria 1947). In recent years this rangeland-based system has evolved into a barley-range based system (Metral 1993; Nygaard and Amir 1988).

The transformation of bedouin production systems

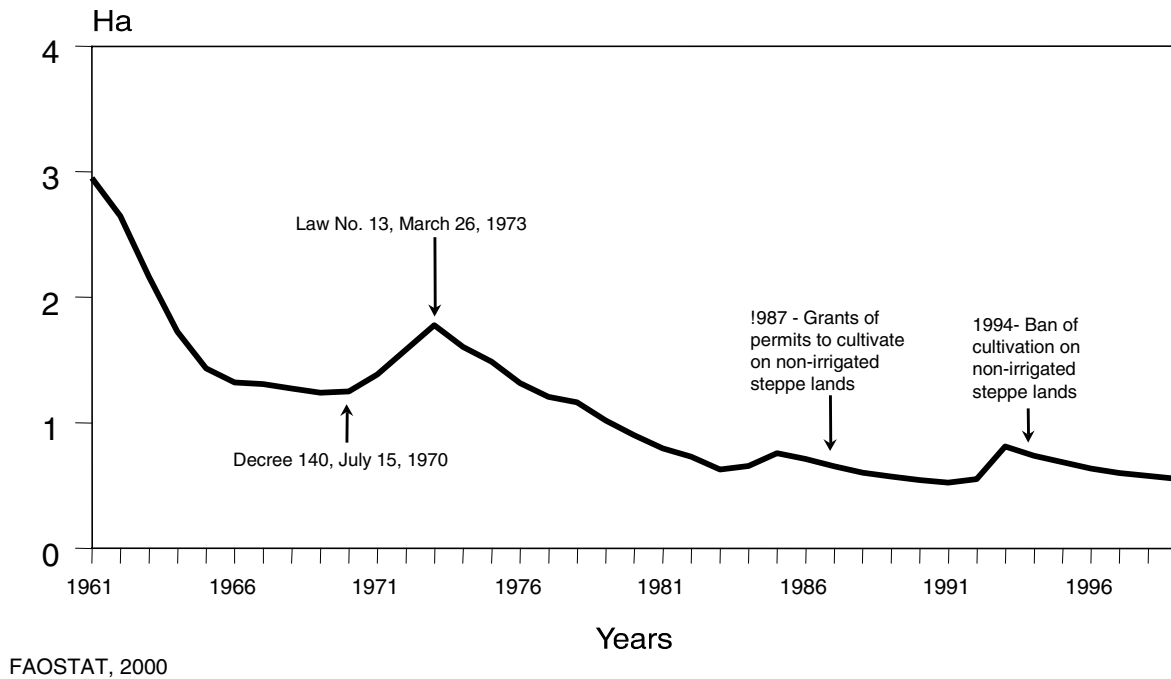
Since late 1950s, the Syrian rangelands have been the focal point of the Syrian Government interventions. State interventions included assertion of state ownership over

rangelands, settlement and transformation of herders into farmers, formal reorganization of the Bedouin population into range improvement and sheep husbandry cooperatives, and development of rangeland reserves (Masri 1991; Leybourne 1993 and 1996; Murad 1998). The GOS enacted numerous decrees⁴ and decisions⁵ setting the modalities for access and cropping in rangelands. The Five-year agricultural plans committed between 30 to 100% of the rangelands for cultivation. These policies extended crop production into more marginal areas leading to widespread land appropriation, destruction of the natural vegetation and dwindling grazing areas. Figure 1 shows the trend of per capita pasture (ha per sheep) in Syrian rangelands. Per capita sheep pasture areas decreased both in quantity due to the increasing number of sheep and quality because of range degradation. Consequently, the contribution of rangeland in sheep diet was reduced and is estimated presently between 10 to 25%. The remaining feed needs comes from grazing crop residues in favorable areas and concentrate feeds.

⁴ The 1958 land reform law (Law No. 161 of 1958) asserted state ownership over rangelands and defined the agrarian reform policies; the July 20, 1970 decree (No. 140) prevented appropriation of rangelands and banned cultivation on non-irrigated steppe lands (Badia); the Presidential decree (No. 31 of May 14, 1980) limited land ownership to 140 ha for areas less than 350 mm and 200 ha for the Hassakeh, Deir Ezzor and Rakka provinces. The decree (No. 96/T) granted the possibility to rent state non-irrigated steppe lands until 1988 when it was forbidden to grant new licenses.

⁵ The March 19, 1973 decision (No. 13) promoted the extension of cultivation in the rangelands.

Figure 1: Evolution of per capita pastures (ha per sheep) in Syria (1961-1999)



In addition, opposing claims between state and pastoral communities have resulted in poorly defined tenure rights on rangeland resources. The confusion between who manages and enforces rules of use and who grants access to rangelands fostered a situation of no-control generally termed "open-access." Masri (1991:10) argues "instability of life and lack of property rights are the real causes of overgrazing and misuse." These policies participated to a great deal on the transformation of Bedouin production systems and degradation of rangelands. The evolution of institutional and market mechanisms used by Bedouins to access local and external resources is shown in Figure 2 and Figure 3. At the level of local resources, families appropriated and cultivated large areas some of which was licensed from the state. Consequently, traditional tribal reciprocity and support systems have eroded within many communities and have fostered individual strategies.

Figure 2: Current grazing resources (Before 1960)

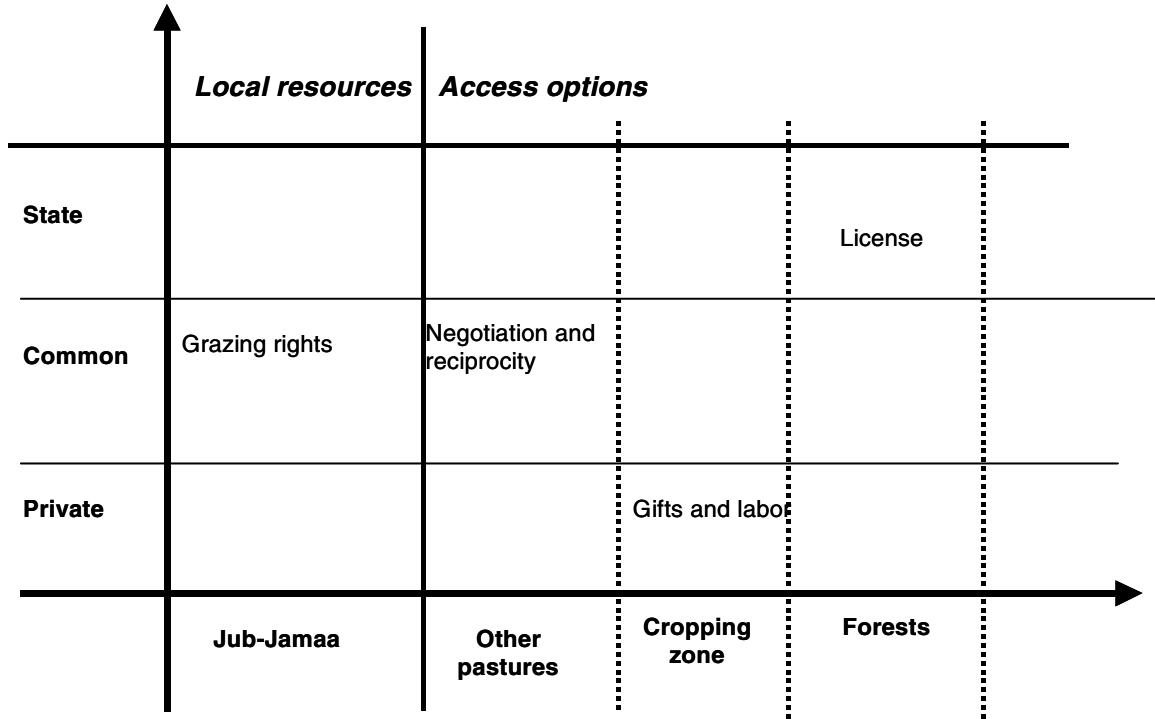
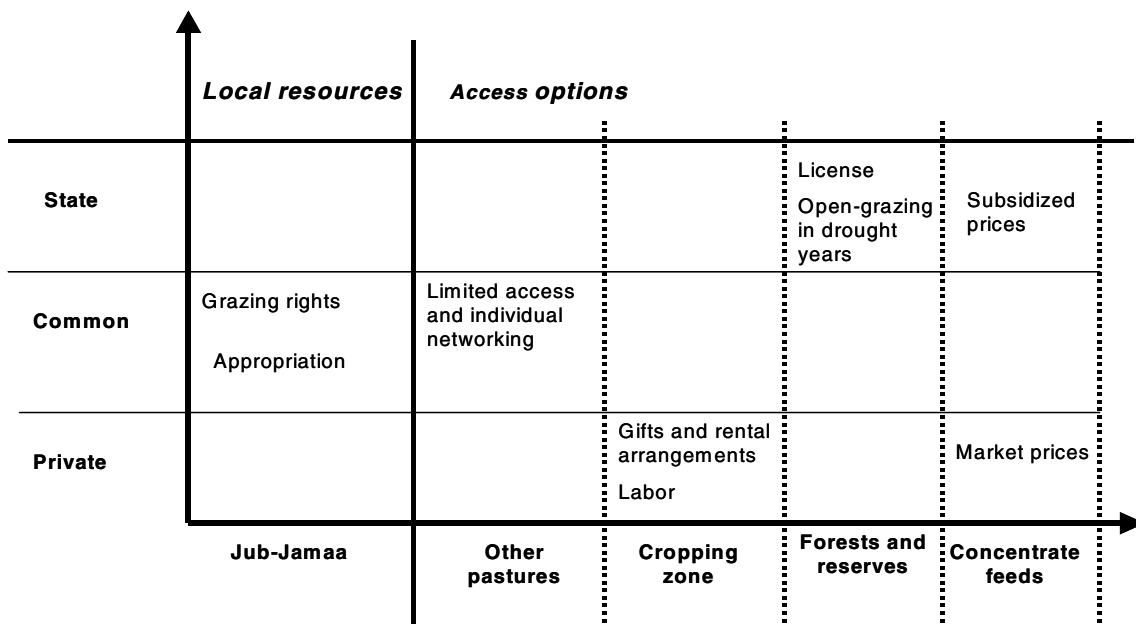


Figure 3: Traditional grazing resources (1960-present)



However, the extent to which these transformations have changed livestock production strategies is not well understood. It is critical, when dealing with pastoral communities, where mobility is an integral part of the production system, to have a holistic understanding of the feed resources and the underlying rules that govern access and use of those resources. There are tradeoffs between quantity and quality of local grazing resources and access-option resources. In the past, these tradeoffs were mainly based on reciprocity mechanisms that helped tribal groups to hedge against feed shortages during either drought spells or summers. The expansion of cropping in local rangelands promoted the development of market relations even amongst the Bedouin themselves. They sold or purchased from each other crop residues and standing barley crops for grazing. Furthermore, personal relationships were the major mean used by Bedouin to access other pastures.

Range management options in Syria

Many institutional options for range management were experimented in Syria to improve rangeland productivity and conserve the environment. The options included licensing cropping lands to households and promoting cooperative organizations to manage their allocated range areas. However, the lack of a legal framework granting tenure security to households or communities limited the effects of these options. The FAO workshops (1991; 1993) on pastoral communities in the near East concluded that land tenure was the major constraint preventing sustainable management of rangelands

and recommended that governments needed to address this issue to promote better resource stewardship by local communities.

Licensing cropping lands and individualized grazing reserves

Licensing land to Bedouin households for cultivation was consistent with agrarian reform policies that promoted the settlement of Bedouins. Bedouin communities were encouraged to grow barley for feeding their animals. Rapidly, many Bedouin households, who viewed these policies as a means to lay ownership claims on rangelands, expended their licensed areas. Consequently, the GOS required license holders to plant 20% of their rented lands with shrubs⁶. However, development of private grazing reserves was mitigated. Contrary to Masri (1991), who found that private reserves covered 11,506 ha in 1989, Leybourne et al. (1994) found a limited number of successful private shrub plantations (Table 1).

⁶ November 11, 1987 decree No. 96/T

Table 1: Private fodder shrub plantations in Northern Syria, 1993

Province	Number of plantations visited	Estimated number of plantations still existing	Number of farmers who received seedling from the government	Estimated percentage of plantations still existing
Aleppo	10	17	300	5.7
Hama	10	Unknown	Unknown	-
Raqqa	5	9	>200	4.5
Deir Ezzor	3	3b	>250	1.2
Hassakeh	2	2	600	0.3

a. Information obtained from the Steppe Directorates for each province

b. This does not include eight farmers with irrigated land who planted *Atriplex* spp. On slaty land as a land reclamation exercise. These farmers did not receive the shrubs from the government.

Source: Leybourne et al., 1994

One of the limiting factors may have been the competition between shrub and barley cropping. Sheep-breeders view barley as superior to *Atriplex* and consequently did not consider planting shrubs as a viable alternative.

Cooperatives

The first attempt to organize herders into livestock cooperatives was in 1968 with the support of World Food Program (WFP) (Jaubert 1993). Each cooperative received a rangeland grazing area to manage as a common reserve for its members. Masri (1991) argues that the 1970 decree was based on government's understanding of the importance of the Hema system⁷. The decree forbade the appropriation and plowing of rangeland and required that "all steppe grazing lands be managed by the Range Improvement and Sheep

⁷ The hema consisted of protecting certain areas of common tribal pastures from grazing for a fixed period (Draz 1969; Neisheiwat 1991; Masri 1995).

Husbandry Cooperatives (RISHC) or as state range reserves for the establishment of Range and Sheep Centers (RSC)” (Masri, 1991). These cooperatives, which were part of the agricultural modernization agenda, were also the means to break down tribal systems.

However, the adaptation of traditional Hema systems for cooperative management failed because the boundaries of the areas allocated to cooperatives and membership composition did not always coincide with tribal grazing areas and membership (Masri, 1991; Rae et al. 1997). This situation prevented many cooperatives to improve their pastures and reduced their effectiveness as an instrument for managing rangeland resources. Masri (1991) found that between 1981-1989 range improvement cooperatives replanted only 2,189 ha compared to 24,088 ha planted by the state and 11,506 ha by private individuals. These cooperative ended up being mainly service cooperatives that were more interested by subsidized feeds than improving rangeland resources.

State rangeland reserves

The mitigated success of private and cooperative range reserves fostered the government to initiate government managed rangeland reserves (Rae et al. 1997). The Steppe Directorate initiated in mid-1980s the development of shrub reserves to reverse the degradation process and provide fodder to livestock (El Asa’ad et al. 1991; Osman et al. 1993; Leybourne et al. 1993; Nordblom et al. 1995). The Directorate introduced grazing contracts for SYP125 per ha and per moth but limited the stocking rate at three sheep per ha. Moreover, contract holders paid 20% of their of their rent to guaranty observance of rules (Nordblom et al. 1995). Such fees were not always effective in restraining people from overstocking on their rented plots or breaking the rules.

The main impediments to existing rangeland reserves are (1) the lack of a defined and practical strategy regarding the role of local communities in the use and management of these resources (Osman et al. 1994), and (2) the confusion over access and use of the reserves (Ngaido et al. 1998). In addition, range reserves prompted new dynamics between local tribes and their neighbors because these reserves, even though considered as state owned meaning that all herders have the possibility to buy grazing licenses, local tribes prevented others from having access to the reserves located on their traditional tribal pastures (Rae et al. 1997).

Banning cultivation in rangelands

The failure of different state attempts to foster collective action and promote herders' stewardship over range resources pushed the Syrian state to gradually ban crop production in rangelands. The process started in 1992 with the Prime Minister's decision⁸ requesting governors to prohibit cultivation of rangelands, which would be planted with shrubs within five years. The government doubled the fees on appropriated lands⁹ before the ban of rainfed cultivation¹⁰ and irrigated cropping¹¹ in rangelands. However, the ban on cultivation did not promote common grazing but pushed some medium and large sheep owners to plant shrubs strengthen their claims (Personal communication with the Steppe Directorate). The Rangeland Development Project jointly funded by IFAD and AFESD was also encouraging this trend.

⁸ September 15, 1992, decision No. 17

⁹ September 20, 1993 circular No. 2/MD

¹⁰ December 6, 1994 Circular No. 4553/1

¹¹ December 3, 1995 Decision No. 27

Community based rangeland management options

The timid devolution efforts in the Syrian rangelands to organize local communities and grant them tenure security are important steps towards sustainable rangeland management. The experiment is so far limited to the three cooperatives involved in the Al-Talila Range Rehabilitation and Wildlife Reserve Project. The cooperatives had their territories mapped and the government enacted a decision recognizing their respective traditional grazing areas¹². The reserve included 24,000 ha of the Arak cooperative, 58,000 ha of the Al-Munbatah cooperative and 15,000 ha for the Al-Abassid cooperative. In addition, the GOS excluded all cultivated lands from the control of the three cooperatives. The organization of cooperatives along tribal lines and the recognition of traditional grazing areas for each cooperative provide incentives for the involvement of local communities in the management of their resource base. The use of traditional grazing areas to determine the cooperative boundaries facilitates group cohesion and reduces the incidence of conflicts.

These different range policies and institutional innovations had important consequences on Bedouin production systems and rangelands. The following section will discuss the case study of a community which pastures were divided into 26 grazing sites and evaluate household feeding strategies.

¹² February 14, 1996 decision No. 759/V

CASE STUDY OF THE JUB-JAMAA COMMUNITY

The present study aims at assessing and evaluating the transformation of livestock production systems in the Jub-Jamaa community. This community is an example of individualized grazing pastures, which prevails in the majority of Syrian rangelands. The Jub-Jamaa community, which is located in the rangelands of the Aleppo province, settled in 1953. The study of this community started in 1998 and included (1) community mapping using Geographic Information System (GIS) to delimit the community boundaries and evaluate the level of cultivation, (2) rapid rural appraisal (RRA) to collect general information about the community, (3) a complete census in 1999 to determine household wealth indicators (sheep, land, tractors, etc) and (4) in-depth survey of 69 selected households. The in-depth households surveys were conducted to study the changes of Bedouin's production strategies in 1999 (May 1998-April 1999) and in 2000 (May 1999-April 2000).

The study area

The present tenure configuration of the community rangelands results from the cultivation policies that fostered land appropriation. The pastures were divided into 26 grazing sites ranging from 40 to 835 hectares. Each family or lineage appropriated a site and the water cistern(s). The level of land fragmentation was very high in the densely populated sites and the intensity of cultivation ranged from 30% to 100% in the areas with watercourse (*wadies*) (Map 2). The census conducted on 1998 found that the community was composed of 352 households (2,918 people) and owned around 53,500 sheep. There were many disparities on sheep ownership and land holdings. For example,

large sheep owners, who accounted for 11% of the households, had on average 614 sheep and 36.5 hectares; medium sheep owners, which accounted for 24%, had on average 215 sheep and 24.75 hectares; and small sheep owners, which accounted for 65% of the households, had on average 54 sheep and 15 hectares. Most of the small livestock owners relied heavily on cultivation to generate additional income. They were the group that was the hardest hit by the ban of cultivation and many of them migrated to the cities to carry out menial jobs.

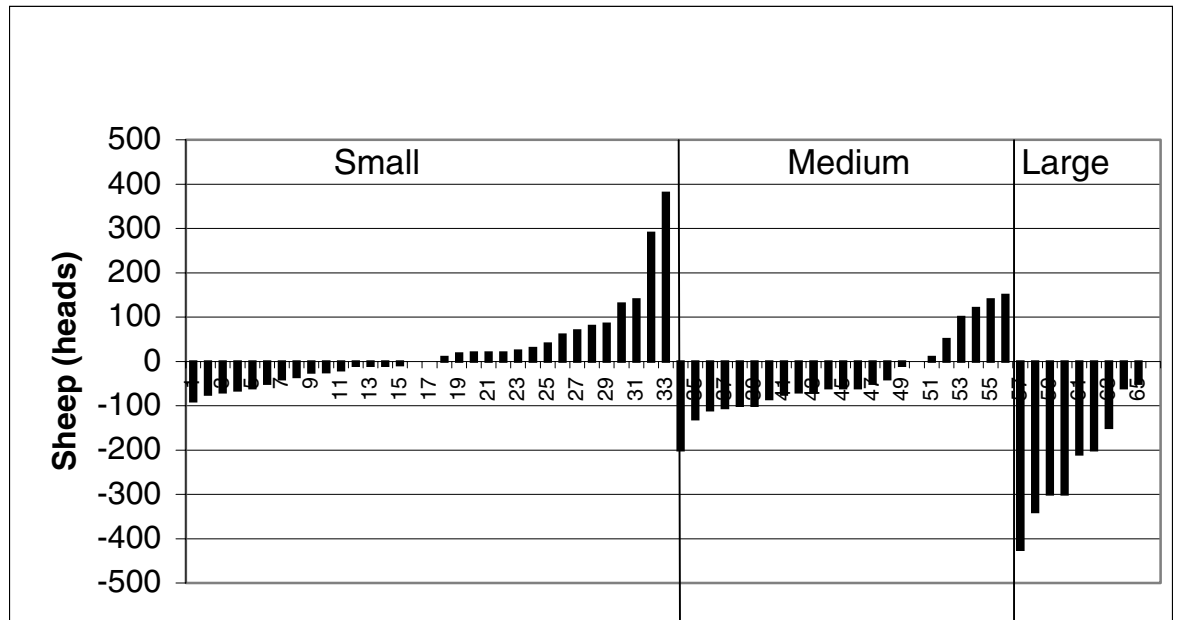
Data

The data used in this analysis is from the two in-depth household surveys that were conducted in 1999 and 2000 amongst 66 households. The same households were interviewed during the two years to monitor their production strategies and migration patterns. Households were clustered into three groups according to sheep ownership. The first group (Group I) was composed of 35 households (51%) in the 1999 survey and 36 households (60%) in year 2000; the second group (Group II) was composed of 25 households (36%) in year 1999 and 19 households (29%) in year 2000; and the third group (Group III) was composed of 9 households (13%) in year 1999 and 7 households (11%) in year 2000. In year 2000 only 62 households were surveyed because one of them sold all his sheep and left sheep herding, the second one did not respond to the interviewers and the third and fourth were not available at the survey time.

Sheep stocking strategies

There is a general understanding that sheep owners reduce the size of their flocks during drought periods as to feed the remaining sheep. However, the comparison of sheep ownership shows that between 1999 and 2000 the groups of small and medium sheep owners were either selling or buying more animals while large sheep owners was the sole group that only sold but did not purchase additional sheep. These results show that even during drought years, small and medium sheep owners profit from low sheep prices to build their stocks (Figure 4). Therefore, it would be misleading to think that animal de-stocking will have beneficial environmental effects because at the community level, the stocking rates would stay the same. However, some of the sites will benefit from reduced stocking rates.

Figure 4: Sheep stocking strategies for 65 sheep owners in Jub-Jamaa (1999&2000)



Feeding strategies

Migration patterns

Mobility was one of the major features of livestock production in Syria until the settlement of the nomads and their involvement in barley production in the rangelands. The promotion of cropping in these areas favored the development of a sedentary production system with herders producing part or the totality of their feed requirements and migrating for very short periods to other cropping areas. Following the ban of cultivation, Bedouins were obliged to seek new grazing and feeding strategies and offset the feed gap. As a result, they migrated earlier and stayed longer outside of their grazing sites. Moreover, the traditional transhumance patterns have changed. Tribe or fraction members are no longer migrating as a group to cropping areas or other pastures. Each single household or households living in the same site will get together and organize their

move. They will also hire a guard to look after the site and their buildings while they are away.

In 1999, 99% of the households of Jub Jamaa moved to cropping areas in Al Jazeera or the Aleppo province or the mountain pastures in the coastal areas of Syria. In 2000, 23 households moved to the same areas the remaining 39 did not even return to their grazing sites. The successive drought years forced flock owners to spend more time out of their sites. Households used different strategies on where to go depending on their social networks, feed, and water availability. For example, the first and second groups moved farther than the third group because they could easily truck their flocks from an area to another. The average length of time spent out of the site in 2000 was 324 days (or 89%) for Group I compared to 190 days in 1999, 326 days (or 89%) for Group II compared to 257 in 1999 and 283 days (or 77%) for Group III compared to 135 in 1999. Moreover, households stayed longer in irrigated areas because of better quality crop residues and free or cheap water. Group I, Group II and Group III spent on average 271 days, 258 days 206 days in irrigated areas respectively (Table 1).

Feed resources

Livestock feed diet comprise of three categories; native pastures especially in good years, crop residues and hand feeding materials (concentrates, straw, etc.). The feed resources will be classified according to whether they are located on the community grazing sites or are accessed either through institutional arrangements or purchased. Such distinction is very important for understanding sheep feeding strategies and their tenure implications (Figure 2 & Figure 3).

Local grazing resources

Local grazing resources since the ban on cultivation are mainly composed of native pastures. The vegetation includes shrubs and annual grasses. Bedouin households use these pastures from October to May but most of the grazing takes place in spring and early summer. During the winter, herders feed their animals with concentrates and straws. During the last two years, drought conditions reduced the productivity of Jub-Jamaa's native pastures. The FAO/WFP mission estimated that during the 1998-1999 rainy season that the herbage from range vegetation was almost equal to zero compared to the productivity of 165 kg of dry matter per ha in normal years. The major feature in the Jub-Jaama community is the confinement of each family in their grazing sites. They have the right of passage on the other sites but do not graze there. This situation determines the complementary strategies used by each household to access additional feeds.

External feeding resources

External resources used by the Jub-Jaama community include the grazing of crop residues, other pastures, government forests and reserves, and concentrate feeds. These feed resources importance both in the Bedouin production system and as well on the mechanisms used to access them (Figure 2 & Figure 3).

Institutionally based grazing access-options

Bedouin households and communities had developed, in the past, a large array of reciprocal access arrangements, which allowed members of neighboring tribes to use

each other's pastures and water resources. Neighboring tribes included tribes from Syria as well as from tribes of neighboring countries (Metral 2000). Tribes respected these reciprocal arrangements because it strengthened their claims and reinforced traditional social relations (Ngaido et al. 1998). These arrangements between pastoral tribes were also risk-sharing devices to overcome environmental variations and enhance access and use of resources in other areas. Importantly, these arrangements enhanced their risk management strategies during drought years (Oram 1995; Behnke et al. 1993).

Following the breakdown of tribal based reciprocity systems, most of the households rely on their social networks to access these pastures (Figure 2 & Figure 3).

In addition, government forests and grazing reserves could be accessed through licenses or open to the herders during drought periods. For example, in 1999 and 2000, the government opened forests and protected areas for free grazing. However, only few households from our sample reported having used government reserves arguing that the salty soils of these reserves have negative effects on their sheep.

The 1999 survey results showed that small and medium sheep owners spent 18% and 9% of their time to graze other rangelands and pastures while none of the large sheep owners grazed on other pastures. In 2000, however, all households spent between 3 to 5% of their time using other rangelands. The reduction on the use of other pastures result from the drought conditions that were prevailing all over Syria. This suggests that, under normal conditions, access to other pastures is an important element of small and medium sheep owners' production strategies because they do not always have readily available cash to purchase hand-feeds.

Rented crop residues

Crop residues from rainfed and irrigated areas are one of the main feed sources for sheep breeding. Each tribe has traditional agricultural regions where they migrate annually for renting crop residues. The Jub-Jamaa community generally migrates to the cropping areas of the Aleppo province but during drought years, some of the households migrate to coastal and mountainous areas. Generally, households move to the same areas because they are familiar with the natural conditions and have developed long-term relationship with the farmers. In early summer, Bedouin household heads visit the farms to evaluate crops, compare rental prices for different crop residues, and assess water availability and costs. Following the inspection, sheep owners negotiate rental prices and agree on the grazing period.

In 2000, rental prices of crop residues were very high compared to prices in normal year. In a good year, the rental prices for barley or wheat residues ranged between SYP500 and SYP800¹³ per ha, but this year the prices fluctuated between SYP1500 and SYP3000 per ha depending on the type and quality of the residues. As such, the total costs of feeds in 2000 increased by three to five folds (Table 2).

¹³ 1 Syrian Pound (SYP) is equal to \$0.2174

Table 2: Average number of days spent by each group in different grazing sources

Source of crop residues	1999			2000		
	Small	Medium	Large	Small	Medium	Large
Rainfed	15	25	15	32	56	61
Irrigated	105	155	93	271	258	206
Other pastures	70	77	27	21	12	17
Jub-Jamaa site	175	108	230	42	40	82
Crop residues costs (SYP)*	8,782	7,815	34,428	22,204	37,247	82,486
Concentrate feeds (SYP)*	91,770	165,140	314,180	79,350	224,204	596,942
Supplementation days	138	130	170	170	176	168
Number of sheep	84	215	561	78	213	563

* 1 US Dollar = 46 Syrian pounds (SYP)

The feeding quality of the rainfed crop residues were very poor because farmers, who had lower production due to drought, collected and sold the straw to generate additional income. Consequently, Bedouin households were obliged to increase supplementation except households that rented cotton residues. In the coastal areas of Lattakia, sheep owners helped farmers to clean their plastic houses and gained access to free vegetable residues. Some of them participated in the harvesting of groundnuts and purchased the residues for SYP400 per ha.

The survey results in 1999 and 2000 showed that medium sheep owners spent more time in the cropping areas. In 1999, they spent 49% of their time grazing crop residues, while small and large spent, 33% and 30%, respectively. In 2000, they spent 86% of their time in the cropping areas while small and large sheep owners spent, 83% and 73%, respectively. Moreover, households spent between 56% and 74% of their time in irrigated areas because of better quality feeds and water availability.

Concentrated feeds

The main sources for concentrates and other hand-feeds are livestock cooperatives and local feed markets. However, there are large price differentials between cooperatives and local markets. Concentrated feeds are very expensive and most of the farmers use barley to feed lambing ewes and for fattening. In 2000, the average costs of hand feeds were SYP1585 per sheep for small sheep owners, SYP1520 and SYP1017 for medium and large sheep owners respectively. Cooperatives sell feeds during the winter at an official government price and according to a quota of 24 kg per sheep per year. However, the Syrian government, as part of its drought mitigation package, gave additional feeds during the spring season as a five-year loan and increased the quota per sheep from 24 kg to 42 kg. The feeds included barley grain, wheat bran, cotton seed cakes, maize grain, and cottonseed hulls.

In 1999, small livestock owners received only 23% of their hand-feed materials from cooperatives and 77% from local markets; medium sheep owners purchased 20% of their feed needs from cooperatives and 80% from markets, and large sheep owners bought 26% of their feeds from the cooperative and 74% from local markets. This shows that herders are strongly dependent on local market even if they pay higher prices. This situation is the result of the flexible payment schedules given by private feed merchants. Sheep owners are not always required to pay cash and could wait until they sell their sheep during the feasts at better market prices. However, in 2000, due to government relief program, all sheep owners received between 63 and 70% of their feeds from the cooperatives.

The model

The major challenge in working with pastoral communities is to evaluate the contribution of their access options strategies on total production costs. Most of these options that are based on reciprocal arrangements are very difficult to quantify. In this section, we attempt to evaluate the tradeoffs between hand feeding and other feeding strategies. Institutional and market access options are important only if they contribute in reducing total household feed expenditures because for sheep breeders the purchase of concentrates constitutes one of the major constraints. We estimated a linear regression model where the dependent variable was total household feed expenditures. Right hand side variables included flock size, livestock income, number of days spent on rainfed crop residues, number of days spent on irrigated crop residues, and number of days spent on free grazing (other pastures and ranges). We assumed that herders move to these different grazing areas because of the quality of grazing resources and to reduce their overall production costs. Stocking rate for each site, which was calculated using the 1998 census data, was used as a proxy to assess whether households living in sites with higher stocking rates purchased more feeds than those living in sites with lower stocking rates. Moreover, we compared two drought years (1998-1999 and 1999-2000) to capture some of the drought effects on the production strategies of Bedouin households. These relationships were estimated using the following equation:

$$Y_{pi} = f(R_i; IR_i; OP_i; H_i; I_i; SR_i)$$

Y_{pi} : Feed expenditures

R_i : Number of days spent in rainfed areas for grazing crop residues

IR_i : Number days in irrigated areas for grazing crop residues

OP_i : Number of days spent to graze freely other pastures

H_i : Herd size (adult sheep and goats)

I_i : Livestock income

SR_i : Stocking rate on their site in Jub-Jamaa

Results and discussions

The estimated parameters are presented in Table 3.

Table 3: Ordinary least square estimates and elasticities

	1999 & 2000	1999	2000
Variables	Coefficients	Coefficients	Coefficients
	268.509	690.960	76.368
Herd size	(59.531)***	(67.557)***	(77.392)
	-227.297	-225.259	-95.398
Rainfed residues (days)	(112.722)**	(96.702)**	(209.416)
	-166.820	-429.367	-12.142
Irrigation residues (days)	(70.014)**	(145.594)***	(159.841)
	-108.423	-120.622	432.182
Other pastures (days)	(173.905)	(134.239)	(341.280)
	-0.003	0.064	0.033
Livestock income	(0.041)	(0.042)	(0.059)
	57.646	378.532	-419.604
Site stocking rate (heads/ha)	(247.632)	(215.458)*	(377.155)
	110763.600	40372.830	95269.620
Constant	(22346.590)***	(19602.440)**	(54075.060)*
R2	0.22	0.74	0.09
Observations	128	66	62

Note: 1 US Dollar is equivalent to 46 SYP

The data shows that aggregated data hide many disparities even during the same drought period. At the beginning of the drought (1998-1999), the production strategies used by Bedouin households contributed in reducing feed expenditures while in the second drought year (1999-2000), the effects of feeding strategies were not significant. Bedouins households, regardless on the size of their flocks, used similar strategies during the drought by spending more time in irrigated areas and more money on concentrates.

The herd size variable was significant for the overall (1999 & 2000) and 1999 equations. In 1999, which was a better rainfall season, sheep owners spent 691 SYP for each additional sheep while in 2000 the coefficient of herd size was positive but not significant. Regarding the tradeoff between feed expenditures and crop residues, the coefficients of the overall (1999/2000) and year 1999 equations were negative and significant suggesting that grazing crop residues contributed to the reduction of household feed expenditures. The coefficients of the year 2000 equation had negative signs for rainfed and irrigated variables but both were insignificant. The coefficient for other pastures, where sheep owners used their social networks to receive free grazing, was positive but not significant. Even though, Bedouin households spent less time on these pastures for the year 2000 (Table 2), they had to purchase feeds while there.

The livestock income variable, which was used here to capture the potential effects of the strategies used by Bedouins to sell part of their herd for feeding the remaining part, was positive for both years but insignificant. The site stocking rate variable was positive for the overall and 1999 equations but was significant only for 1999. These results suggest that in normal years, households located on the densely populated sites would purchase more feeds to supplement their sheep. During drought

years like in 2000, however, as many households did not return to their sites, the stocking rate variable had a negative sign but was not significant.

It is clear, that the amount of time Bedouin household spent outside their grazing sites had direct effects on their feeding strategies. The longer they stay outside their own pastures, the more likely they will have to resort to supplementation. This explains why Bedouin herders of the Jub-Jamaa communities raised the issue of water as one of the main factor that is keeping them away from their ranges. For the small herd owners, however, the migration to cropping areas was also an opportunity to carry out menial activities and generate additional income for their families.

CONCLUSIONS

Bedouin livestock production system is increasingly being dependent on market based feed resources. Sheep owners are increasingly relying on rented crop residues and concentrates to feed their animals. Native pastures, either from their sites or from other communities, contribute a very small portion of the sheep diet. The major issue that emerges from these results is whether the present pathway of the livestock production system is sustainable. Clearly, Bedouin households, who are already facing many problems to make ends meet, are developing strategies such as selling part of their flock to purchase irrigated fields or opting out from the livestock industry by investing in the transportation business, small trade, or migrating to the Arabian Peninsula. Some of these strategies may work on the short run but may not be sustainable in the long-term.

Furthermore, the actual trends and the lack of adequate water and marketing infrastructures weaken Bedouin production systems. A Bedouin family needs at least a

herd of 100 to 150 ewes to make a living unless some of the family members are involved in off-farm activities to generate complementary income. The results of the surveys have shown that sheep owners spent more time outside of their grazing sites and moved much earlier than in previous years.

The way forward for improving the livelihood of the Bedouin families in the Badia will depend very much on the extent to which adequate policy, institutional and technical options are identified and used with the full participation of the communities. There are many reforms being undertaken both in developing the legal enabling framework like in the case of the FAO Talila project, where the territories of the three involved communities were mapped and a decree was enacted to grant them tenure security on their lands. Though, development options should not be confined solely on improving rangeland vegetation and infrastructure but should seek to promote add value activities for women and the new generations of Bedouins in order to enhance their livelihood and give them the opportunity to keep the way of life that is so dear to them. The first step towards achieving these goals would be to extend the decree used in the Talila project to other rangelands. These would provide incentives to communities as well as individuals to organize themselves and invest human and financial resources in the management of their pastures.

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