



# Review of the literature on Pastoral Economics and Marketing:

## North Africa

Report prepared for the World Initiative for Sustainable Pastoralism, IUCN EARO

by Céline Dutilly-Diane, 2006

With gratitude to Dr Mohammed El Mourid, Prof. Jeanne Chiche, Dr Mohammed Rahmi and Mr. Salah Chouki for having provided a great help in facilitating documents compilation, and to those who contributed to the bibliographical review.

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## **Rationale for pastoralism**

North Africa is characterized by vast territories of steppe and saharian land. The primary vocation of these regions was livestock production and the steppe was named 'the world of sheep'. Pastoralism was the traditional mode of valorization of the steppe but the society is in great transformation (Bourbouze, 2000) with the regressions of traditional organizations and increase in inequalities in livestock holdings, the privatization of common rangelands and the development of barley cropping and arboriculture (olives), and the regression of animal mobility with the sedentarization of the population. The rangelands are subject to increasing pressure leading to their degradation. In order to cope with these changes, some pastoralists, mainly from the last generation, stop the livestock production activity looking for a more lucrative one in big cities or overseas. Other pastoralists diversify their income sources by proposing small services in the surroundings villages. Finally, for those whose livestock production remains the principal activity, they develop fattening activities and the dependence to complementary feeding is getting stronger and stronger.

## **Pastoral lands**

The biggest pastoral countries in terms of rangelands areas are Morocco and Algeria, which are grossly composed of 20 million ha of steppe i.e. 40% of their territory. Then comes Tunisia with 25% of rangelands. Egypt and Libya are desert countries where rangelands represent 1-2% of the national territory, however in absolute number Libya owns the same area of rangelands than Tunisia.

One of the greatest challenges faced in the region is the degradation of the rangelands. It has been estimated that rangeland areas have decreased by 10% in Morocco and Tunisia and 14% in Algeria between the mid 1970's and the mid 1990's (Abdelguerfi et al., 2000). In addition to their reduction in area, rangeland productivity is decreasing. Nedjraoui (2004) shows that today's forage production corresponds to 30% of the 1968 level. In Morocco, a diagnostic made by MAMVA in 1993 shows that 8.3 millions ha concentrated in the region of the Oriental, the Arganeraie, pre-Sahara and Sahara are defined as severely degraded. The rangelands of the Oriental are degrading at a rate of 1557 ha/year (Mayhou et al, 2001).

The cultivation of the steppe is an important factor explaining the degradation. With increasing population pressure, rangeland is ploughed and converted to crop land, destroying the protecting vegetative cover. In these harsh environments, the soil becomes prone to erosion and within a few years the land is abandoned, reverting back to rangeland. However, once destroyed by cultivation, native species are slow to return, and the vegetation often consists of only a few native weedy annuals. Overgrazing is another source of degradation of the steppe. It impacts the floristic composition; the best palatable species are not given enough rest to survive and invader plants are developing. In addition, overgrazing conducts to a decrease in the perennial vegetation cover as alfa species (Nedjraoui, 2004). Finally, changes in pastoral production strategies have impacted on the rangelands. In the mid-20th century, the mobility pattern of the pastoralists was perfectly associated with the pastoral resources (forage and water) accessibility and availability. With the mechanization of water transportation and the reliance on supplemental feed, animals can be kept continuously on the range, which disturbs the natural balance and intensifies the degradation process (Sidahmed, 1996).

## **Pastoral population**

Statistical data relative to pastoral population (nomads, semi-nomads and settle households) are sparse, old and contradicting each others. While, the steppe and desert population is estimated to represent 38% of the total population in Morocco and Algeria and 28% in Tunisia (Abaad et al., 1995), national statistics in Algeria consider that 12% of the population leaves in the steppe (ONS, 1998). Nomad households were estimated to represent 1.3% of the total population of the region in 1975 and respectively 1.2.% in Morocco, 5% in Libya and 0.5% in Egypt (Le Houerou, 1975). In Tunisia, national statistics of 1975 were showing that nomads represented 1.3% of the population (Bedrani, 1987). Algeria keeps regular track of the nomadic population. While it has decreased by 100,000 people over the 1950-1980 period, statistics shows a 200,000 increase between 1980 and 2000, counting for 20% of the total population of the steppe (4 million people) in 1998 (Nedjraoui, 2004).

## Livestock production

Livestock production is practiced by almost all rural households in the Maghreb countries and constitutes respectively 26%, 30% and 50% of the Morocco, Tunisia and Algeria agricultural GDP (Table 1). Morocco and Algeria are the biggest producers of small ruminants (22 million of head in each country), however once reported to the total population, they have the smallest animal/population ratio (1 small ruminant for 2 people). While Algeria had twice less sheep than Morocco in 1960, population has been multiplied by four in 2005 while it has doubled in Morocco (Figure 1 in Annex 1). Small ruminant population is more limited in the 3 other countries, with respectively, 6, 8 and 9 million of sheep and goats in Libya, Tunisia and Egypt. Goats are well represented in Egypt as they represent 43% of the small ruminants. The evolution of the population over 1960-2005 period (Figures 1 and 2 in annex 1) is relatively constant for sheep in Tunisia and goats in Libya, while in Egypt the number of sheep has increased 3 fold and goats 5 folds.

Camels are mainly raised in Algeria and Tunisia, their number has been maintained in Egypt (Figure 3 in Annex 1) through the regular imports of live animal from Sudan and it has almost disappeared from Morocco and Libya (according to official data). In Tunisia, camels are found in the desert zone with less than 100 mm rainfall and covering 7.5 M ha. National statistics are very approximate but camels were contributing to 3-4% of the value of livestock production in Tunisia in 1995 (Ben Dhia et al., 1995).

The figures related to the share of pastoral animals vary according to the reference sources and the definition of pastoralism. In fact, there is not a clear definition of pastoralism in the region as livestock systems lie in a continuum between the semi-nomadism with few complementation, to a range of agropastoralism systems - with the integration of crop and livestock either on farm, through the rent of crop residues or the purchase of complementary feeds - up to the intensified system (with lamb fattening). According to Chiche (citing the World Bank, 2001), pastoral systems include respectively 48%, 62% and 75% of the total small ruminant population in Algeria, Tunisia and Morocco. These figures might overestimate the reality as for Tunisia, they include animals located in the center of the country. This region used to be a pastoral land, but most of it has been converted to agro-pastoral systems with private land tenure, also pastoral flocks are mainly located in the South of the country. In Morocco, some overestimations suggest that the rangelands contribute to 25% of the agricultural GDP (Berkat, 1995) considering that they cover 70% of the feed requirement of 22 million of small ruminants.

**Table 1: Economic, land use and population figures for North Africa**

	<b>Morocco</b>	<b>Algeria</b>	<b>Tunisia</b>	<b>Libya</b>	<b>Egypt</b>
<b>Economic indicators</b>					
GDP	43 727	66 530	25 037	19 131	82 427
Share of Agric. GDP (%)	16.8	10.2	12.1	5	16.1
Livestock share in agric. GDP (%) <sup>a</sup>	26	48	30	30 <sup>b</sup>	.
<b>Areas</b>					
Total area (M ha)	44.7	52.3	16.0	160.9	100.0
Rangelands = arid land (M ha) <sup>c</sup>	12	20	5.5	9	3
Total rangelands (Mha) <sup>d</sup>	18.7	20.4	3.9	3.2	1
Rangelands as % of total area <sup>d</sup>	42	39	25	2	1
<b>Total human population (2006)</b>					
Total human population	31.6	32.9	10.0	5.8	74.9
Total rural population	13.0	13.2	3.6	0.8	43.2
<b>Human population in the steppe</b>					
Population of the steppe and desertic zone (%) <sup>e</sup>	37.9	37.8	28.1	.	.
Nomadic population (000) <sup>b</sup>	200	794.0 (1998) <sup>f</sup>	78.2 (1975) <sup>g</sup>	100	200
<b>Total livestock population (2006)</b>					
Population of sheep (million of head)	17.1	18.7	6.7	4.5	5.2
Population of goats (million of head)	5.4	3.2	1.4	1.3	3.9
Population of camels (000)	36	245	231	47	120
Sheep/rural human	1.32	1.42	1.86	5.63	0.12
Sheep/human	0.54	0.57	0.67	0.78	0.07
<b>Share of livestock production in rangelands</b>					
Share of small ruminants pop. in pastoral zone (%) <sup>a</sup>	75	48	20	.	27 <sup>h</sup>
Contribution of range to total feed balance (%)	30 <sup>i</sup>	10 <sup>j</sup>	10 <sup>k</sup> /24 <sup>l</sup>	.	5 <sup>m</sup>

*Sources* : World Bank, 2005; FAOSTAT, 2006; a=Chiche, 2001; b=Al-Masri, 1997; c=Le Houerou, 1975; d=derived from WRI, 2003; e=Abaad et al, 1995; f=Nedjraoui, 2004; g=Bedrani, 1987; h=Al-Keraby, 1997; i=MADR, 2003; j=Boutonnet, 1991; k=Nefzaoui et al, 2002; l=Rekik, 1998; m=Thomson, 1997.

In contrast to the majority of dry lands in Sub-Sahara Africa, pastoral livestock production relies heavily on imported and subsidized feed grain. Today, rangelands cover from 5% (Egypt) to 30% (Morocco) of the feed requirement of the total small ruminant population against 70-80% in the 1960's (Table 1). Differences among countries are due to several elements:

- The total small ruminant population relative to rangelands area
- Level of rangeland degradation (qualitative and quantitative degradation)
- Level of total rangeland area converted to cropland
- Percentage of livestock located in the rangelands
- Cereals production and imports
- The price ratio of sheep to grain (Table 2)

**Table 2: Price ratio of sheep to grain in North African countries (2000-2002)**

	<b>Morocco</b>	<b>Algeria</b>	<b>Tunisia</b>	<b>Egypt</b>
2000	20.1	17.5	23.5	18.7
2001	21.6	15.4	21.2	19.8
2002	33.0	17.9	23.5	22.0

Also, it is appropriate to decompose this indicator according to the different production systems. Such a decomposition is available for Morocco, where a study (MAMVA, 1994) shows that rangelands and fallow contribute 50-62% to the feed requirement of the ovine

pastoral system, 8-36% of the ovine agro-pastoral system, 12-42% of the rainfed bovine system and 3-14% of the mixed bovine system.

## **Overview of the North African countries**

In Morocco, the pastoral system is defined as a livestock system where the rangelands contribute more than 50% to the feed calendar (Benlekhal, 2004). It is found in the mountainous regions (High Atlas) and in the arid steppes of the Oriental Plateau, central plateau and south of medium Atlas. Rangelands contribute 36% of the feed requirement of the global livestock population of Morocco in an average rainfall year (Sbihi et al, 2002). Small ruminant production represents a third of the total value added of the livestock sector in the country (Agroconcept, 1989), mainly through its contribution to the meat market. Looking now pastoralism from the mobility angle, recent studies have showed that semi-nomadism concerns 56 to 80% of the herders in the High plateau, 22 to 47% of the Tafraoute region and 9-17% of the herders of the medium Moulouya (Narjisse, 2006). While national figures show that 18% of the ovine producers are landless (Agroconcept, 1989), in the Oriental, a survey (Dutilly-Diane et al., 2005) showed that in fact 97% of the herders own a piece of land (of an average area of 19 ha). The plots consisting in part of traditional cultivated land (woulf) that is located in the best rangelands (depressions) but increasingly are the results of illegal encroachment on the rangelands as a mean of appropriation of the surroundings grazing land.

In Algeria, the steppe is located between the Tellian Atlas (isohyets 400 mm) in the North and the Saharian Atlas in the South (isohyets 100 mm). It covers 20 M ha and out of 3.9 million people, the 'nomadic' population was evaluated at almost 0.8 million in 1998 by the ONS (Nedjaroui, 2004). As most of the north African countries, the pastoral society has been through great changes; animal movements are limited to the site surroundings (10-50 km) and long distance transhumance concerns 5% of the steppe population, pastoralists are cultivating barley to complement their flocks and herd size has been reduced; 80% of owners having less than 100 head (Nedjaroui, 2001). Out of the 5 North African countries, Algeria is the most experienced and advanced one in considering the steppe as an agro-ecological region integrated in the national economy. Algeria promulgated a pastoral Code in 1972 that was later abandoned because the operations were not accepted by the pastoralists. In 1985 it created the 'Haut Commissariat au Développement de la Steppe' (HCDS) in charge of developing policies for the development of this zone. Finally, the country possesses an item 'pastoralism' in the budget of the Ministry of Agriculture.

In Tunisia, the majority of arid rangelands are located in the South-Eastern region of the country (Governorates of Gabes, Medenine and Tataouine) which covers 1/3 of the national territory, but include today only 1/10 of the small ruminants population and half the camelines (Nasr, 2000). With the sedentarization of the population, the privatization policy of the rangelands (more than 1.5 M ha of the best rangelands privatized since the independence) and their development through arboriculture, important changes have occurred, mainly in the northern part of the region (Jeffara). A study (IRA-IRD, 2003, p 70) shows that in this region, the steppe area decreased by 39% between 1972 and 1998 to the profits of culture and arboriculture, leading to a fragmentation of the space and an atomization of the steppe. Livestock production became for most of the households a secondary productive activity. However, 70% of the households still hold a small ruminant flock, which is essential to their subsistence and residual steppes are still playing a critical role in maintaining these flocks.

Also today, collective rangelands are mainly found in the Tataouine governorate. They cover more than 1.2 million hectares and lie between the Jaffara, El Ouara plains and the Dahar plateau and receive between 50 and 150 mm of rainfall per year. Recently, the region was still exploited by nomadic and semi-nomadic herders that were practicing seasonal transhumances at the local, regional and national scale, but the cultivation frontier is moving from the Jeffara to this region relatively spared by this agricultural intensification practice until now (IRA-IRD, 2003, p 78).

Out of the 2.2 million hectares of arable land in Libya, 1.3 million are rangelands, 355,000 in permanent pasture and 320,000 in forest and woodland. Some 5% of the people live as pastoral nomads, mostly in Cyrenaica. Most of the large flocks owners of sheep, goats and camels are located in the semi-desert zone with average annual rainfall between 50 and 150

mm, while large-scale and small-scale flock owners use both the Green Mountain and the Western Mountain areas for grazing sheep and goats (Al-Masri, 1997).

The 4.22 million sheep and 3.13 million goats in Egypt are raised mainly in three regions: the Nile Delta, Upper Egypt and in the desert rangelands, particularly in the north-west coastal zone. Production systems and breeds in the three zones are different. There are about one million sheep and 700,000 goats in the Nile Delta, where agriculture is very intensive. In Upper Egypt, which is characterized by mild, dry winters and very hot summers, agriculture is less intensive. There are about 1.5 million sheep and 1.7 million goats, mainly in mixed flocks, with some goats kept as household animals. In the desert rangelands, 1.4 million sheep and goats are kept in extensive systems. (Al-Keraby, 1997).

## Structure of pastoral products markets

### Regional pastoral products

The main pastoral product in North Africa is red meat. Sheep meat averages 20% of the total meat production in Morocco, Tunisia and Libya, while it represents 30% of the total meat production of Algeria and is marginal in Egypt (Table 3). Camel meat is marginal, nevertheless it represents a market of 43 000 million of tons in Egypt.

North African sheep breeds are of low milk productivity and the milk self-consumed by the pastoralist households. However, in Algeria and Libya, respectively 22% and 35% of milk production is provided by small ruminants. Libya is producing different sheep milk cheeses as the traditional Al Zahra, Jibnet Grus and Al Naseem and is even developing the production of new cheese as the blue-veined cheese (Meunier-Goddik et al., 2006). Camel milk production is marginal in all 5 countries.

Goat production does not represent more than 4.2 % of the total meat production in the 5 countries but represents a promising sector in Morocco. Caprine population in Morocco represents the 1st rank in North Africa and 13th rank in the world. The population is mainly located in marginal zones (20% in mountainous zones) and on rangelands. The caprine sector produces 8 to 18% of the red meat production of the country, skin production satisfies 11% of the leather industry in the country and goat hairs are used for different handy craft products of the rural zones (Ait Baba, 1997). Goat milk represents only 5% of the total milk production, and most of it is self-consumed by rural households. The milk market is not developed because fresh milk is never consumed fresh and the 'goat taste' of cheese is not appreciated by the consumers. But as the demand is evolving, this sector offers great potentialities (Thomas et al., 1996).

**Table 3: Milk and meat production in North African countries (average 2000-2005).**

	Morocco	Algeria	Tunisia	Libya	Egypt
<b>Milk production</b>					
Total milk production (Mt)	1,299,083	1,583,583	946,183	201,401	4,395,332
% Sheep	2.08	12.05	1.81	27.68	2.12
% Goat	2.64	9.92	1.29	7.64	0.34
% Camel	0.3	0.5	0.1	1.0	0.0
<b>Meat production</b>					
Total meat production (Mt)	603,117	562,463	249,601	143,268	1,368,097
% Sheep	18.5	29.3	21.8	19.7	3.5
% Goat	3.5	2.2	3.8	4.2	1.6
% Camel	0.3	0.6	0.6	2.6	3.1

Source: Fao, 2006.

It is difficult to know what is the share of the different systems to the provision of small ruminant products to the national market given the integration of the different systems from the breeding to the fattening activities. In addition, feed exchanges are taking place among regions, showing strong linkages between different agro-ecosystems and then questioning the specificity of every production systems (Boulanouar et al., 2006).

## **Price formation on the ovine market**

The ovine markets are strongly speculative in the region, the price varying between years according to climatic conditions (high rainfall year = lower prices) and within the year with a peak occurring in Eid El Kebir. In addition, as showed in a case study in Algeria (Boutonnet, 1994), prices variation are also particular to each class of animal (ewe, fattened lamb, non fattened lamb).

Algeria, Morocco and Tunisia are opening their agricultural markets, but keep control over the ovine sector. In Morocco, import tax averages 250%, while in Algeria the control of imports has resulted in a high discrepancy between the supply and the demand resulting in important price increase. National prices of ovine meat are 4-5 folds the international price, Algerian meat being one of the most expensive meat in the world. Imports in Algeria are regulated by big wholesale butcher (chevillards). In addition, it has been observed a phenomenon of concentration of the sector in Morocco and Algeria where urban herders that own more than 500 heads control the marketing of red meat. In Tunisia, the state intervenes during the feast periods in order to avoid price explosion (Alary et al, 2005).

At the households level, we can find two types of marketing strategies adopted by the herders: sell the maximum of male lamb (after fattening them) for the Eid El Adha (Eid El Kebir) when the price are the highest, or if the producer is cash constraint, sell regularly an animal to cover for households expenses (Alary et al, 2005).

## **Pastoral markets in Morocco**

In Morocco, red meat production is provided by ovines (43%), bovines (40%) and caprines (8%) (Ait Baba, 1993). 95% of the animal transactions are occurring in weekly souks (rural markets) and selling is realized in live weight. The market circuit is characterized by a multitude of actors. This long actor's chain before the slaughtering put pastoralists in a position of weak bargaining power. In addition, livestock producers are not organized professionally. The author mentions the absence of appropriate infrastructure and of price information systems which are playing against the pastoralists. Municipal slaughterhouses (60 in the country) are old and need to be renovated and rural slaughterhouses (750) are not providing the minimal sanitary conditions. Also, the author estimates that half the consumed animals are provided by controlled slaughtering. An important number of animals are slaughtered informally on the road axis and for the ceremonies of Eid El Kebir or marriages. According to Ait Baba (2003), 15% of the red meat production is of pastoral origin.

## **Pastoral markets in Algeria**

A study of Robin (1986, pp 66-76) compares three types of livestock markets in the Ouest region of Algeria : i) the soukhs of the steppe, ii) the soukhs of the Tell (mountainous zone located between the sea and the High-Plateau), iii) the northern soukhs. The operators in the steppe soukhs are composed i) on the supply side, by the nomad and sedentary livestock producers of the steppe and the herders-brokers ('maquignons-éleveurs'), and ii) on the demand side by brokers from the North and the Tell, fatteners from the North and Tell, butchers from the steppe, herders-brokers, and public offices (ORVO, OREVIC). The steppe herders will also be present on the tellian soukhs in summer time, on their transhumance road to sell the spring births.

The slaughterhouses are of two types: i) the registered ones where veterinary controls are practiced. The buildings are poorly equipped and very often degraded. Therefore the hygienic conditions are not fulfilled. Slaughtering is practiced according to the Islamic ritual by a 'sacrificer', ii) the informal slaughter places are numerous, particularly in the small villages, but also in urban centers. Clandestine slaughtering is increasing when live animal price is high as the butcher is willing to save for the slaughtering tax paid to the slaughterhouse and the 'sacrificer'.

## **Livestock marketing infrastructures in Tunisia**

No specific studies on the pastoral product markets were found, the livestock sector being considered nationally or in agricultural and agro-pastoral regions. A study by the Ministry of Agriculture in 2006, reported that 228 livestock markets are functioning in the country, 22% of

them being located in the South, 48% in the center and 30% in the North. There are classified as:

**Table 4: Livestock markets in Tunisia.**

	% of total market number	% of total traded animals
Small local markets (limited transactions)	40	10
Collect markets (destination of animals limited to the region)	20	10-30
Transfer and distribution markets (broad animal origins and destination)	35	40-50
Large markets (oriented to serve large cities)	5	20-30

The supply is dominated by brokers (47% of transactions) and farmers (33% of the transactions), whereas the demand comes from the butchers (45%), followed by traders (30%) and the farmers (15%). This shows the dominance of short circuit of distribution in addition to an informal circuit that is considered important. It is reported that price information system are lacking which is affecting markets' efficiency.

The total number of slaughterhouses is 238, most of them being of small capacity. Beside the National Company 'Ellouhoum', all of them do not satisfy the basic hygiene conditions.

## **Annotated bibliography of the economics of pastoralism**

Data relative to the natural conditions of the rangelands are more abundant than those relative to the social environment and dynamics of the pastoral systems. Economic analyses of the extensive livestock systems are mainly microeconomic and representative of a small zone. Very few references are available on the contribution of this sector to the national economy. Here are five of them:

### ***Ministère de l'Agriculture et de la Révolution Agraire. 1974. La Steppe Algérienne. Revue statistique agricole. No. 14***

This document offers a unique tentative of submitting pastoralism to a global analysis. It is composed of 2 parts:

- The results of a 1968 survey on nomadism and pastoralism, implemented by the Ministry of Finance and Planning (Ministère d'Etat chargé des Finances et du Plan) and the Ministry of Agriculture and of Agrarian Reform (Ministère de l'Agriculture et de la Réforme Agraire). The main objective of the survey was to understand the fundamental elements of the economic activities of the populations of the steppe region in order to i) locate nomadism within national boundaries, and ii) show the variations within the steppe region that is otherwise very quickly considered as homogenous.
- A geographical introduction of the steppe made by the Department of statistics and economic surveys of the Ministry of Agriculture and Agrarian Reform. It consists in gathering data related to the steppe that has been collected in a fragmented way over time. A particular emphasis is given to the degradation of the rangelands.

### ***Boutonnet, J.P. 1989. La spéculation ovine en Algérie. Un produit-clé de la céréaliculture. Série Notes et Documents No. 90, ENSAM, INRA, Montpellier.***

This document is a comprehensive study of the ovine sector in Algeria. The inputs are evaluated: a parallel with the cereal sector is built to address the importance of barley and cropped forages as input to livestock production and the share of ranges to the diet of the total ovine population is evaluated. Animal performance and production are assessed, the evolution of ovine meat consumption is described as well as price formation. This document emphasizes the speculative nature of the ovine sector and proposes some recommendations for improving the production of meat.



**Boutonnet, J.P. 1991. Production de viande ovine en Algérie. Est-elle encore issue des parcours ? Proceedings of the IVth International Rangeland Congress, Montpellier, France.**

Ovine production system in Algeria is often presented as mainly pastoral (relying on the steppe). This image results from an ancient situation where the total number of ewes was 3-6 millions in Algeria (first half of 20e century). The paper objective is to establish what is the contribution of the steppe to the nutritional need of the entire sheep population of Algeria.

The method used consists in dressing forage balances (difference between animal feed requirement and their availability) and cereals balance at the national scale based on macro-economic variables (total land areas, livestock population, and trade balances of livestock products) and technical coefficients (animals' nutritional needs) derived from local survey.

Results show that even if the steppe would be rehabilitated so that it would reach its maximum productivity level, rangelands would contribute only to one third of the red meat consumption of Algerian population (which is already low at 8 kg/pers./year). The increased in livestock production should be pursued through the intensification of the cropping zones and not by pastoral development. This paper is built on the results of Boutonnet, 1989 (cited above).

**Homewood, K.M. 1993. Livestock economy and ecology in El Kala, Algeria. Evaluating ecological and economic costs and benefits in pastoralist systems. Pastoral Development Network Paper No. 35a. ODI.**

<http://www.odi.org.uk/pdn/papers/35a.pdf>

Is pastoralism in El Kala an economically robust and ecologically sustainable form of land use? This paper draws attention to some of the problems that arise in understanding the cost and benefit flows in pastoralist systems. Security issues influence production and marketing and pastoralists' own evaluation of costs and benefits. Figures on pastoral contribution to the national economy include:

- A revision of the livestock population in the study site
- Estimation of the contribution of livestock rearing to the local economy in terms of rural employments and livelihoods. The author shows also the indirect benefits produced by the pastoral system since the livestock system is closely interlinked to cultivation and local economic activities (butchers, traders, fodder sales,...).
- Revision of the meat exports figure from the region, method derived from an approach used to link ivory trade to elephant offtake figures (Pilgram and Western, 1986).

Finally, the author emphasizes the potential of livestock production system to accommodate to climatic and economic conditions by their ability to move along a continuum of labour intensive milk-based production system to a more market-oriented meat-exporting enterprise. This adaptation capacity makes this livestock system very efficient and productive.

**Hamloui, Y. 1985. L'économie pastorale en Algérie. These de 3e cycle, Université de Montpellier I, Faculté de Droit et Sciences Economiques, Spécialité Economie du Développement, février 1985, 279 p.**

## **Identification of knowledge gaps**

Among the numerous reports on small ruminant sector studies, the pastoral sector or the rangelands have been mentioned in few cases only (Ait Baba, 2003 and Robin, 1986). The livestock studies concentrate on specific species (ovine, goat) but not on specific agro-ecosystems (as the rangelands/steppe). Also, very little is known about the contribution of pastoral products to the sectors (meat, milk, wool, skins..). This will be facilitated if the national statistics disaggregate livestock sector data according to the different production systems.

In addition, information on other form of contribution of the rangelands to the national economy has to be studied. For example, more and more pastoral households are

diversifying their income sources (off-farm labor). They are also contributing to the local economy through the development of small services.

An important research need is also the valuation of the opportunity cost of barley cultivation in terms of losses to the livestock product but also in terms of environmental services produced under pastoral land use.

Information is mainly available for the 3 Maghreb countries. Very little information had been found for Libya and Egypt. In the first case, this is due to a general deficiency of statistical data and electronic available literature. In the second case, rangelands and the pastoral sector is relatively marginal in this country where agriculture is developed through irrigation.

## **Economic valuation as a tool for decision making**

In order to undertake economic valuation of pastoralism, statistical data have to be available. To our knowledge, only Algeria organized a systematic survey on pastoralism in 1968 (Regazzola, 1968). This study showed the importance of the urban livestock producers (that would own 30% of the sheep population of the steppe), and of the cropping activity (55% of the 'nomadic' households would cultivate a piece of land) that was characterizing the steppe. These data have never been actualized systematically. According to Guillerrou (1990) the interest of these statistical analyses resides more in the proportion and general trends than in the exact figures and constitutes an important tool susceptible to influence policy makers.

In Tunisia, population and livestock statistics are not disaggregated for the pastoral sector. This will start by being able to define what a pastoral household is today as very few households kept a nomadic style of life and the contribution of steppe forages to the animals' diet reach a maximum of 70% in the years with good precipitations.

Finally, several stockholders (including some policy makers) in the agricultural sector are willing to know what is the environmental cost of the current policy of inaction in the drylands and pastoral zones. The need for valuation is therefore not only obvious but also demanded.

## **Arguments for the development of pro-pastoral policy environment**

In order to consider all opportunities that can offer the rangelands of North Africa, we might not want to only focus on the contribution of pastoralism through animal production, but also consider the multiple uses that are made of the rangelands (Grice et al., 2002).

## **Contribution of pastoralism to national economies**

### ***Proportion of population, national product and exports earning***

The general tendency is that drylands population is increasing, but pastoral population is decreasing to the profits of agropastoral population. This supports the idea that we might not want to focus on animal production but also to safeguarding dry lands and rangelands existing productivity and functions.

Economic valuation of pastoral production (GDP share) is not available, but according to the contribution of livestock to agricultural GDP: Algeria is probably the country susceptible to find arguments here, followed by Morocco and Tunisia.

The export argument can not be used any more for North Africa which switches from net exporter of meat to net importer in the 80's. According to FAO data (Table 5), all five countries are net importers of sheep meat and alive animals (except for Egypt which is exporting 800 000 heads of sheep and goats). However, we have to consider the importance of informal trade between neighboring countries estimated at 1.8 M heads and mainly resulting from exchanges between Algeria and Tunisia and Algeria and Morocco. It is associated with a regional specializations (breeding/fattening systems) occurring in the zone (Alary and El Mourid, 2005).

North African countries are also net importers of skin and wool, excepted of Libya which is a net exporter for both products and Tunisia which is a net exporter of wool (82 M USD in 2004). Libyan wool is exported as treated wool to carpet producing countries like India and Iran through Dubai.

**Table 5: Trade figures for animal products in North Africa.**

	Morocco	Algeria	Tunisia	Libya	Egypt
Mutton and lamb meat					
Imports (1000\$)	198	29045	4525	6797	377
Exports (1000\$)	36	0	0	.	60
Skin with wool sheep					
Imports (1000\$)	43	103	626	53	20
Exports (1000\$)	0	61	0	1634	0
Wool					
Imports (1000\$)	3150	394	34	0	2931
Exports (1000\$)	11	0	116	1897	736
Alive animal					
Camels imports (000 heads)	0	0	0	0.9	39.7
Camels exports (000 heads)	0	0	0	0	0
Sheep and goats imports (000 heads)	0	0.02	0	1.4	0
Sheep and goats exports (000 heads)	0	0	0	0	0.8

Source: FAOSTAT 2006.

### **Contribution of meat product to domestic economies**

The contribution of animals from pastoral origin to the red meat market is not known in the region (except for an estimation of 15% to the red meat market in Morocco, Ait Baba, 2003). A categorization of the meat provenance and quality (traceability) would be necessary not only to support the production of the species appreciated by the consumer but also to organize the complementarity of the products (Chiche, 2001) and develop niche markets of certified biological products (El-Akhrum, 2000). If we consider that the vocation of arid rangeland is to support extensive production systems and that deviating from this vocation will be made to the depends of the sustainable development of these zones, then the pastoral zones have reached their maximum carrying capacity. The challenge is then to increase livestock production without increasing livestock population in the steppe. Potential productivity improvement through the increase of the rate of market off-take is slim as young adults are mainly sold before 1 year old. The increase of value added products represents also a low potential as animals are not milked, however some product niches are developing. Therefore the possibilities to increase livestock production lies in the increase of animal growth rate or the reduction of the consumption index (Boutonnet, 1989). Finally, genetic improvement could be promoted by the identification and elimination of the weakest animals (Rekik, 1998). With the dependence of the pastoralists to drought management program (feed subsidies), animals are less vulnerable to drought and today, the logic of genetic selection is inverted. Whereas in the past, flock size was regulated according to climatic conditions and resulted in the elimination of the weakest individuals in times of drought, in today's drought conditions, the best ewes are sold, leaving the flocks with the less performing productive elements. This results in chronic problems of infirmity and malformation, sterility, lowest grazing capacity (dental deflections) and delay in animals' growth.

### **Contribution of other livestock products**

- Milk products: Libya is producing a game of sheep milk cheese and market niches are developing for goat milk cheese in Morocco.
- Skin and wool. In addition to the export of wool in fiber, there is a renewal of fabrication of tapestries in Tunisia and Morocco among which the traditional products of nomad weavers (klims in Tunisia, Berber carpets). New wool sectors could also be explored as camel's hair (RFI, 2003).
- Cultural: If ewes are mainly slaughtered in the rural markets, the males, and particularly the young ram (kebch) remain a prestige product that is mainly consumed on specific occasions as the religious celebrations. Chiche (2002) explains that the ritual sacrifice of ram with reference to Islam is a way for the consumers to identify to the Arabic peninsula, which is the birthplace of the religion and the country of kebch. In Egypt, while the

consumer preference is for beef and buffalo meat, small ruminants are consumed solely for the religious celebrations (Iniguez, 2005).

### **Livestock genetic diversity**

It is greatly recognized today that pastoralists and indigenous communities play a role to conserve domestic animal diversity because they are not part of the general promotion of cross-breeding or the substitution of indigenous breeds with exotic breeds. This is happening either by choice to resist the integration into this breed 'globalization' or because they live in remote areas that are not approached by development projects (Maier et al., 2002). In North Africa 7 out of the 16 local breeds of sheep of the arid regions are under high risk of disappearance (Table 6) either because the animals are replaced by exotic species or because they are cross-bred with more productive species.

For example, with the sedentarization of herders in South Tunisia, we observe a switch in the ovine race used from the Barbarine (fat tail, resistant to drought) to the Bergui or Queue Fine (thin tail, more exigent in feeding). This is also occurring in a way to fit the changing urban demand for these animal species' products (Alary et El Mourid, 2005). In Algeria, the race Ouled Djellal is taking the monopole and is being crossed with other local races. This population is responding to the intensification need of the producers and is developing in the zones of traditional agricultural vocation to the depends of the other local races (Madani et al., 2003). Therefore, in Algeria, the Barbarine population has decreased by 60% between 1990 and 2000 and the D'man population by 50% in the same period (Laaziz, 2005). An other phenomenon being observed is the modification of flock composition. Bovine number is increasing in the arid zones of Morocco and flocks are switching from a mix composition (ovine, caprine, camel) to a unique specie and race (Abdelguerfi et al., 2000).

**Table 6: Sheep Breeds in NA of Mobile Production System.**

<b>Breed</b>	<b>Avg. Rainfall</b>	<b>Location</b>	<b>Risk to genetic diversity</b>	<b>Primary Purpose</b>
Atlas Mountain breeds	500 (Mountain)	M	High	Meat + wool + skin
Barbarine	150/350	MATL	High/Low	Meat, milk
Barki	150-300	EL	None	Meat, wool
Beni Guil	100-250	M	High	Meat, wool
Berber	450-500 (Mountain)	A	High	Meat, milk
Boujaad	300	M	None	Meat, wool
D'man	100 (Oasis)	MAT	High	Meat, manure
Farafra	100 (Oasis)	E	None	Meat, wool
Hamra	200-250	A	High	Meat, fleece, milk
Ouled Djellal	200-500	AT	None	Meat, fleece, milk
Queue fine de l'Ouest	200-400	T	None	Meat
Rembi	300	A	Moderate	Meat, fleece, milk
Sardi	300	M	None	Meat
Taadmit	.	A	Extreme	.
Tergui-Sidaou	50	A	Low	Meat
Timahdite	500 (Mountain)	M	None	Meat + wool

M=Morocco; A=Algeria; T=Tunisia; L=Libya; E=Egypt

Source: computed from Iniguez (2005) and Meyer et al. (2004)

Also, acknowledging the role of pastoralists as the guardians of livestock genetic diversity and the economic potential that it represents has to be developed in the region through (Koehler-Rollefson, 2002):

- Economic valuation of the indigenous breeds on the livelihood and well-being of herders
- Evaluate the commercial potential of the indigenous breeds: recently, breeding companies in the developed countries have become interested in certain indigenous genes from developing countries.

## **Contribution of pastoral land (rangelands) to national economy**

### ***Contribution of rangelands to livestock feed requirements***

The main product of pastoral zone is the forage freely available for the animal to graze. Rangelands are degrading and the contribution of rangelands to the diet of the total population is decreasing. As we have seen the causes are multiple. Governments have developed several rehabilitation and preservation program over the past 30 years. However, impact has been very limited. Institutional and policy options in order to favor local/community management of the resources are needed to restore range productivity.

### ***Environmental services and goods***

Rangeland degradation is not only costly in terms of animal productivity (expenses in complementary feeds) but this impacts the local, national and international community through the generation of negative externalities as:

- Wild fauna and flora biodiversity loss
- Decrease in carbon sequestration :
- Wind (dust storm) and water (flash flood) erosion

The per hectare contribution of rangelands to these global services is smaller that from forests, but the contribution applies to vast expanses so that the total services are substantial. Therefore, better managed rangelands will provide environmental services that are getting today valued and marketable (Dutilly-Diane et al., 2005). This offers an opportunity, particular in the implementation of the National Action programmes (NAP) to combat desertification.

### ***Other products***

Food and Medicinal plants: Besides using the rangelands as forage for the animal, pastoralists exploits it for other products as the mushroom, truffles, or medicinal plants. A study in the Oriental region of Morocco shows that the interruption of long transhumance reduces the access of households to food and medicinal plants, which is traditionally a women activity. But still today, 48% of pastoral households collect medicinal plants and 70% of them collect wild mushroom and truffles (Steinmann, 1998). Activities are developing in the region (Tunisia, Egypt) in order to catalogue wild plant species and identify those that have an important social and economical interest and which could play an important role in the development of drylands.

Finally, promoting pro-pastoral policies and better rangeland management incentives, could benefit to the development of the desert tourism. Desert tourism industries exploit the 'Bedouin lifestyle' of the arid zone to attract clients. In addition, Chatelard (2005) suggest that tourism industry is complementary to pastoral activity due the flexibility and mobility inherent to this system.

## **To summarise**

The citation of Box (1986) used by Grice and Hodgkinson (2002) could greatly be adapted to our purpose:

*It [the II International Rangeland Congress] did not adequately address rangeland products other than livestock. To focus on commercial pastoralism, a human lifestyle of developed nations is to further marginalize the people issues of rangelands. More attention to other*

*goods and services will help develop the flexibility needed for the proper use of the rangelands.*

If we want to look for economic arguments to be used in advocating for pro-pastoral policies, we need to emphasize on the services and goods provided by the pastoral zone beside the livestock products. In North Africa, it may be more rewarding to maintain current rangelands' productivity and functions by preventing further degradation rather than focusing on animal production. Environmental services (carbon sequestration, combating desertification and erosion, biodiversity) are today valued and their promotion could represent an important economic potential.

## **Examples of best practice**

We could not find a comprehensive study of economic valuation of pastoralism for the North African region. Nevertheless, in regards to the valuation of the contribution of rangelands to the national livestock production (contribution of forage to feed requirement), the study of Boutonnet in Algeria is probably one where the methodology is the better refined. As a result Boutonnet shows that rangelands participate to 10% of the global feed requirement, while broad estimations were considering it was 60% (Thomson, 1997).

Besides, studies are developing in the region to evaluate environmental services provided by alley cropping in the arid zones of Algeria (Alary et al, 2005) and Morocco (Shideed et al., 2005). They consist in assessing the environmental impact of the introduction of cactus/shrubs (*Atriplex*) in barley croplands in terms of biomass production, soil erosion and organic matter. This offers some potential methodology that could be applied to the rangelands in order to evaluate the environmental opportunity cost of rangeland conversion to cultivation.

Future studies that are going to address the economics of pastoralism will face the following main constraints:

- Definition of pastoralism: what is today a pastoral household in North Africa ?
- Climate and price fluctuations: need to work over long enough period or at least compare 3 years (good/medium/low rainfall) in order to obtain representative figures.
- Multiple scale: it is necessary to work at different geographical scales and national data have to be refined by microeconomic survey.
- Methodology for economic valuation of environmental services: in progression for the onsite effects but off-site effects are poorly assessed.

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## Annex 1: Animal population trends.

Figure 1. Sheep population trend in the North African region (1962-2005).

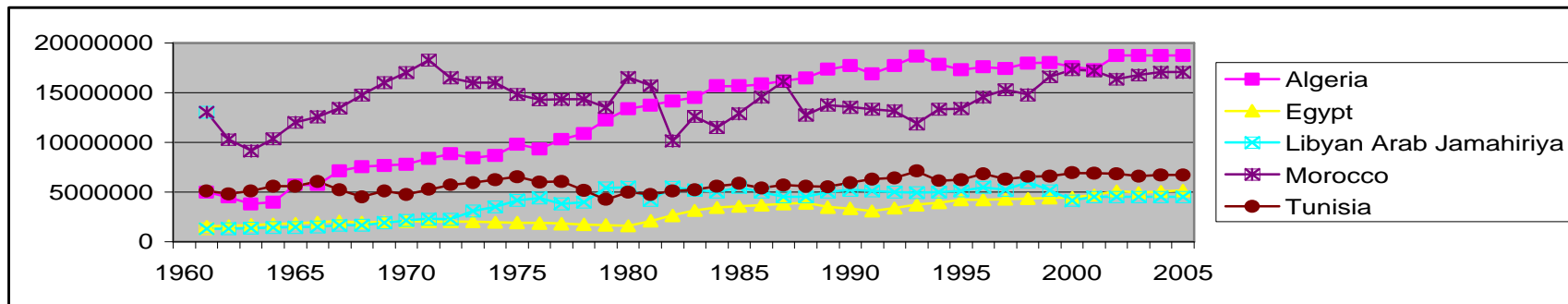


Figure 2. Goat population trend in the North African region (1962-2005).

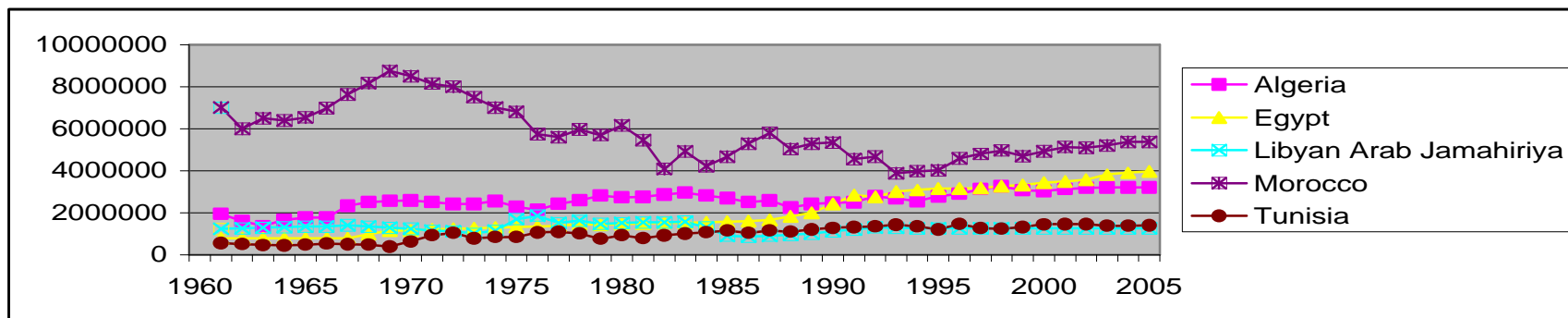


Figure 3. Camel population trend in the North African region (1962-2005).

