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Abstract. The overview of the sheep and goat sectors around the Mediterranean Basin shows permanent and common traits and these sectors have always a peculiar importance. But drastic changes have been observed for the last decade with a decreasing share of sheep and goat meat supply with new trends in marketing. The sheep and goat milks play always a significant role in the region but with changes in the demand of consumers and a growing demand for goat milk products. But the future of these sectors cannot be explored only through the markets and the consumers' behaviours which have to be connected to the farmers' decision processes and the social and economic situation of the hinterlands. The pastoral components of the production systems appear to be a good lever to prospect their futures. The remuneration of eco –systemic services (to prevent fire, protect bio-diversity, and preserve landscapes, for instance), the enhancement of agro-ecological characteristics of pastoral systems and products (based on local breeds, use of natural feeding resources, local marketing on short chains...), the certification and labelling of pastoral products in relation to the other activities of the territories are all possible ways to improve the value chains of sheep and goats. In all cases, the improvement of the information systems for these pastoral sectors, the reorganization of training programs and implementation of more efficient extension services is necessary to concretize these outlooks and depends of the internal dynamics, choices and balances of powers within each territory.

Keywords. Small ruminants – Value systems – Local development – Technology assessment – Marketing.

Les secteurs ovins caprins en Méditerranée au cours de la dernière décennie entre invariants et mutations: défis et perspectives d'avenirs

Résumé. *Un balayage de la situation des secteurs ovins et caprins dans le bassin méditerranéen montre qu'ils y ont toujours une importance particulière avec des traits communs et permanents. Mais des changements drastiques ont pu être observés lors de la dernière décennie avec une part décroissante des viandes de petits ruminants dans la consommation carnée et de nouvelles tendances en matière de marketing. Les laits de brebis et de chèvres jouent toujours un rôle important dans la région, mais avec des changements dans la demande des consommateurs et une demande croissante pour les produits à base de lait de chèvre. Mais l'analyse des marchés et du comportement des consommateurs ne suffit pas à appréhender l'avenir de ces secteurs dans la mesure où il dépend aussi des facteurs de décision des éleveurs et de la situation sociale et économique de chaque arrière-pays concerné. A cet égard, les composantes pastorales des systèmes de production ovins et caprins, qui constituent une de leurs spécificités, semblent être un bon levier pour appréhender leurs perspectives futures. La rémunération des services éco systémiques qu'ils rendent (en termes de prévention des incendies, de préservation de la biodiversité, de protection des paysages, par exemple), l'amélioration des caractéristiques agro-écologiques des systèmes et des produits pastoraux (basée sur la valorisation de races locales, l'utilisation de ressources alimentaires naturelles, la commercialisation en circuits courts,...), la certification et l'étiquetage des produits pastoraux en lien avec les autres activités des territoires sont toutes des voies possibles pour améliorer les chaînes de valeur des petits ruminants. Dans tous* *les cas, l'amélioration des systèmes d'information pour ces secteurs pastoraux, la réorganisation des programmes de formation et la mise en œuvre des services de vulgarisation plus efficaces et généralisés sont nécessaires pour concrétiser ces perspectives. Leur mise en œuvre dépend des dynamiques internes, des choix et des rapports de force au sein de chaque territoire.*

Mots-clés. *Prospective technologique – Commercialisation – Développement local – Système de valeurs – Petits ruminants.*

I – Introduction: the constant characteristics of the Mediterranean sheep and goat sectors in a changing world

The objective of a general presentation of the Sheep and Goats sectors in the Mediterranean is to give keys and stakes for the organization, strategies, marketing, and production systems of value chains in these sectors.

1. Sheep and goats: a significant role in the Mediterranean Basin

The more recent statistics (FAOStat, 2016) show that small ruminants (SR) have always a peculiar importance in the Mediterranean (See Table 1): Although they are only 16% of the total SR livestock in the world, it is the only region where they are about one third of the ruminants and this percentage has been stable since 1993.The livestock has slightly decreased (-7%)in the North Bank, slightly increased in Middle East (+13%) and significantly increased in Northern Africa (45%), more than in the rest of the world (+22%).

Table 1. The sheep and goat livestock in the Mediterranean and in the world

	Sheep and goat numbers (million heads)		Sheep and goat as % of total ruminant numbers (% of cattle units)	
	1993	**2013**	**1993**	**2013**
Southern Europe	65	50	32	29
Northern Africa	120	175	30	30
Western Asia	110	125	44	40
Mediterranean Basin	295 (16%)	350 (16%)	35	33
Oceania	190	110	45	29
China	200	350	22	26
World	1750 (100%)	2150 (100%)	15	16

Source: FAOstat, 2016-year 2015.

2. Sheep and goats in the Mediterranean are still kept for producing three commodities

Historically, sheep and goats were not as specialized as now in intensified systems and the animals were often used for milk, fibres and meat.

There is a strong tradition of kids and lambs consumption and especially during special events and religious celebrations (Pessa'h for Jewish people, Christmas or Easter for Christian people, Aid El Adha for Muslim ones).The importance of wool has decreased significantly and the Mediterranean is not a leader in cashmere or mohair which face an important competition from China, or Central Asia for instance.

The Mediterranean SR dairy sector is original and very diverse. In North Africa, where there is no strong dairy tradition, ewe milk and above all goat milk is used mainly for family use (liquid milk or white fresh cheese, the *jbem*). In Southern Europe, strong cheese industries based on export coexist with small scale cheese producers. Hard cheeses were mainly produced by industry in Italy (Pecorino) or Spain (Manchego) and the small scale sector produces a variety of traditional often soft cheeses. In the east of the Mediterranean area, the white cheeses are dominant (cheeses in brine like Feta in Greece, Halloumi, Labaneh and other acid milks). The Mediterranean region is almost the only region of the world where ewes are milked at a large scale with specific sectors. The dairy products are either pure sheep or goat milk or mixed (Vallerand *et al*., 2007, Dubeuf *et al*., 2004).

3. The productions systems have still an important pastoral component with always an increasing importance of feedstuffs or sub products of agriculture

The productions systems are still influenced by the geographical organization of the Mediterranean with overpopulated crowded coast lines, some rich but limited irrigated plain lands, hills and mountainous marginal lands where long distance or close transhumance could be practised during dry and warm summers. In the Mediterranean, a characteristic of sheep and goats systems is still their diverse abilities to valorise rangelands: Under the eye of shepherds, goat herds can use steep rangelands of scrubs and woods, sheep flock graze natural meadows on hills and are transported on long distance mountain rangelands. The practices have not been unchangeable and in the regions where structured dairy sheep sectors have been developed like in Roquefort, Sardinia, Corsica, Spain, Southern Italy or Turkey, the use of irrigated meadows has been developed after the 1950s as the indoor distribution of concentrates.

More recently, we have observed also that in South Europe, dry mountains are more and more encroached by shrubs and low woods due to human abandonment and the decrease of agricultural uses. In these areas where non-agricultural uses have been developed for tourism (hunting, trekking, landscape discovery...), sheep and goats could help to maintain a human activity and the preservation of natural resources. In Middle-East and North Africa, in the semi arid areas where the climatic conditions are harsh (heat, wind, frost,, drought) and get worse due to climate changing, sheep and goats are a resilient activity for local populations complementary to horticulture and crops.

Another characteristic of the sheep and goats sector is the long time but increasing importance of concentrates distribution in the feeding of herds: Concentrates or sub products are more and more used to palliate the lack of dry forage and during the lactation peaks for dairy animals (for instance between 40kg and 270kg/goat/year in Corsica – ILOCC, 2015) kg and to fatten meat sheep (see Table 2).

Table 2. Mediterranean meat sheep are significantly grain-fed

	Concentrate (% of total feed intake in meat sheep flocks)
South-East France (Institut de l'élevage, 2008)	28
M'sila region (Algeria) (Boutonnet & Dib, 2011)	40
Northern Africa (Bourbouze, 1990)	30

II – Changes in the consumers habits and products

The starting points of the analysis are the evolution of the consumption of sheep and goat (S & G) meats and dairy products as shown by statistics (Tables 3 and 4).

Table 3. Share of the sheep and goat meat supply in the Mediterranean

	Sheep and goat meat consumption (kg/capita/year)		Total meat consumption (kg/capita/year)		Sheep and goat meat consumption (%of total meat)	
	1991	2011	1991	2011	1991	2011
Southern Europe	4.3	2.7	80	82	5	3
Northern Africa	3.7	5.5	17	26	21	21
Western Asia	5.9	4.7	24	37	24	13

Source: FAOSTAT, 2015.

Table 4. Changes in Sheep and goat milk production in the Mediterranean basin

	Sheep milk production (million tonnes)		Goat milk production (million tonnes)	
	1993	2013	1993	2013
Southern Europe	2.1	1.9	1.2	1
Northern Africa	0.8	1.1	1.2	1.9
Western Asia	1.7	2.3	0.7	1
Mediterranean Basin	4.4 (57%)	5.3 (53%)	3.1 (28%)	3.9 (21%)
World	8 (100%)	10 (100%)	11 (100%)	18 (100%)

Source: FAOSTAT, 2015.

1. Changes in the demand for sheep and goat meat

A. A decreasing share of sheep and goats meats in total meat supply, but a strong cultural image

Although S & G meat consumption remains high in all Mediterranean regions and although the general demographic growth in the Mediterranean has increased the general demand for S & G meat, the trends have been different according to the several regions for the last twenty years: In Southern Europe where the global meat consumption is high and stable, the consumption of S & G meat greatly decreased (-37%) and is only 3% of the total consumption of meat. The traditional consumptions habits in rural areas, for instance during Eastern for lambs and Christmas for kids with animals bought from the butcher decreased and the generalization of distribution in supermarket favoured other types of meats. In Western Asia (Turkey, Lebanon, etc...), the consumption is still higher than in Europe but has decreased significantly and now is lower than in Northern Africa. The total meat consumption is closer to that of Europe (45% in 2011 *vs* 30% in 1991); the S & G meat consumption is 74% higher than in Europe but decreased 21% and S & G meat is now nearly on a niche market (13%). In Northern Africa, the trend is very different: the total meat consumption increased (+52 %) thanks to the general increase of standards of living but remains low compared to Europe (31%) and Western Asia (70%). But the part of S & G meat is stable (21%). However, S&G meat is no longer an important source of animal protein but, for a large extent, a source of specific quality products, mainly consumed in festive occasions during weddings, religious celebrations, etc. (Alary *et al*., 2009) Due to this higher demand during religious periods or other festive occasions, sheep meat has often to be imported or lambs fattened with more grain. Consequently, consumers consider this sheep meat too fat. and appreciate more goat meat because it is more dietetic and healthy.

B. New trends in marketing channels for meat

a] In Western Asia and Northern Africa

The traditional marketing channels in this area are characterized by a large number of small traders competing for buying animals from shepherds mainly on traditional markets ("souks") and with low margins (85% of the price paid by the consumer goes to the farmer (Alary and al., 2006) . The consequence of this situation is an absence of segmentation and a very direct relationship from the shepherd to the final consumer.

Although this trend is still a weak signal because no precise data are available on it, we observe in these areas a fast growing interest for new modes of purchasing and packaging related to the development of supermarkets in urban areas where a majority of population is now living. This increasing market share hold by supermarkets generates a huge change in the markets practices with more carcasses and less live animals in the cities and a general increase of the meat whole sale sector (Alary *et al*., 2009). Probably under the influence of the western consumers habits, a growing attention to the different cuts (for grill and boiling) is observed with consequences on slaughtering at whole sale levels but also to origin with new labels and brands to segment the markets (like the certification Protected Geographical Indications (PGI) project of the kid in the Argane tree area around Essaouira, (Chatibi et *et al*., 2014) or the PGI label for the Beniguil lamb in Morocco).

b] In Southern Europe

In Southern Europe, trading is now oligopolistic with few big traders who could obtain high margins (farmers receiving only 45% of consumers spending. The market is now segmented by several labels, brands and geographical indications (11 in France, 5 in Spain, 2 in Italy, 2 in Greece and 12 in Portugal with a large majority of sheep meat except in Greece and Portugal where several kids have obtained a PGI, according to the European Commission, 2016). These traders are able to promote innovation in marketing but they have not always the capacity to promote the local farmers and due to bad marketing situations, the kids and lambs bred in pastoral systems can have difficulties to be marketed further than on local markets. Meanwhile the consumers pay more attention to proximity and to the mode of production and to short chains or even direct sales, so out of the big meat company (Nozières *et al*., 2015).

2. A significant role of the Mediterranean production of sheep and goat milk in the world with a growing demand for goat milk

A. In Southern Europe and Western Asia: High value dairy products

The statistics on S & G milk (Table 4) include auto consumed and not marketed milk and there is few data to estimate the real quantity of milk valorised in non domestic value chains. Consequently these data are rather hard to interpret when auto consumption is high.

Although the S & G milk production is rather stable in the all the region, the trend is generally in favour of the development of locally rooted "terroir" products with a large number of small scale Protected Denomination of Origin (PDO) S & G cheeses (more than 60 PDO ewe milk cheeses for example, in Southern Europe, Dubeuf, 2005).

It is particularly clear in Southern Europe where small scale and farm made cheese units have developed this type of high quality products. The S & G cheeses, once generally an everyday component of the Mediterranean diet (with Feta, Pecorino or Manchego type cheeses), become more and more upscale gastronomic for connoisseurs consumers (Dubeuf and Le Jaouen, 2007). This trend can be observed in regions where a S & G dairy industry exists (Sardinia, Roquefort, Greece, etc.) but also in many mountain regions in Portugal, South -East France, Northern and Central Italy without an important S & G industry. The goat milk sector seems to be more innovative with a great range of new products (organic dairy products, dietetic liquid milk, cheeses associated with wine, olive oil, aromatic plants) which meet an increasing demand. At a lower extent this trend exists also in Western Asia in Turkey or in Lebanon with a recent but increasing demand for organic and diversified local products like organic Labneh or Kechek in Lebanon for instance (Lactimed, 2016).

B. In Northern Africa: mainly for domestic use

In Northern Africa, where the total S&G milk production seems to be as important as in each of the two other regions, the sheep and goat milk industry is nearly non-existent and most of the milk is auto consumed. In spite of many cooperation projects, the success to develop processing is limited with only small cheese units for peri-urban niche markets. The market is growing but is small. For instance in North Morocco, the public authorities have supported the development of a dairy goat sector and the creation of a co-operative cheese unit (Dubeuf, 2014; Thomas *et al*., 1996). Although this project is often considered as an example with the certification of the PGI “Fromage de Chefchaouen”, the Bellota cooperative cheese unit has difficulties to develop marketing and increase its production. Several individual small units have been created around the cities but very often the specificity of goat milk is not enhanced and cheeses are often made with mixed milks. These initiatives are generally with goat milk which seems to have more potentialities than sheep milk. This trend can be observed elsewhere in many regions in the world. Among the few examples of sheep milk industry in Northern Africa, we can quote the small ewe milk cheese nucleus around Beja in Tunisia where a cheese unit, the SOTULAIFROM Company, has developed for 50 years the famous NUMIDIA blue cheese. Although the number of dairy ewes decreased dramatically after the 90s, several projects try to re dynamize this activity with the creation of a new small scale unit, “From art Beja” (Lactimed, 2016).

III – Challenges on the value chain and outlooks

The previous paragraphs show that although the S&G sectors in the Mediterranean are still globally dynamic and alive, and that their key characteristics look unchanged, they have faced important changes regarding their markets and the consumers’ habits: their products (milk, fibres and meat) are no longer staple commodities but high quality and high value products.

If the farmers’ decision processes are influenced by the constraints of the market, they are also driven by other important challenges related to the social and economic situation of the rural marginal lands. In spite of the bad unemployment situation in the cities of the two sides of the Mediterranean, young people of the rural areas, and specially, the most educated think always there are more opportunities in urban cities for other types of jobs. Consequently there is a declining supply of labor for herding because these activities are considered too hard and not enough paid and there is a loss of know- how. So, in the areas where the demand for meat or milk is high with rather profitable activities, it is hard to find a shepherd and high wages may be offered like in Turkey, Southern Alps, etc.… The answer to this situation is often intensification and fattening the animals with grain or distributing more feedstuffs or sub-products to increase milk production. A consequence is the abandonment of pastoral practices and in many areas like for instance in Maghreb, less than 15% of S&G feed is from pastoral origin (Alary *et al*., 2009). In many less favored and mountain areas, the villages and rangelands are progressively abandoned. This process is now completed in Southern Europe but begins to be observable on the Southern side of the Mediterranean in more remote areas. The young villagers, often from poor small farms, prefer to emigrate in the big cities or in Europe and send money to their parents, than stay shepherd when they cannot find a rare public job, or become artisan (Van Den Eynde, 2006).

A key issue for S&G value chain is their joint contribution to the preservation and the social development of rural Mediterranean hinterlands. Improving competitiveness with the old past recipes (by reducing the production costs, increasing productivity using best lands and specializing production) cannot be the solution in these regions where specific improvements of the local resources and local practices have to be enhanced by developing the capacity of the breeders and the local technical/economic references! In abandoned areas, in Europe but also in remote Maghreb or Near East areas, the rangelands are covered with shrubs and get closed. The consequences are collective with a very high and costly fire hazard and an important loss of biodiversity. In the regions where the stocking rate is still high, the lack of collective organization and the loss of traditional collective management practices (like Agdal in Morocco, El Aïch *et al*., 2005) leads to overgrazing stressed by the higher frequency of drought periods due to climate changing.

From these key points, the main challenges on S&G value chains seem deeply linked to pastoralism in all its dimensions as a mode of production for the future and the pastoral challenges are the following ones:

1. Identifying and remunerating ecosystem services

S&G could provide real ecosystemic services by preventing fires, controlling shrubs and weeds, preserving biodiversity and pastoral rangelands, a key component of landscapes appreciated by tourism. These services are presently, neither well identified (Gutiérrez-Peña, R. and al., 2014) nor paid and considered as a free positive externality. The public authorities have often considered pastoralism as negative for environment and begin to be aware of their positive effect. For instance, in Spain, a promote tool has been built to promote pastoral activities, for preventing fires, the RAPCA, the Grazed Fuel break Network in Andalusia (Junta de Andalucia, 2016). In the Argane tree area in Morocco, as very often in the Mediterranean, the goats were considered responsible for the degradation of the argane forest, an important source of value for the region as very often in the Mediterranean. In recent years, the authorities begin to be aware that on the opposite, goats are a factor of biodiversity and preservation but that a good management of grazing is necessary. The certification of the kid of the Argane area around Essaouira is presently reconsidered in this direction with new specifications (Chatibi *et al*., 2013, 2014).

2. Identifying and improving the agro-ecological dimensions of pastoralism

Agro-ecology is enhanced more and more to combine simultaneously the economic, social and environmental performances. It is considered as a real project for agriculture for the future to limit the emission of greenhouse gases, the use of non-renewable resources, and its negative impact on soils fertility and waters quality. Including organic fertilisation and the use of manure could be also an opportunity. In France, the priority of the Ministry of Agriculture is to implement an ambitious program of training and incentives in favour of Agro-ecology. Moreover, livestock has been considered during the last decade as an important source of negative externalities for environment (Jutzy *et al*., 2006). So the agro-ecological stake is high for livestock and pastoralism is generally considered as a mode of production corresponding to its objectives. A method to evaluate of the degree of approximation of S&G farms and systems to the organic models and agro-ecological requirements in the Mediterranean and to identify how to improve them has been implemented by Mena *et al*. (2012) and tested in several Mediterranean situations. Agro-ecological components include not only feeding and grazing management, fertilization and weeds controls on the lands, animal health but also the type of breeds, animal welfare and marketing with a multi criteria approach. For instance, short food channels with forages produced on the farm and products sold in the near-by are agro-ecological indicators to be enhanced.

3. Producing references and developing extension for S&G pastoral systems

An important issue is that in spite of these considerations, the dominant mental model is the intensive one and progress in livestock is still too often seen through more individual performances, more specialisation, and better technical performances. This realty due to many causes including the references taught to young technicians, gives rise to lock in effects and they have prejudices against new approaches. It is the reason why it is so important to produce and disseminate references on pastoral methods or rangelands management. In France, reorganizing the education programs in favour of pastoral areas is now a priority. The main challenge is to control the sanitary quality of the products while preserving the pastoral conditions of the activities in a profitable way. In Spain, several shepherd's schools have been organized specifically to improve the technical level of farmers –in nutrition, reproduction, health, and products sanitary quality under pastoral conditions. But there is still a gap with the Southern side of the Basin where extension services are generally very weak, sanitary conditions are not always satisfied and where the local potentialities and traditional practices are not considered positively. In all cases, the improvement of the information system for technology, management and marketing strategies has to be considered (Dubeuf *et al*., 2012).

4. Improving the access to markets for pastoral products by promotion and certification

The pastoral products are often produced in remote areas by small stake holders what gives them a difficult access to markets. The logistics to collect milk cheeses and animals is difficult to organize and very expensive. For example, the lambs and kids are far from slaughtering houses and it is generally forbidden to slaughter them within farms.

Besides, their specific production system is not always well identified by the consumers. Labeling is be a good way to get them acknowledged. Several labels are available. The most known and often the most efficient are the Geographical Indications alone or associated with others. The organic label is a good way to identify the agro-ecological characteristics of the product. But these two labels require a very strict documentation and monitoring. Other initiatives could be associated with the tourism in the area with creation of farm inns, thematic routes, local shops (for cheeses or wool for instance), exhibitions, regional labels (Lactimed, 2016). The objectives of these initiatives are not only to identify the products but also to attract the consumers by their roots in the territory. It means also that these promotions have not to be only a show but to be associated with larger operations and requiring the support of local organizations (Dubeuf, 2015).

IV – Conclusions

This global overview of the sheep and goat sectors in the Mediterranean has shown that their outlooks are today very opened according to each situation. For few of them, particularly the intensified systems, to be more competitive and efficient on the world market for milk or meat can be an objective. But in most cases, the future of the sheep and goats is linked to the outlooks of the hinterlands where they are bred. In spite of their real resilience, it is likely that situations of rupture in these regions would lead to the disappearance of S & G. The agro-ecological and eco-systemic challenges are both opportunities and dangers and their futures will be linked to the prospective capacity of the local actors to collaborate and to organize together the transition towards new value chains.

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