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The sheep farming system in the Pogoni area in Epirus-Greece

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SUMMARY – The present paper is the result of a study concerning the sheep production system in a less favoured area in Epirus-Greece. This system is a semi-extensive one and is based on the exploitation of local natural resources. It is characerised by small size farms with an excessive fragmentation, ageing of the active rural population, degradation of communal pastures and a high proportion of leased arable and pasture lands. Factors such as the upgrading of sheep and goat flocks and mechanisation of agricultural work mainly in the plain zone as well as a greater use of purchased concentrates and hay, have led to a greater degree of intensification of the sheep production system in the target area, with a corresponding decrease in dependence on natural resources. The development of the agricultural system would be based on the necessity of more rational exploitation of local natural resources in the framework of sustainability on the one hand and of the guarantee of a reasonable standard of life to the area's rural population on the other. This orientation will decrease the dependence of farms on the market of inputs and will thus give them the opportunity to be better integrated into the natural system of the area. As the sole agricultural activity cannot guarantee the development of less favoured regions, new opportunities for off-farm activities must also be created.

Key words: Sheep production system, less favoured areas, Epirus-Greece, feeding system.

RESUME – *"Le système de production ovine dans la zone de Pogoni dans Epire-Grèce". Cette publication est le résultat d'une étude concernant les systèmes d'élevage ovin dans une région défavorisée en Epire-Grèce. Le système peut être caractérisé de demi-extensif en se basant sur l'exploitation des ressources naturelles locales. Il se distingue par l'existence d'exploitations de petite taille avec un morcellement excessif, le vieillissement de la population rurale active, la dégradation des pâturages communaux et la proportion élevée de terres arables et pâturées en location : l'amélioration des troupeaux ovins et caprins, la mécanisation du travail agricole (principalement dans la zone de plaine) et l'utilisation plus fréquente de concentrés et de foins achetés, ont contribué à une intensification de la production ovine plus élevée dans la région, tandis qu'a eu lieu une diminution correspondante de la dépendance des ressources naturelles. Le développement du système agricole devrait se baser sur la nécessité d'une exploitation rationnelle des ressources naturelles avec les objectifs de durabilité d'une part et de garantie d'un niveau de vie raisonable pour la population rurale, d'autre part. Cette orientation diminuerait la dépendance des exploitations agricoles du marché des inputs et leur donnerait l'occasion de mieux s'intégrer dans le système naturel de la région. Comme la seule activité agricole ne peut pas garantir le développement des régions défavorisées, il faut créer de nouvelles opportunités pour des activités hors du secteur agricole.*

Mots-clés : Système de production ovine, régions défavorisées, Epire-Grèce, système d'alimentation.

Objective

Any effort for the development of less favoured Mediterranean areas presupposes a precise knowledge of the structure and operation of their agricultural systems. Physical and biological factors, economic conditions and marketing networks, as well as the social background make up the structure of a system, while the relationships and interactions among these factors compose the dynamic of the agricultural system.

The present paper is the result of the diagnostic of the Epirus small ruminants' livestock system. The objective is to assess the operation of the system and to identify the main constraints to its development. The research team focused its attention on a target area. Based on this analysis some recommendations can be made.

In a further stage an on-farm research project should be carried out in order to test the best solutions from the technical and economic point of view and their adoption by sheep farmers.

However, the effects of any intervention on the socio-economic structure of the system and on the environment must be taken in consideration.

Methodology

The method of livestock systems study, as described by Steiner (1987), Tipp and Woolley (1989) and ILCA (1990), was applied. The research team was a multidisciplinary one, as is required in such cases (Flinn and Denning, 1982), composed of animal production specialists, economists and sociologists.

The total project was divided into two steps. The first step aimed at the knowledge of the system by collecting data from various bibliographic sources, by interviewing co-operative and local administrative personnel and by compiling 95 questionnaires corresponding to an equal number of sheep farms. This sample is 17% of the total number of farms in the target area and 57% of those that have flocks of over 50 sheep. Technical and economic studies carried out in the area consider sheep or goat farms those farms whose income is mainly due to sheep or goat farming. In terms of size of flock, such farms are those containing at least 50 sheep or goats.

The analysis of the data gathered in the first step led to a general approach to the system. Following this step the research team went on to a more detailed study on sheep farms and focused its attention on the feeding strategy applied by farmers, because it was ascertained that this was the vulnerable point in the system. For this purpose, seven farms were selected, the owners of which showed interest and willingness to collaborate with the research team. These farms constitute a sample of medium-sized and rather intensive enterprises. Over a period of two years data were collected in those farms by monitoring the feeding strategy of the flocks with the aid of a feeding calendar.

Nutrient requirements and nutritive value of feedstuffs were calculated by using the corresponding tables of INRA (1980).

Results

Biophysical environment of the target area

Location, villages, population

The target area is located in the north-west of the Ioannina prefecture and is part of the Pogoni area. It consists of 28 villages which cover an area of 44,040 ha. The 1991 population census registered 7,311 inhabitants (a population density of 16.6 inhabitants/km^2). Real population, however, must be fewer. In the same year, during the agricultural census, 587 rural households were registered, containing 1,034 working individuals (1.7 active individuals/farm). Taken into consideration that the target area is almost exclusively an agricultural one, this number of 1034 inhabitants would be closer to the real population.

Climate

Based upon data of the Meteorological Station of Ioannina (Fig. 1), the climate of the area may be characterised, according to Emberger's climatogramme, as a mild Mediterranean one, with humid and cold winters. The arid period lasts approximately 3-4 months which coincide with summer and the beginning of autumn.

Geomorphology

Geologically the area belongs to the Adriatic-Ionian zone and its rocks are mainly limestone of Trias up to Upper Eocene. Undivided flysch of Upper Eocene and Aquitanian occurs in the north-western mountainous zone. Alluvial deposits are noted along the rivers.
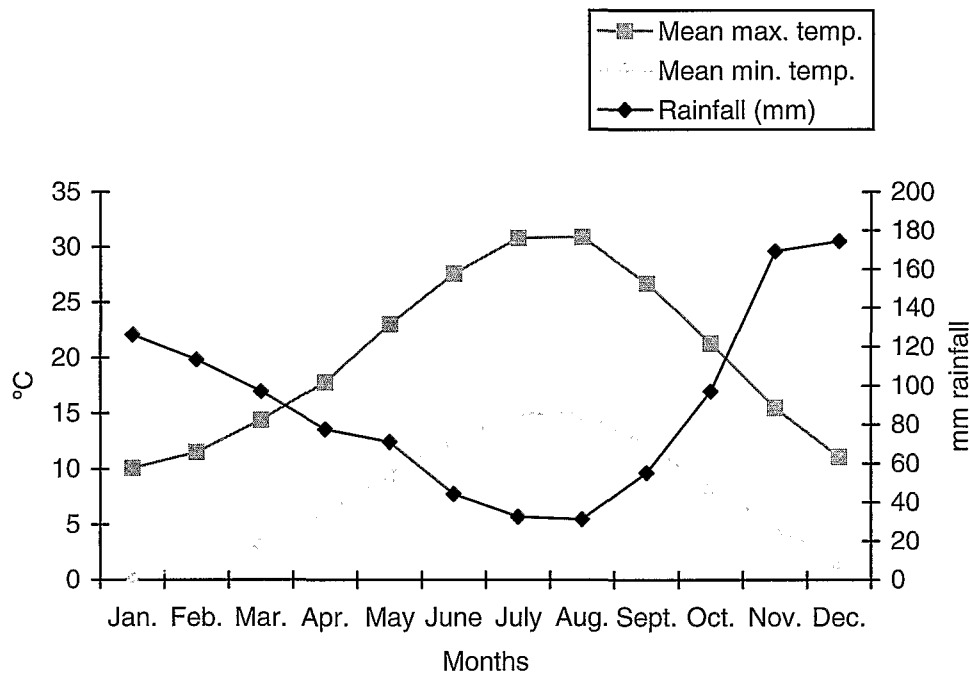
Fig. 1.   Temperature and rainfall data of Ioannina (National Meteorological Service, 1956-1996).

The relief of the area is mountainous with diverse topographic conformation. The altitude ranges from 500 m at Kalpaki to 2,198 m at Mt. Douskon. The north, north-western part of the area is occupied by mountains which transform gradually into hills and end in a small plain in the south-east.

According to the topography, the region is divided into two zones: the mountainous, semi-mountainous zone (M,S-M) (85.4% of the total area, 24 villages) and the plain zone (P) (14.6% of the total area, 4 villages).

Water resources

The most important river of the area is Kalamas river. The M,S-M zone is crossed by Drin, Gormos and Nezeros rivers. There is also a small lake in the area.

Vegetation

The vegetation of the area belongs to the close-mediterranean zone of pubescent oak (*Quercus pubescens, Quercetalia pubescentis*) and more precisely to the Coccifero-caprinetum augmented space of Ostryo-caprinion sub-zone.

Concerning the vegetation of pastures, the following types can be delineated:

(i) Grasslands dominated by annual and perennial grasses and legumes. In some places grasslands are infected by dwarf phryganic shrubs, mainly Jerusalem sage (*Phlomis fruticosa*).

(ii) Shrublands mostly found in low and middle altitude zones. This is the predominant pasture type, belonging either to maquis, which is a dense community composed of sclerophyllous and evergreen shrubs, mainly represented by kermes oak, or phrygana, which is an open-scrub community dominated by dwarf shrubs where Jerusalem sage prevails.

(iii) Pastures in woodlands. It is an under-cover herbaceous vegetation in Ostryo-caprinion and Quercion-frainetto formations.

The agricultural system of the target area

The existence of widespread pastures, the production of forage crops and corn, as well as the number and composition of domestic animals denote the fact that the agricultural system of the area is characterised by the small ruminants production under semi-extensive conditions. Sheep production is dominant, while goat production is less important.

Land use, land ownership patterns, size of farms

The great majority of the land is covered by pastures (predominantly communal ones), while a small part (6.4%) is cultivated land. There are, however, important differences between M,S-M and P zones. The participation of cultivated land is greater in the P zone than in the M,S-M zone (Fig. 2). Irrigated land exists, almost exclusively, in the P zone, where the cultivation of cereals (especially maize) predominates. In the arable land of M,S-M zone alfalfa production is most important (Fig. 3). According to available data of the National Statistical Service the surface of cultivated land diminishes in the target area during the last decades, as a result of a decrease in the number of farms. However the situation is rather stable in the P zone (Figs 4 and 5).
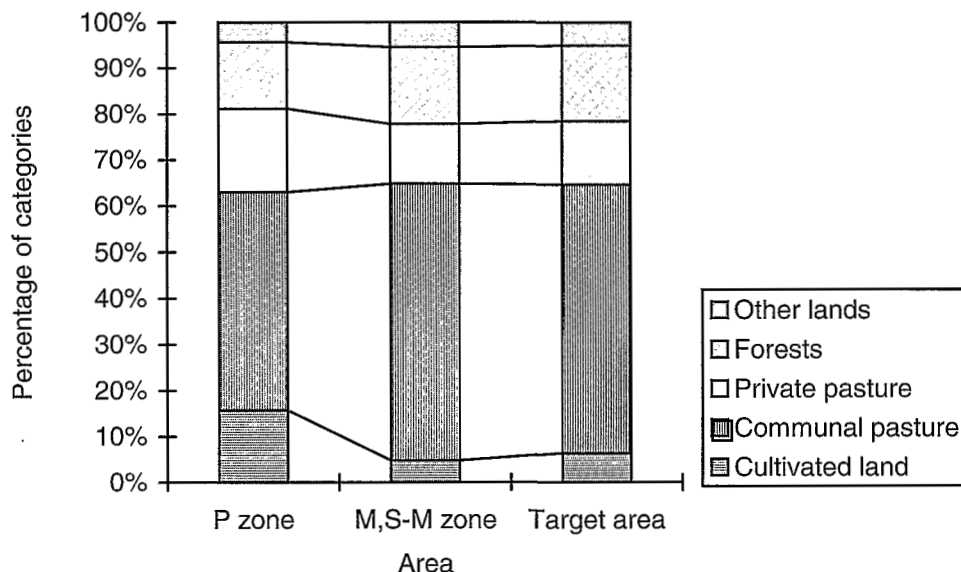

Fig. 2.   Land use patterns (National Statistical Service, 1991).

Concerning the land ownership patterns, the greater part (65.6%) of the arable and pasture lands is leased. This phenomenon is more usual in the M,S-M zone. Leased land in the area, as well as in most parts of Greece, belongs to monasteries or to people that have left the countryside and migrated either abroad or to urban centres of Greece. Although they are not farmers anymore, they keep the ownership of their land.

The size of farms is small in both zones. There are proportionally more small-sized farms in the M,S-M zone, where 58% of them belongs to the 0-20 ha class. In the P zone only 40% of the farms belongs to the above-mentioned class.

The fragmentation of arable and pasture lands is greater in the P zone (18.4 plots/farm) than in the M,S-M zone (13.5 plots/farm).

Animal population

The composition of the animal population in the area is shown in Table 1. Its evolution is characterised by the decrease of the solid-hoof population during the last thirty years, as a result of

the mechanisation of farming and the extension of asphalted roads, a slight decrease in the sheep population which remained stable over the last ten years and finally an important decrease in the goat and cattle population.
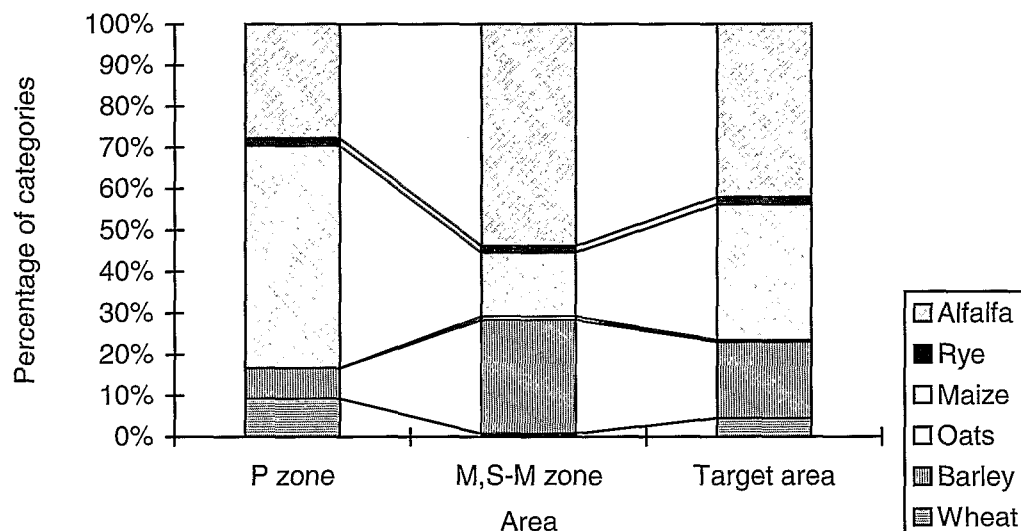

Fig. 3.   Arable land (National Statistical Service, 1991).
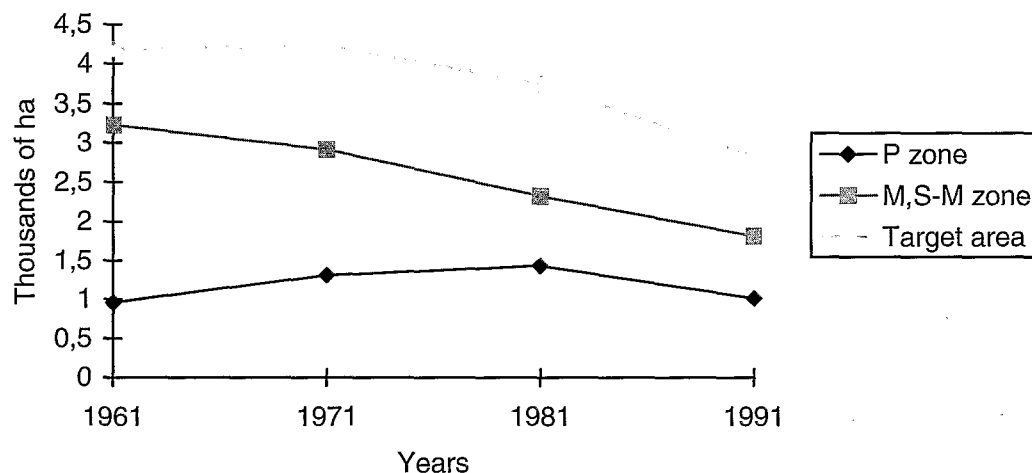
Fig. 4.   Cultivated land in the target area (National Statistical Service, 1961-1991).

It is remarkable that in the P zone, after 1981, some medium-sized enterprises of monogastrics were established. This is due to the fact that the policy of the Ministry of Agriculture was to subsidise the production of "white meat". Since then the number of such enterprises has decreased drastically as the result of their low productivity, the cessation of subsidies and the relatively low prices of swine and poultry.

The size of sheep and goat farms

Sheep farms are more numerous than goat farms. The mixed farms (farms with sheep and goats) are predominantly sheep farms with a small number of goats.

Fig. 5.   Number of farms in the target area (National Statistical Service, 1991).

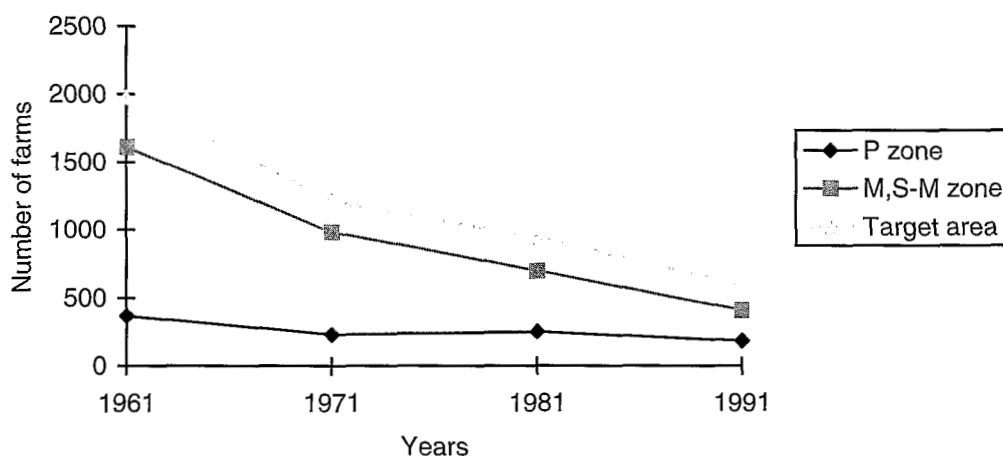Table 1.   Animal population (heads) (National Statistical Service, 1991)

	Cattle	Sheep	Goats	Pigs	Solid-hoof
P zone	96	12,909	1,968	10,681	42
M,S-M zone	387	24,565	5,595	1,4149	
Target area	483	37,474	7,563	12,138	191

In Fig. 6 there is the classification of a sample of 136 sheep farms according to the size of their flocks. The majority of these farms (61.5%) belong to the 1-50 sheep class. Such farms, as was already mentioned, cannot be considered as pure sheep farms. Among the others, the class of 51-150 sheep per flock is the most frequent. The same occurs for goat farms; 59% of them belongs to 1-50 class and 19% to the 51-100 class (Fig. 7). Farms with mixed flocks are few and they are usually small farms.

Sheep and goat breeds

The sheep bred in the area is *Vlachiko* or *Boutsiko* (a local breed diffused in the mountains of Epirus), although crosses with other Greek breeds have taken place in order to upgrade the local population. Goats belong to the Greek goat breed.

Average commercial milk production is 91 kg per ewe and 117 kg per goat. Although these levels of production are considered satisfactory, further improvement is achievable, mainly by selection. It is noticeable that average commercial milk production of the flocks participating in the sheep genetic improvement programme is 114 kg per ewe for 180 days of milking.

Milk processing industry

There are five cheese factories in the target area with a total capacity of 6,792 t milk. The largest one is a co-operative cheese factory. There are also other cheese factories located in the broader Epirus region. At a small distance from the target area is the co-operative milk processing factory "Dodoni" to which a lot of farmers of the area sell their milk. Recently another similar private factory named "Epirus" was established in the Epirus region. The processing of sheep and goat milk produces cheese (especially "feta") and yoghurt. Many farmers produce small quantities of "feta" for their own consumption or for sell.
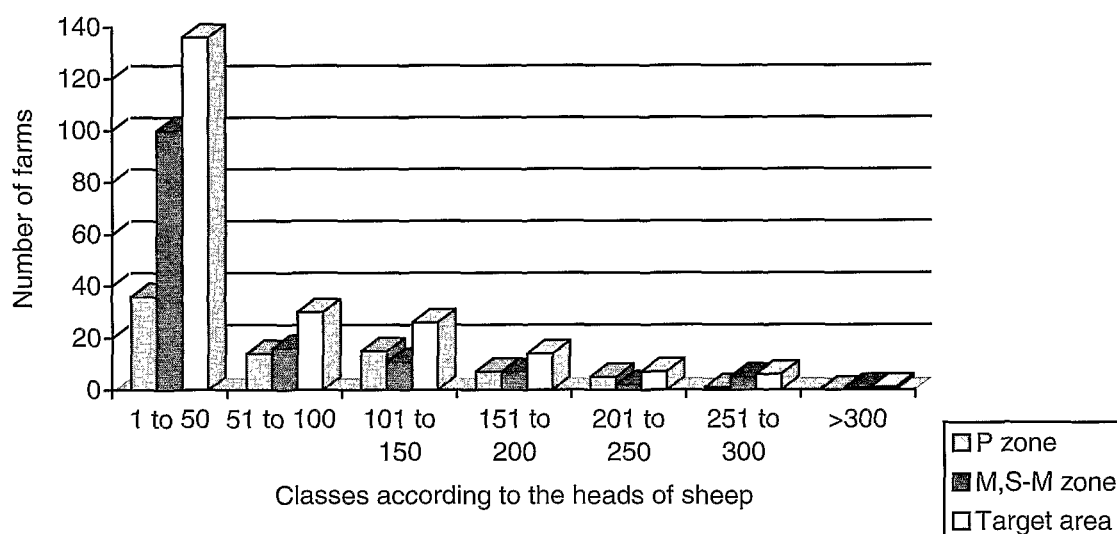
Fig. 6.   Classification of sheep farms (survey data, 1991).
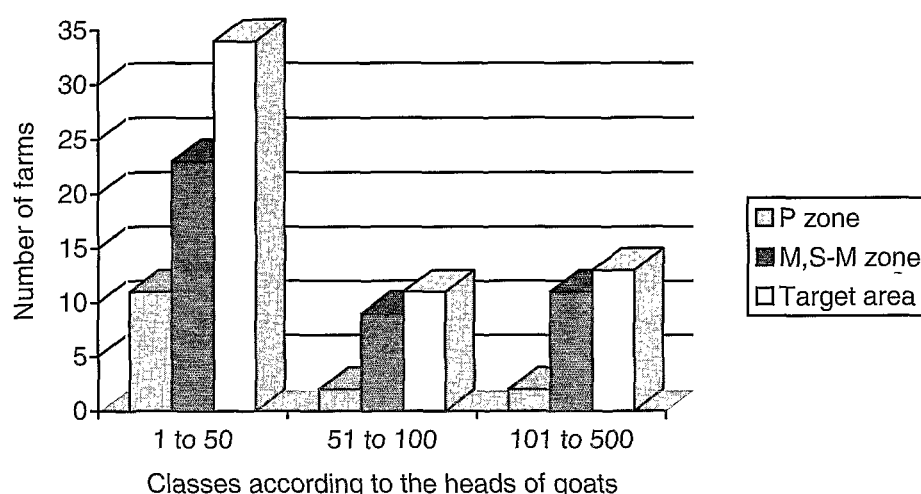
Fig. 7.   Classification of goat farms (survey data, 1991).

Meat production

Milk is the main product in the target area. Sheep and goat breeds here, as in the rest of the country, are specialised in milk production. Fattening lambs is not a profitable business because of the low quality of meat that aged lambs of milk-breeds produce (excess of fat tissue). For these reasons lambs are slaughtered at the age of 45-55 days, immediately after weaning when they have reached a weight of 12.5-13.5 kg.

Flock management

Reproduction of the flock

Precocious ewe-lambs (born in October) are mated at the age of 10.5 months in P zone, while in the M,S-M zone it starts at 9.5 months. For the last born ewe-lambs the reproduction starts when they are 16.5 months. Goatlings mate for the first time at the age of 10 months.

The weaning age of lambs and kids is between 45 and 55 days. The mating period for ewes starts mainly in May or June and lasts 15 to 30 days, while for goats this period starts in July or August and lasts 20-30 days.

Only 15% of the farmers prepare their animals for mating, mainly by flushing. Synchronisation of oestrus and artificial insemination are not practised in the area, though the techniques are not unknown to the farmers.

Lambing starts in October and ends in February. The maximum concentration occurs in November (54.7% of farms) and October (29.5% of farms). Kidding takes place mainly in December (80% of farms) and partly in January (20% of farms). The mean duration of the lambing period on a farm is 30 days and for the kidding period it is 17 days.

Prolificacy in both sheep and goats is 1.2. The mean lactation period for ewes lasts 200 days and for goats 180 days. This means that the majority of ewes stop producing milk in July and the goats in August.

Breeding of the flock

As mentioned above, an important part of the sheep population in the area is crossbred. Greek sheep milk breeds like *Chios, Karagouniko, Frisarta* have been used. They are all high-performance breeds and have contributed to the genetic upgrading of the local sheep population. There are more crossbred flocks in the M,S-M zone (95% of the flocks) than in the P zone (85% of the flocks). The goat flocks are pure-bred. Sheep and goat pure-bred animals belong to the local breeds.

The average productive life of ewes is five years in farms of the P zone and seven years in the M,S-M zone, while for the rams the corresponding figures are four years and five years. The productive life lasts eight years for goats and six years for bucks.

The replacement percentage for ewes is 15-20% per year and for goats 12% per year. The ewe-ram ratio in the farms of the P zone is 19 and in the M,S-M zone it is 17. Goat-buck ratio in the target area is 19.

Housing conditions

There are barns for sheep and goats in almost all the area's farms. There are also few open type shelters and shades. Half of the barns have a slat floor, while in the other half a permanent litter is used which is renewed twice a year. There is no milking parlour in the farms interviewed. Five farmers use mobile milk plants for the milking of sheep and goats in the barn.

Health conditions

Most important diseases are mastitis and internal parasites. Some 15% of the animals belonging to the interviewed farmers were infected with various diseases. However, the number of dead animals is low (12% of infected animals), due to the fact that veterinary care of the flocks is sufficient.

In general, farmers try to prevent diseases by better feeding, application of vaccination and disinfection of barns and animals. They also try to control diseases by using different drugs.

Stillborn lambs were 6% of the total number of lambs born during the interview period, while stillborn kids were 4% at the same period. During the suckling period 3% of lambs and 7% of kids died due to various reasons.

Feeding strategy

Types of pastures and forage production

The following types of pastures can be distinguished, according to their ownership and use:

(i) Herbage pastures. *These are private pastures* composed of annual and perennial grasses and legumes which constitute the best plots for forage production and grazing. They are previously cultivated land or long-lasting fallows. During April and May farmers let the sward to grow and then they cut it at the end of May in order to make hay. These plots are grazed in winter by lactating ewes and by the whole flock during the rest of the year. Almost all the farmers of the target area (95% of them) utilise such types of pastures. However, the intensity of their utilisation differs between the zones. In the P zone 28% of farmers use these pastures for grazing all year round, while in the M,S-M zone the corresponding percentage is 47%.

Few farmers fertilise these pastures (25% in the P zone and 20% in the M,S-M zone).

(ii) Private pastures with shrubs. These pastures are degraded and are mainly those hired by farmers. The plots belonging to this category are grazed throughout the year. They are used in winter by ewe-lambs and pregnant ewes.

(iii) Communal pastures. These are usually herbage pastures invaded to a more or less great extent by short and tall shrubs. Where the soil is not deep and limestone prevails, these pastures are infested with Jerusalem sage. The greater part of them are seriously degraded because of intensive grazing and lack of any sort of maintenance. They are used by all the flocks of the village all year round. The majority of farmers (72% in the P zone and 89% in the M,S-M zone) use such kind of pastures. The flocks of the P zone are less dependant on communal pastures, because feed production is proportionally greater in the P zone than in the M,S-M zone.

(iv) Cereal fields. This type of pasture is common in the P zone (46% of farms), while it is less common in the M,S-M zone (18% of farms). Cereal crops (mainly barley, oats and rye) are grazed lightly by milking ewes during February and March and then harvested in summer (1,500-2,000 kg crop production/ha). If there is no harvest, grazing continues until summer.

(v) Alfalfa fields. It is the production of hay that is of interest in this case. There are three or four cuts during the year in the P zone. The first cut takes place in May and the last one in the middle of September. These plots are grazed during autumn and sometimes in winter, if the weather is favourable. Alfalfa is mainly cultivated in the M,S-M zone (54% of the arable land), while in the P zone it is less important (37.2% of the arable land).

Feeding strategy

The factors that are taken into consideration by the farmers in order to formulate their feeding strategy are related to soil and climatic conditions, the performance of the flock, the conditions of feed production and marketing (mainly concentrates) and the ownership patterns of agricultural land.

There are three main feeding periods in the year, according to the reproduction cycle of the ewes, the climatic conditions and the fragmentation of the pastures (Figs 8 and 9).

The first period is the summer one, extending up to the middle of autumn. At the beginning of this period the matings take place and one month later the milking ceases. Nutrient requirements are low and the flock satisfies them exclusively by grazing. Because of the low productivity of pastures during this period, the flock is obliged to graze all available pasture surfaces of the farm as well as the communal ones. In the P zone alfalfa is cut three or four times during this period for hay making.

The second period starts in the middle of autumn and continues until the beginning of spring. This is the most critical period of the year for two reasons. Firstly, nutrient requirements increase (suckling, milking) and secondly the production of pastures decreases. If the weather is good the flock goes out of the barn, for walking rather than for satisfying its nutrient requirements by grazing. These requirements are satisfied almost exclusively in the barn on hay and concentrates. It is worth noticing that in this period the farmer wastes important quantities of feed which are often purchased (Figs 10 and 11). Towards the end of the period (February, March) the ewes of the P zone graze lightly the cereal fields.

	AUG	SEP	OCT	NOV	DEC		JAN	FEB	MAR	APR	MAY	JUN		JUL	
Herbage pastures	P	P	P							M,LL	Regrowth Cut		M+P P	M+P P	P
Private pastures with shrubs	P	P	P								M,LL	M+P,P		M+P P	P
Communal pastures	P	P	P	P	S	M,S	M	M	M	M,LL	M,LL	M+P,P		M+P P	P
Barn (hay+ concentrates)				S,LL	S, LL	M,S, LL	M,LL	M,LL	M,LL						

Reproductive cycle: Gestation — Lambing — Suckling .... Mating — Gestation
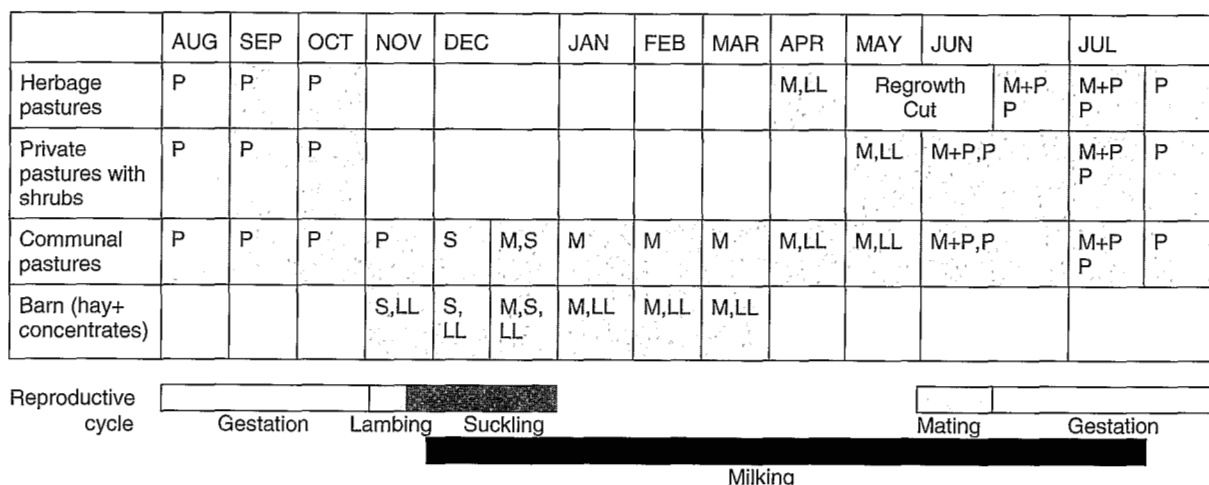Milking

Fig. 8. Schematic representation of feeding strategy in a typical M,S-M sheep farm. P: Pregnant ewes; S: Ewes that are suckling lambs; M: Milking ewes; L: Ewe-lambs; LL: Ewe-lambs less than one year; M+P: Ewes that are pregnant and produce milk simultaneously.

The third period coincides with spring. It lasts two months during which the flock use all the pasture plots that give then their maximum production. The herbage pastures are cut at the end of May for hay production.

	AUG	SEP	OCT	NOV		DEC	JAN	FEB	MAR	APR	MAY		JUN	JUL	
Herbage pastures	P,LL	P,LL	Regrowth			M,L	M,L	M,L	M,L	Regrowth, Cut			M+P P,LL	M+P P,LL	P,LL
Private pastures with shrubs	P,LL	P,LL	P,LL	P,L	L	M,L	M,L	M,L	M,L	M,L	M,L	M+P P,LL	M+P P,LL	M+P P,LL	P,LL
Communal pastures									M,L	M,L	M,L LL	M+P P,LL			
Irrigated alfalfa		Last cut	P,LL	P,L	L	P,L					First cut				
Cereal fields (rye)	P,LL	P,LL						M	M	M	M+P		M+P P,LL	M+P,P,LL	
Barn (hay+ concentrate)			S	S		M,S, LL	M,LL	M,LL	M,LL	M,LL					

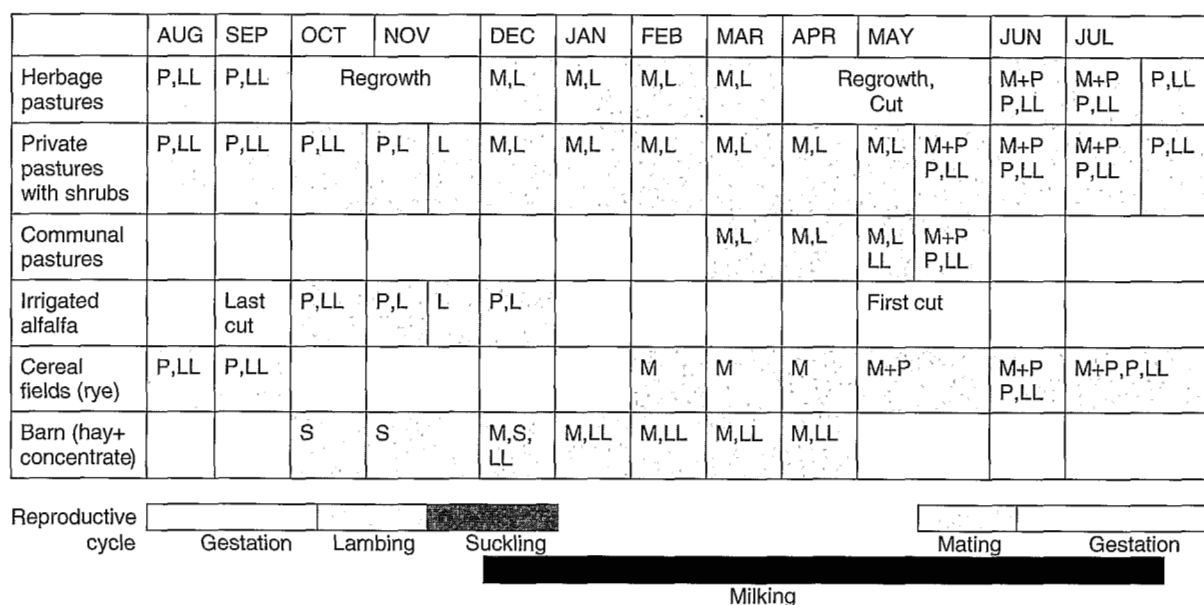Reproductive cycle: Gestation — Lambing — Suckling .... Mating — Gestation
Milking

Fig. 9. Schematic representation of feeding strategy in a typical P sheep farm. P: Pregnant ewes; S: Ewes that are suckling lambs; M: Milking; L: Ewe-lambs; LL: Ewe-lambs less than one year; M+P: Ewes that are pregnant and produce milk simultaneously.

Grouping of the farms

In order to identify the factors that diversify sheep farms in the area, we tried to group the seven farms of the sample according to their feeding characteristics and the performance of the ewes. A cluster analysis took place by using four indexes (Table 2). This analysis has led to the formation of two well distinct groups.

The first group includes the farms of the M,S-M zone. Their characteristic is their greater dependence on the pastures than those of the second group (207 days per year the flocks cover their

nutrient requirements exclusively by grazing). They also depend greatly upon the purchased feed (92% of allowances to the flock is purchased). The performances of the first group are lower than those of the second (209 kg total milk production per ewe), although the differences between the two groups are not significant. In this group less concentrates are used (38.6% of the requirements are satisfied by concentrates). In this case as well the difference between the groups is not significant. It is worth noticing that the three farms of this group do not dispose irrigated land. Their average cultivated land is 1.6 ha and 13.3 ha of pasture land. The main crops produced in these farms are barley, oats and rye. The average flock size is 180 ewes.

The second group is composed of four farms in the P zone. They are characterised by a weaker dependence on pastures (113 days exclusively grazing per year) and on purchased feed (62.6% of allowances to the flock is purchased). The performances in this group are greater (251 kg total milk production per ewe). Here the participation of concentrates in the ration is greater than in the first group. The average cultivated surface per farm is 11 ha, where maize and alfalfa are mainly cultivated. The average pasture land is 31 ha per farm and the size of the flock is 205 ewes. One of these farms is a particular case, because the farmer applies the transhumance system. From the beginning of October up to May the flock stays in the barn, fed exclusively on hay and concentrates. It spends the rest of the year in the mountains where its feeding is based upon summer mountain pastures of high altitudes. These pastures are 100 km away from the barn.
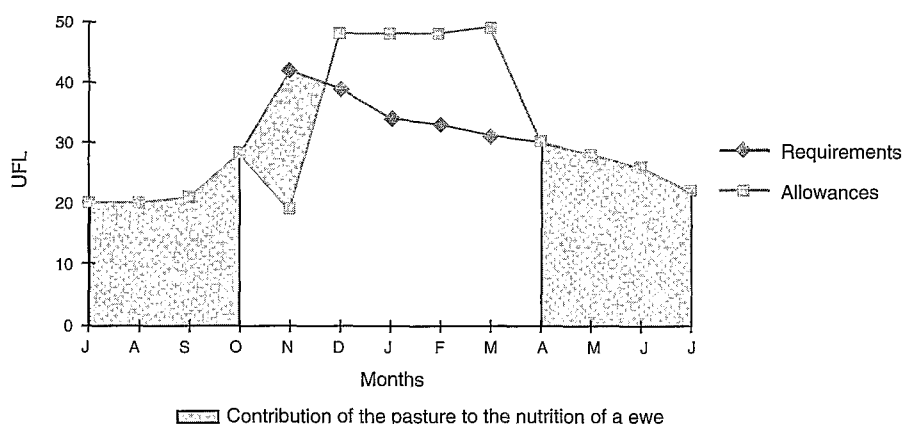

Fig. 10.   Energy requirements and allowances of an ewe in one of the three M,S-M sheep farms.
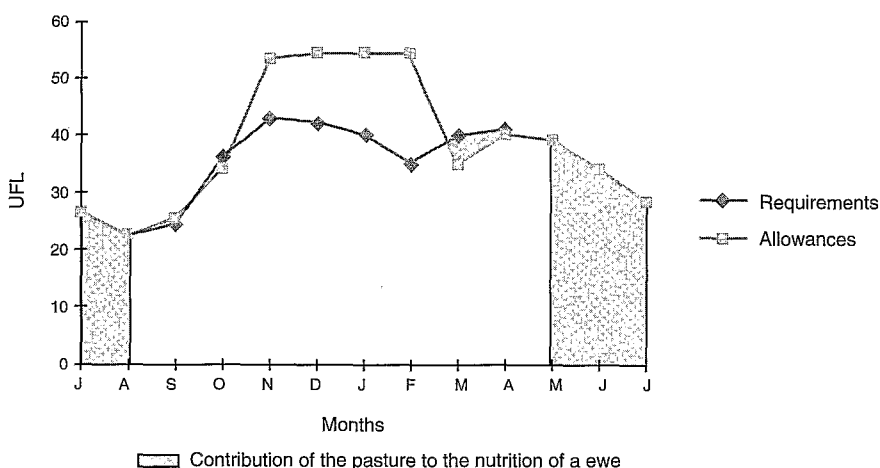

Fig. 11.   Energy requirements and allowances of a ewe in one of the four P sheep farms.

Table 2.   Grouping of a sample of seven sheep farms. Averages of indexes per group[†]

Group	I1	I2	I3	I4
1	209	207	92	39
2	251	113	63	52
	n.s.	$P < 0.05$	$P < 0.05$	n.s.

[†]Index I1: kg of total milk per ewe; index I2: days when requirements are fulfilled exclusively on pasture per ewe per year; index I3: UFL of purchased feed per UFL of allowances (%); index I4: UFL of concentrates per UFL of requirements

Discussion and conclusions

In order to better understand the operation of the small ruminants' system of the target area it is necessary, first of all, to get an overview of its evolution through the last decades. It is an evolution that characterises the majority of the less-favoured region of Greece.

In the past grazing of vast areas by numerous flocks and the cultivation of the arable land wherever it was possible, with forage plants and cereals, was the result of a balanced exploitation of natural resources of the area which sustained a more numerous human population than today.

The great rural exodus which took place after second world war and characterised the whole Greek countryside, struck particularly the border and mountainous regions of the country. This massive abandonment of the rural areas had serious consequences on their development, as they were deprived of a considerable part of their labour force.

The result of this deprivation as well as the introduction of new technologies into the remaining farms changed the structure and operation of the agricultural system, although its productive orientation remained substantially the same. The main changes that took place were the following:

(i) A decrease of the number of farms.

(ii) A decrease of the population of animals that mostly characterise the extensiveness of an area (ruminants and horses).

(iii) The abandonment of cultivated land transformed into permanent pastures or in shrub-land.

(iv) In marginal mountainous villages abandonment and undergrazing of large surfaces of mainly communal pastures and in consequence their degradation (transformed into maquis and/or frygana pastures).

(v) The rise of the average age of the farmers (ageing of the active rural population).

(vi) The upgrading of the animal population (mainly the sheep population by cross-breeding), so that flocks with crossbred animals are now common in the area. These are animals of high performance, but they are more exigent in feeding, housing, management and hygiene.

All these changes, but also the national and EU policy of subsidies for less favoured regions and prices of livestock products, as well as the parallel creation of marketing and food processing networks, resulted in the gradual intensification of animal production in the region and especially in the P zone, with the corresponding decrease in dependence on natural resources. Thus, as we have mentioned already, feeding, which puts a serious strain on the cost of production in the farms, depends today to great extend upon purchased feed.

The social factor and more precisely the institutional and customary framework of the transfer of rights of succession on the land ownership, as well as the existing status of the exploitation of communal pastures must also be taken into consideration. Thus, the farm land is usually divided among the farmer's heirs-in-low, even if they live in urban areas and do not work in the agricultural

sector. These repeated divisions have led to the fragmentation of the agricultural land and to the small-sized farms, so therefore the majority of the pasture and agricultural land is hired out by the farmers with annual contracts. There are, on the other hand, strict prohibitions on grazing in vast areas of communal pastures, which have been characterised as woodlands by the forest authorities and protected as such areas. This results in a continuous conflict between the Forestry Services and the farmers.

Nowadays two sub-systems can be distinguished in the target area: the P zone system and the M,S-M zone system.

The factor that mainly diversifies these two sub-systems is the feeding system. Although in both zones the participation of grazing is an essential factor, in the P zone farm produced feedstuffs and especially concentrates play a more important role. It is due to the fact that there are more possibilities here for feedstuff plants to be cultivated, because of the geomorphology and the existence of water resources. A similar feeding system is applied in other mountain regions of Greece (Zervas *et al.*, 1994).

The genetic upgrading of the sheep population as well as better conditions of flock management led to the creation of higher performance flocks in both zones, especially in the P zone. The result of all these changes was an increase in nutritive demands that grazing cannot satisfy anymore throughout the year. Thus in the critical period of the wintertime and sometimes also in the spring for the high performance animals, the allowance of great quantities of concentrates is necessary. Our estimation in the seven farms, which are farms that produce milk above the average of the target area sheep population, results in the conclusion that during winter there is a relevant waste of concentrates, because the farmers are afraid of a rapid decrease of milk production during this period in the case of insufficient feeding of ewes and goats.

Although grazing covers an important part of the feed requirements of sheep and goats (greater in M,S-M zone than in the P zone) the quantity and quality of the biomass produced is low. This is mainly the case in the communal pastures that cover the majority of the grazing area. Small stocking rates, however, give the opportunity to the flocks to almost completely satisfy their feeding requirements during summer and the beginning of autumn.

Nevertheless, the best pastures are herbage pastures (fallow lands) and private pastures with shrubs (formerly cultivated lands). These two kinds of pastures are grazed all year round in the P zone, but their importance is greater during winter, when they are kept exclusively for feeding milking and lambing ewes. Herbage pastures are cut for hay-making during spring and sometimes during autumn, if the weather is favourable.

Proposals

The present analysis of the sheep farming system in the Pogoni area leads to the following proposals.

The technical improvements that might be proposed in the area have their roots in the necessity of rational exploitation of natural resources in the framework of sustainability on the one hand and of the guarantee of a reasonable standard of life to the rural population of the area on the other. This orientation will decrease the dependence of the sheep farmers on the market of inputs and will give them the opportunity to be better integrated into the natural system of the area.

Concerning the communal pastures, improvements can occur to the extent that legislative changes will take place so that the surface covered by such types of pasture could be well defined. Collective pasture management projects could then be applied, if farmers would accept them and collaborate willingly. This type of management contributes also to the cessation of the landscape destruction, as well as to the conservation of a certain organisation of the agricultural space in large units of homogeneous pasture potentialities (Balent and Gibon, 1993). Support of every kind of national and EU authorities in this direction is necessary.

Leased private pastures also need a legislative regulation so that long-term contracts can be signed between farmers and the owners of pasture lands. Under these circumstances of security the

farmers could improve their pasture management by completing infrastructure works (fences, watering-troughs, upgrading the floristic composition, land reclamation, etc.).

Among forage plants, alfalfa plays the most important role. New drought-resistant cultivars must be tested, mainly in the M,S-M zone, in order to increase alfalfa hay production.

In the P zone, particularly, research must be undertaken in order to improve yield of cereals such as fodder crops.

Silage making is a completely unknown technique in the area. On-farm research and/or demonstration projects in order to introduce this innovation to the medium or large-sized sheep farms which cultivate maize or sorghum in the P zone would be of extreme importance.

The sole agricultural activity cannot guarantee the development of less favoured regions, although the rural activity is rentable in some cases like sheep production in the P zone of the target area. New opportunities for off-farm activities must be created (agrotourism, craft, etc.) (Jazra Bandarra, 1993; Megros, 1994; Kazakopoulos, 1996; Apostolopoulos, 1998). The EU project "LEADER" has been utilised to some extent towards this direction in the target area.

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