

**DEVELOPING BIODIVERSITY INDICATORS FOR THE
LIVESTOCK IN GREECE**

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SUMMARY

Greece in relation to its area possesses a considerable number of native breeds of farm animals, particularly of large (buffaloes, cattle) and small (sheep, goats) ruminants. According to a latest survey, there are 1 buffalo, 3 cattle, 27 sheep and 2 goat breeds and also some small imported populations. To this situation contribute the rich diversity of the geographical shape of the country (plains, mountains, valleys and islands) and the historical interactions with the other neighbouring countries in southeastern Europe.

Nevertheless, during the last 50 years the erosion of the farm animal genetic resources has progressed rapidly and now all the three cattle and 13 of the sheep breeds are protected under the 1750/99 EU regulation. This situation makes the commonly used as biodiversity indicator number of breeding animals and/or herds/flocks unsatisfactory. Beside other population parameters (genetic distances, structure, mating system, inbreeding etc.), there are other important factors to be considered as the location of the herds/flocks, the climatic conditions and the applied production system. In this context, extensive documentation including the application of Geographical Information Systems (G.I.S.) could be useful in understanding the biodiversity of the farm animal genetic resources, especially in areas with complex geographical shape and complicate spatial distribution of the breeds and their related systems of production.

INTRODUCTION

Animal production policies in Greece do recognize the varying and often conflicting claims of rural development, tourism, industry and urbanization. Differences in climate, topography and soil lead to a great diversity in the agricultural potential of the different regions of the country. In most cases, the official recommendations as well as the governmental encouragement and efforts have tended so far, to introduce high yielding strains and breeds. As a consequence, the indigenous cattle breeds have either been completely replaced by high yielding, but very demanding, animal populations or they are

in the process of being rapidly replaced through massive upgrading by imported types that respond better to improved feeding and management and intensive production conditions. On the better lands, intensive or semi-intensive ruminant (e.g. dairying and intensive fattening) and non-ruminant (poultry, pigs) production has been integrated with the other agricultural sectors, whereas on the poorer lands extensive suckling cows and small ruminant production, forestry and tourism developed complementary to answer the existing needs.

The management of the Animal Genetic Resources and the conservation of unique breeds and strains that are threatened by extinction are encouraged financially and technically by the Ministry of Agriculture. The activities concerning characterization, conservation, collection and utilization of the farm animal genetic resources of the country are undertaken in collaboration with the Agricultural Universities. Sufficient numbers of purebred indigenous sheep breeds are maintained in nucleus form in Agricultural Stations of the National Agricultural Research Foundation (N.AG.RE.F.), for research and as a source of genes for future use.

CHARACTERIZATION AND PRESENT SITUATION OF LIVESTOCK SPECIES AND BREEDS

The water buffalo used to be an integral part of the biodiversity of many Greek wetland ecosystems, enriched their landscape and provided invaluable services and products to the rural people living close to wetlands, and to the economy in general. Buffaloes total population in Greece before the 1950's was over 100,000 animals. Presently, it is found only in four wetland sites in Macedonian and Thrace. According to our investigations, the Greek buffalo population numbered a total of about 900 animals in 2000. Even this small population is threatened with immediate extinction because of the rapidly changing rural socio-economic conditions and the expansion of cultivated fields into wet meadows.

For many decades, the mutually constituted bovine nucleus of the country has been undergoing a population change with the introduction from abroad of improved and purebred cows and bulls. However, the real alteration took place after World War II, with the extensive application of the artificial insemination, using sperm of pure breeds, mainly Brown Swiss, aiming at upgrading the indigenous bovine populations. As a consequence, the cattle in Greece were genetically stratified as follows: indigenous breeds and crossbred animals (used mainly for meat production) and purebreds of foreign origin (dairy type animals). Following this trend, the number of cattle has decreased from 1,131,000 animals in 1965 to 608,000 in 1993. In 2000 the number of dairy cows is estimated at 216,000 heads, from which 94.0% are Holstein-Friesian. Only 28.6% of these dairy cows are recorded (Georgoudis and Baltas, 1998).

In Greece, there are two types of indigenous cattle that are in danger to become extinct, the *Steppe breed*, with two types, *Sykia* and *Katerini*, and the *Shorthorn (Brachyceros) breed*. Dairy cattle in Greece are kept in

environments, which range from the upper medium to high level of inputs. The local cattle breeds and the crossbreds are kept mainly in semi-mountainous and mountainous areas, under poor feeding (poor, dry pastures) and management conditions (Georgoudis et al., 2000).

Small ruminants husbandry is the most important branch of the Greek animal production. In Greece about 9.244 million sheep and 5.900 million goats, which correspond to 50% of the total goat population of the European Union, are raised (Loukeri, 1996). The majority of sheep and goats are raised in the mountainous and marginal regions of the country, having a substantial economic, social and ecological role by keeping the remaining inhabitants in the villages and contributing to the conservation of the environment (Boyazoglu, 1999).

Sheep population in Greece is characterized by certain specific situations, as well as breed structure and husbandry methods. The evolution and distribution of the different sheep types and breeds in Greece are the result of developments and changes that took place over the past thirty years. The uncontrolled crossbreeding between the different breeds and the unplanned extension of artificial insemination played a major role in the disappearance of certain smaller breeds and the diminishing number of the purebred mountain populations. The major segment of the sheep population belongs to the Zackel type, which is found all over the country and is characterized by the long tail and the coarse wool. A second segment of breeds belong to the Ruda type, with finer and more uniform wool and are found mainly in Macedonia, Thrace and on some Aegean islands. A third category consists of the so-called semi-fat-tailed type, found on East Aegean islands. Although all of the above breeds can be broadly classified as dual-purpose sheep (milk and meat), in the second and third category belong breeds combining high prolificacy and milk yield (Boyazoglu, 1991; Hatziminaoglou et al., 1985; Ligda et al., 1997; Zervas et al. 1991).

The 90% of the present goat population in Greece numbers belong to various indigenous types. These local breeds represent about 4,5 million heads in 200,000 flocks. The local goat is to be found over the entire country and derives its name from the particular region. Big interest is being attracted to the Skopelos goat, originated from the homonymous island. A small percentage of the population consists of purebred imported goat breeds such as Malta, Zaanen, Toggenburg and Damascus breeds and their crosses with the local (Hatziminaoglou et al., 1995).

OVERALL INPUT LEVEL OF THE PRODUCTION ENVIRONMENT

Very extensive husbandry systems are applied to the local breeds, which play a major role in the rural economy of the difficult mountainous and semi-mountainous and mountainous regions of the country. Seventy eight per cent of sheep and 90% of goats are raised under low input production system. These species, which are naturally adapted to the optimal use of poor and marginal regions under difficult grazing conditions, play a major role in the

rural economy of these regions (Loukeri, 1996). The total population of ewes and goats in the country is milked and about 90% of this milk is transformed into good to high quality cheeses. The average prices of ewes' and goats' milk are higher than that of cows' milk. The relative values are 40-70% and 35-50% higher than the price of cows' milk for ewes' and goats' milk, respectively. On average 60% of the total income comes from milk production and 40% from lamb or kid meat production, which in Greece traditionally are slaughtered in a liveweight not higher than 14 kg. Taking into account the above parameters, the breeding objective was defined as the improvement of milk production and having the lamb/kid as by-product (Ligda et al., 1999)

The sheep population in Greece is characterised by a great variability in husbandry practices. Sixty per cent of all flocks contains 1-50 ewes indicating that sheep raising is of complementary importance to other agricultural production branches.

The main production systems are:

- The extensive system with transhumance, which is applied to the mountain breeds Boutsiko and Sfakia,
- The extensive or semi-intensive system without transhumance, which involves occasionally the Boutsiko and Sfakia breeds, the plain breeds, Karagouniko, Serres and Frisarta and occasionally the island breeds Chios, Lesvos, Zakynthos and Kefallinias, and,
- The intensive system which mainly concerns the Chios, Lesvos, Zakynthos and Kefallinias breeds and occasionally the Karagouniko, Serres and Frisarta breeds (Hatziminaoglou et al., 1985).

CURRENT AND PROPOSED INDICATORS

OECD proposed the following three indicators relevant to animal genetic resources (Environmental Indicators for Agriculture Vol. 3, 2001),

1. For the main livestock categories the total number of livestock breeds that have been registered and certified for marketing
2. The share of key livestock breeds in respective categories of livestock numbers
3. The number of national livestock breeds that are endangered.

According to a nation-wide survey initiated by the Ministry of Agriculture and conducted during the years 1998 to 2000 by experts of the Agricultural Universities and the Ministry, for the determination of the actual demographic distribution and the characterisation of the farm animal genetic resources of the country, the situation regarding the three proposed indicators is shown in Figures 1, 2.1, 2.2, 2.3, 2.4 and 3. It has to be noticed that the system used in Greece to classify genetic diversity and assess the breeds of livestock is based on the number of the female breeding animals registered by the relevant authorities according to the relevant EU regulations.

Indicator number one is describing the current situation and comparing the figures of past years, giving a clear picture of the actual trend in a county or region, where higher numbers of existing breeds are demonstrating in general a richer biodiversity. A peculiarity concerning Greece but also other countries with similar conditions is the high number of crossbred populations that are, in general, classified as native but not attributed to a specific breed. These crossbreds constitute a high percentage of the total cattle and sheep populations as stated in the previous chapter, but this situation is not reflected in the indicator. As a consequence, this indicator is most relevant for situations where the total population in a livestock category is the total of the number of animals in each of the existing breeds. Obviously, a clear picture of the biodiversity can be acquired only in relation to the other two indicators, giving the distribution of the actual numbers of the breeds in each category.

Indicator number two should be calculated on the basis of the key livestock breeds, which is a rather subjective criterion. For this reason, the figures 2.1 and 2.2 are presenting instead of the key breeds, the share of all breeds in the respective livestock categories. The crossbred animals are excluded again, a situation that refers to the same problems as mentioned for the first indicator. Obviously, the domination of one breed (as it is the case for the cattle population) or some breeds (as it is the case for the sheep population) indicates an erosion of the biodiversity, without taken into consideration the availability of different environments and production systems in the country. The in depth study of the existing populations is the appropriate tool to investigate the in breed variation which is a clear indicator of the biodiversity status in the relevant livestock category.

Indicator number three is calculated as the total of the endangered breeds in each category. Two important points must be noticed regarding this approach, namely the definition of the status of endangerment and the possibility to rank the breeds according to their endangerment in the same category. As a result of the mentioned nation-wide survey in Greece, the situation regarding the breeds threatened by extinction is as follows:

- A. Two cattle and five sheep breeds are listed under the “critical” status.
- B. The total of the buffalo population, four sheep and one pig breeds are listed under the “endangered” status.
- C. Eight sheep and one goat breed are listed under the “vulnerable” status.
- D. One cattle, ten sheep breeds and the total of Greek goat population are being listed as normal.

A number of the above breeds is supported in the frame regulation 1257/99, which is a continuation of the 2078/92. As the definition of the endangerment status in relation to the possible financial support was not accepted by the whole scientific community, new criteria have been developed and proposed by the EAAP Working Group on Animal Genetic Resources.

In general, the indicators proposed by OECD have the advantages to be rather simple in their construction and calculation procedure but they do not go in depth in analyzing the current biodiversity status. Another drawback is

their appropriateness only for countries with well-described breeds supported by breeders' organizations, without significant crossbred populations.

These indicators are based on figures which are attributed to the genetic level of the livestock breeds, leaving out the environment, which is a major part of the total biological diversity. Taking into account the populations constituting the livestock diversity in a country, especially in the high industrialized ones, where modern breeding programs are operating successfully since several decades, it seems that the above indicators do not cover the existing biodiversity as a whole. From the other side, it is known that livestock breeds are the result of a long selection process on several production traits associated with specific environmental conditions. Moreover, it is to emphasize that the production system in which a breed is adapted and exploited, is still playing a major role regarding its prospects of surviving covering current and/or future needs.

Both of the above attributes, namely the location and the production system of a breed, can compose together or separately indicator(s) for the biological diversity of livestock in a country or region.

The proposed indicators,

- location of the herds/flocks,
- number of existing types of production systems,

can be obtained using the following characteristics of the Geographical Information Systems (GIS) which make them capable to describe the biodiversity.

1. Description of the AnGR which exist in a particular area

The subject concerns the populations and breeds of farm animals, which are kept in a specific area. This area can be specified by various ways, such as a county, a village or just as a location with its place-name or by their geographic co-ordinates. Thus, a GIS can show the distribution of an autochthonous breed population in a specific area and also give more detailed information, such as the owner/breeder (name, address, age), herd data (number of the animals, sex, age), morphological and performance data, etc.

2. Classification of geographic areas with livestock, according to certain criteria

With a GIS, geographic areas where farm animals are kept can be classified taking into consideration certain criteria, as, for instance, the altitude, the distance from the sea, the vicinity with water resources (lakes, rivers), the yearly distribution of temperatures and rainfalls, the density of human population etc.

3. Determination of changes, which have taken place within a time period in a specific area

This topic concerns the changes, which occurred in a specific geographic area between two given dates, and especially the changes that can be combined with the alterations of the local farm animals' breeds or populations.

4. Finding associations of available information with specific spatial data concerning AnGR

In this issue, the queries, which might be posed to the GIS, could be referred to eventual relations between the decreasing rate of the numbers of the autochthonous breeds or populations and the spreading of the artificial insemination, in different geographical areas and in different periods of time.

5. Forecasting of anticipated changes of the status of the AnGR in a specific area

In this case, the investigation concerns the changes, which may happen in a specific area, when alternative eventual events that will take place are considered, with questions of the type "what is going to happen if" set in a simulated process.

The main parameters to be considered as inputs from the GIS to the proposed indicator(s) are: the average distance between the herds/flocks, the area which is covered by the relevant populations (herds/flocks or grazing animals) and the number and the area covered by the existing different production systems.

The input of the described data in a GIS and their appropriate processing can provide useful results for assessing the biodiversity and the danger of a breed to be extinct. An example is the distribution of the Greek Buffalo population shown in Map 1. From the five locations shown on the map only one has more than one Buffalo farms. Consequently, even if the population poses a wide distribution, it is obvious that the danger of extinction rises significantly when the number of animals in the main location will decline.

The Greek Focal Point for Animal Genetic Resources uses GIS since 1997 for the implementation of the census of the autochthonous breeds, which is carried out in collaboration with the Ministry of Agriculture and other Institutions. The system has been used for mapping the locations where crossbred populations and the last enclaves of the purebred autochthonous cattle breeds are kept. The mapping of the remaining native sheep, goat and horse breeds and the appropriate processing of the collected data will follow in the near future (Georgoudis et al., 1999).

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Figure 1 : Total number of breeds for the main livestock categories in Greece

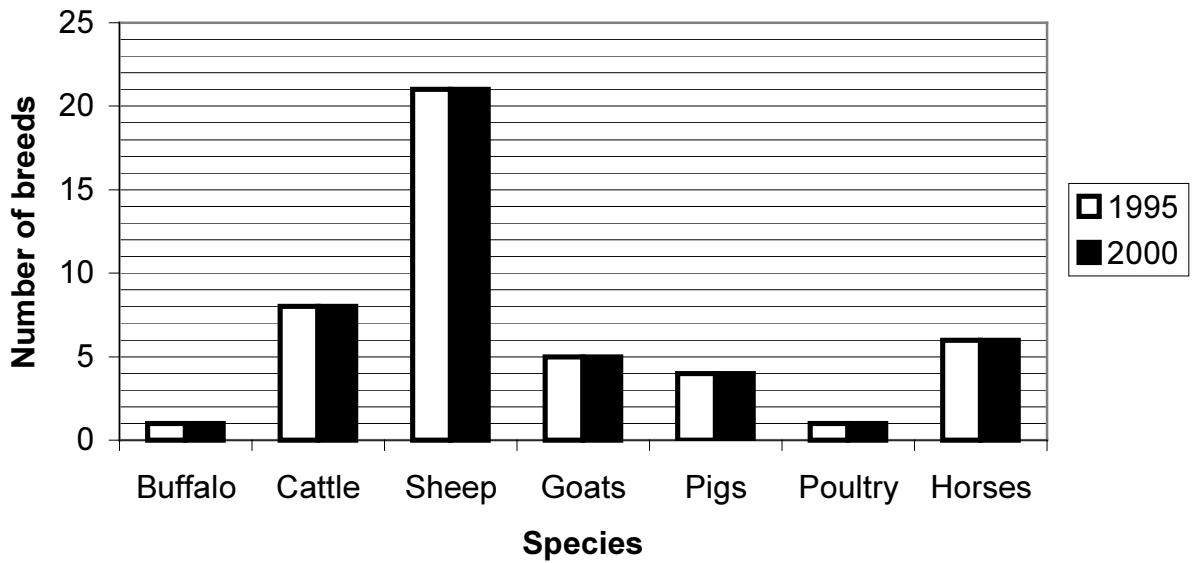


Figure 2.1 : Share of breeds in the total cattle population in Greece

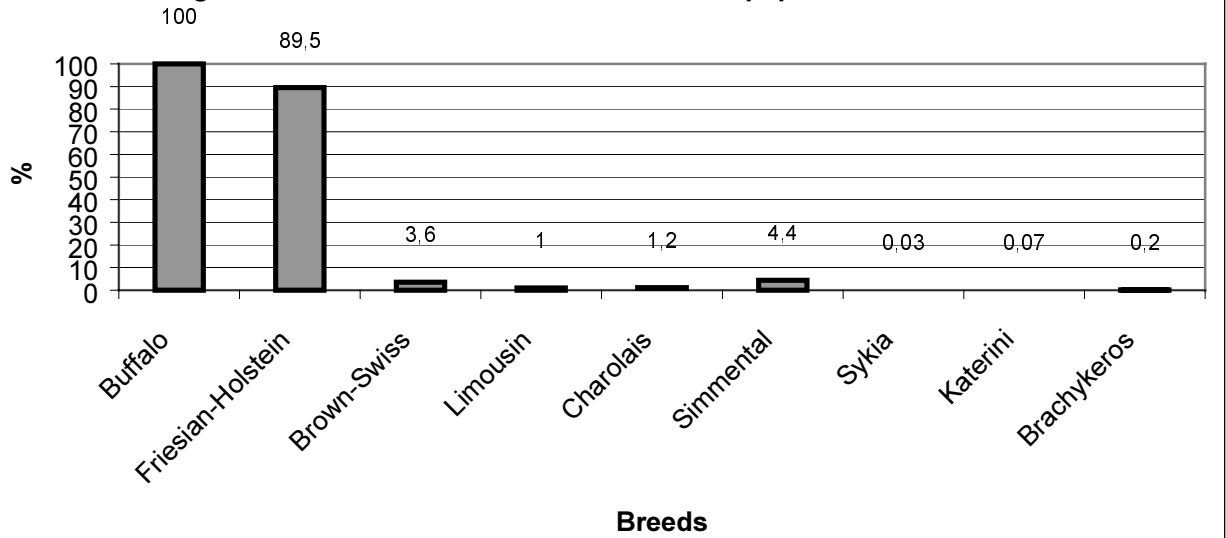


Figure 2.2: Share of breeds in the total sheep population in Greece

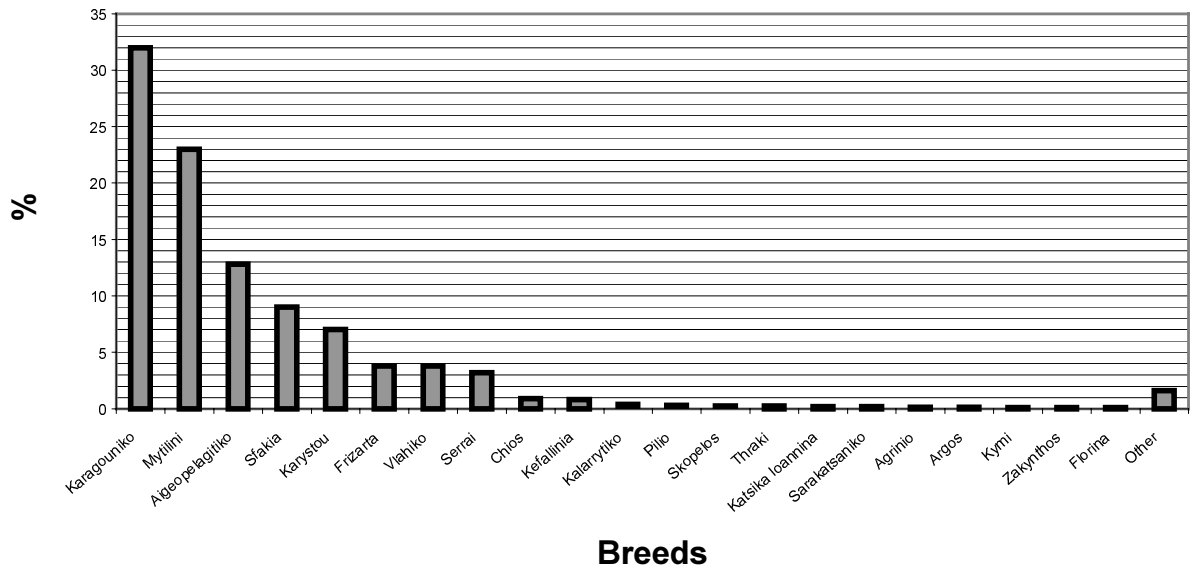


Figure 2.3: Share of breeds in the total goats population in Greece

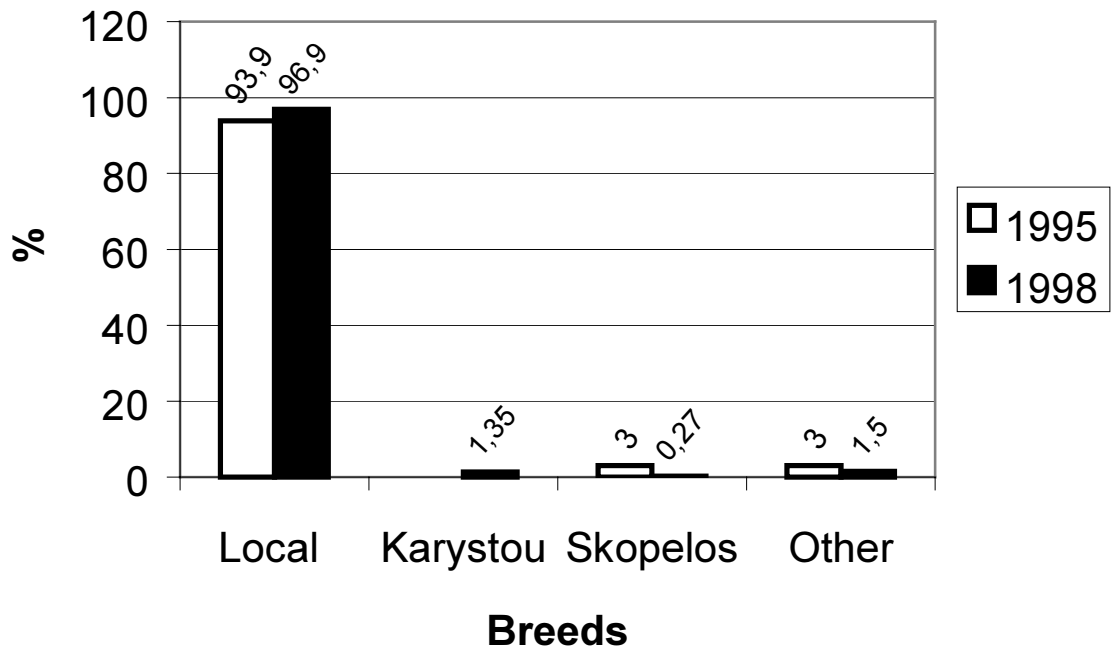


Figure 2.4: Share of breeds in the total horses population in Greece

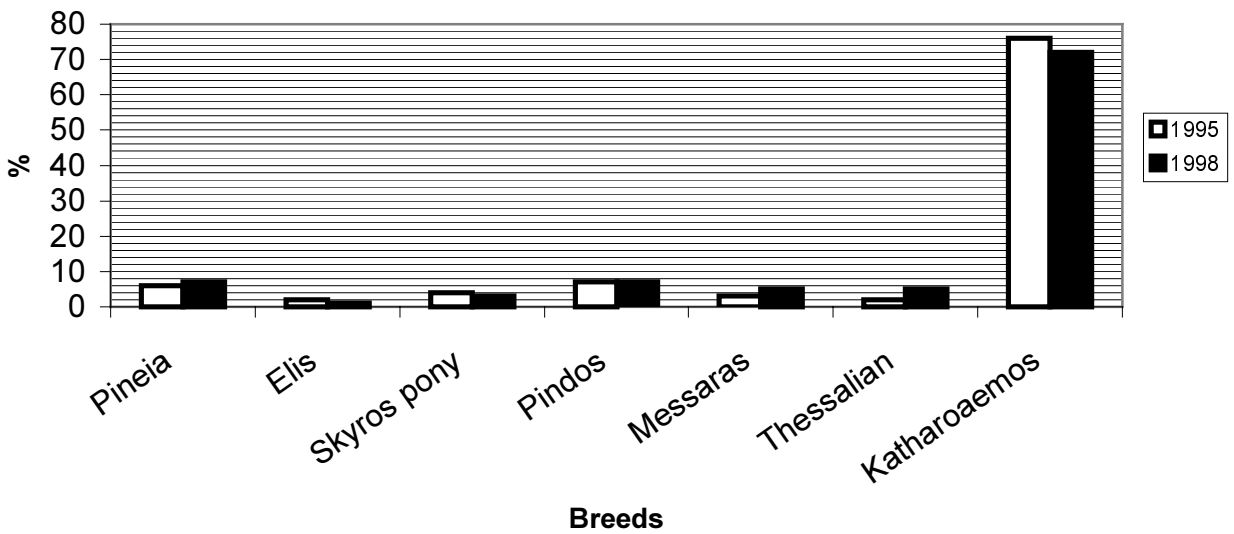


Figure 3: Number of endangered livestock breeds for the main livestock categories in Greece

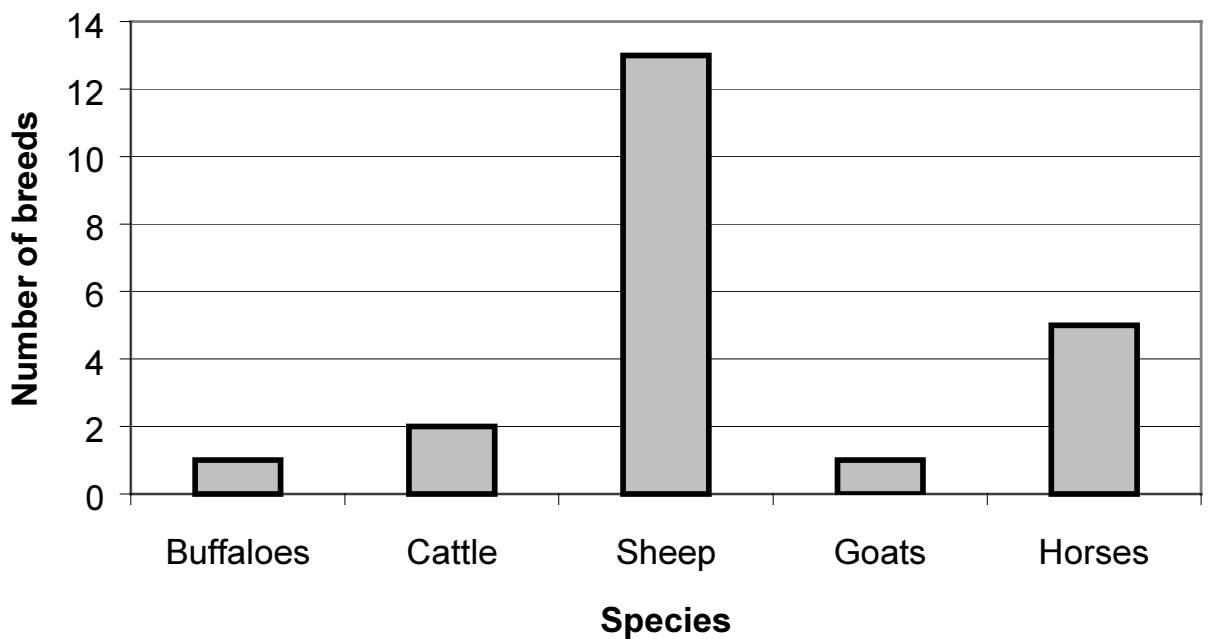
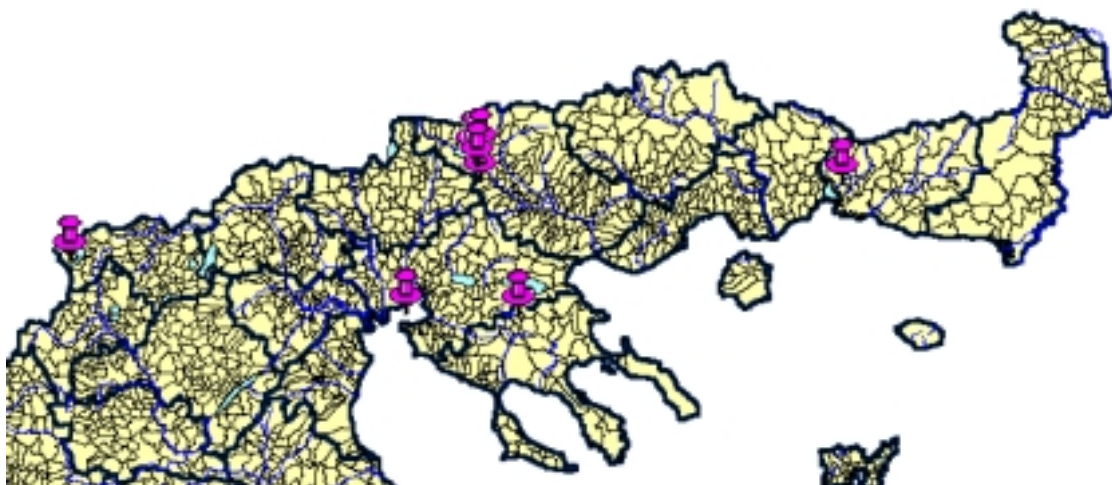
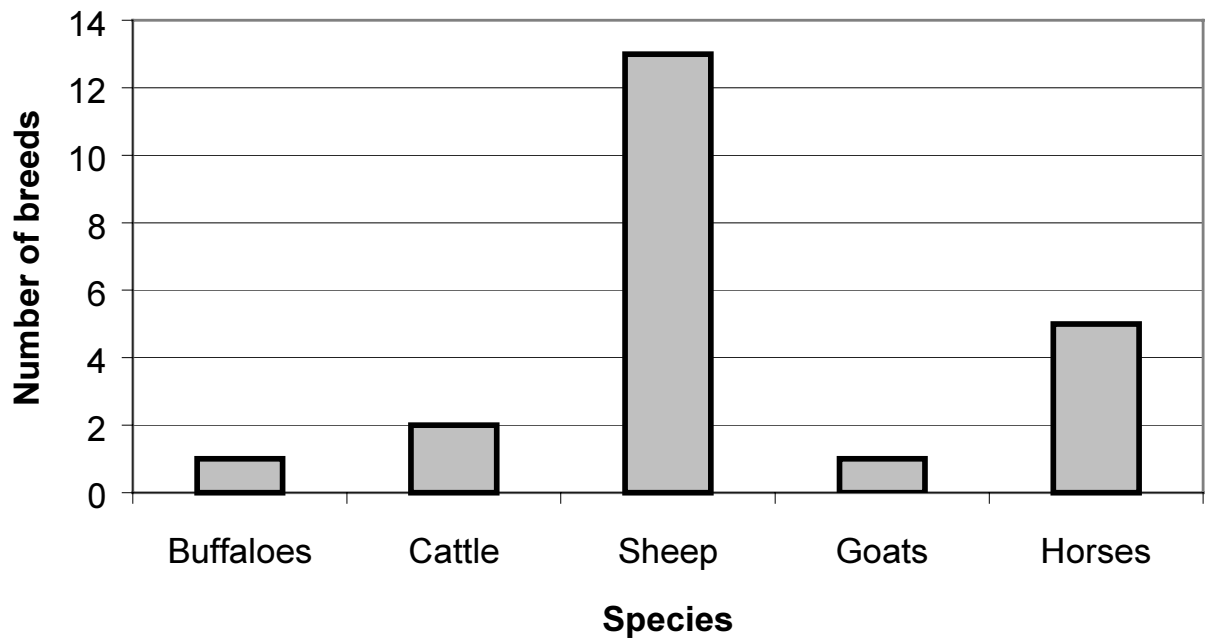


Figure 3: Number of endangered livestock breeds for the main livestock categories in Greece



Map 1: Distribution of the Greek Buffalo population (~1,000 animals). Each pin represents a buffalo farm.