

HUMAN SETTLEMENT AND LAND USE AT TRÉVELEZ (SIERRA NEVADA) A HISTORICAL-GEOGRAPHICAL APPROACH¹

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ABSTRACT.- Based on written documents of the 16th, 18th and 19th century and on information from a publication of the early 1970s, as well as on our own field observations, we attempt to describe the evolution of settlement and land use in the territory of Trévez (Sierra Nevada, Provincia de Granada, Spain), from the end of the morisco period until the present. After the Christian colonization in 1572, a process of extensification took place, which resulted in a type of land use which gave great importance to rainfed cereal agriculture and husbandry of small ungulates. From the end of the 18th century/beginning of the 19th century onward, there are indications of another process of agricultural intensification and diversification, with great importance given to irrigated cultivation. During the past two decades, an abandonment of agricultural areas can be observed, as well as an increase in activities linked to tourism and a certain recuperation of sheep and goat husbandry. It must be pointed out that land use has been submitted to important changes during the past, and that the "traditional" agricultural landscape is of relatively recent origin.

RESUMEN.- En base a documentos escritos del siglo XVI, XVIII, XIX y apoyándonos en una publicación de la primera mitad de los años 1970, así como en observaciones propias de campo se intenta describir la evolución del poblamiento y de los usos del suelo en el término de Trévez (Sierra Nevada, Prov. de Granada), desde el final de los tiempos moriscos hasta la actualidad. Después de la colonización cristiana de 1572 tuvo lugar un proceso de extensificación, dando paso a un tipo de uso del suelo en que el cultivo en secano de cereales y la ganadería menor tenían gran importancia. A partir de finales del siglo XVIII principios del siglo XIX hay indicios de un segundo proceso de intensificación y diversificación de la agricultura, con gran importancia del regadío. Durante los últimos dos decenios, se observa un abandono de las superficies cultivadas, un aumento de las actividades en torno al turismo, y cierta recuperación de la importancia de la ganadería menor. Cabe destacar que los usos del suelo han sido sometidos a cambios importantes, durante épocas del pasado, y que el paisaje agrícola "tradicional" es de origen relativamente reciente.

¹ Received, December 1991.

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ZUSAMMENFASSUNG.- Aufgrund schriftlicher Dokumente aus dem 16., 18. und 19. Jahrhundert, außerdem mit Informationen einer neueren Veröffentlichung und unter Berücksichtigung eigener Geländebeobachtungen wird versucht, die Entwicklung von Besiedelung und Landnutzung in der Gemeinde Trévez (Sierra Nevada, Provinz Granada, Spanien) vom Ende der moriskischen Zeit bis heute zu beschreiben. Im Anschluß an die christliche Kolonisation (1572) fand ein Prozess der Extensivierung statt, der zu einer Landwirtschaft mit großer Bedeutung von unbewässertem Anbau und Kleinviehhaltung führte. Ab Ende des 19./Anfang des 20. Jahrhunderts gibt es Hinweise auf einen Prozess der erneuten Intensivierung und Diversifizierung der Landwirtschaft, bei einer großen Bedeutung des Bewässerten Anbaus. Während der letzten zwei Jahrzehnte ist eine Aufgabe der Landwirtschaftsflächen zu beobachten, außerdem eine Zunahme der Aktivitäten, die mit dem Tourismus in Zusammenhang stehen und eine leichte Zunahme der Schaf- und Ziegenhaltung. Es sei hervorgehoben, daß die Landnutzungsweisen in der Vergangenheit bedeutenden Änderungen unterworfen waren, und daß die "traditionelle" Agrarlandschaft von relativ neuem Ursprung ist.

Key words: land use, human settlement, Sierra Nevada.

About 15 years ago, LISZEWSKI & SULIBORSKI (1977) published a paper on Trévez, a village of the southern slope of Sierra Nevada (Spain)-the Alpujarra (fig. 1). This study provides interesting information on human settlement, land use and rural economy in a Mediterranean mountain region. However,

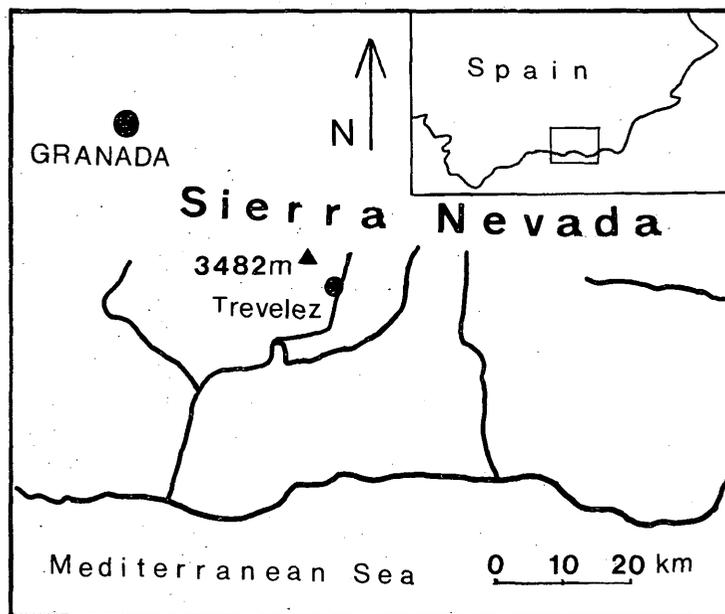


Fig. 1.: Localisation of Trévez in the Sierra Nevada (Southern Spain). (Localización de Trévez en Sierra Nevada, Sureste de España).

the "picture of an agricultural economy of the high mountain zone" of LISZEWSKI & SULIBORSKI (1977) is only an instantaneous photograph, taken in the early 1970s.

Here we present a complementary approach, attempting to describe the main features of historic evolution of land use in Trévelez. Archaeological or historical evidence from periods former to the Christian conquest, at the end of the 15th century, is not available, so we have to limit the scope of our study to modern times, from the 16th century onward until present. Written documents exist from the second half of the 16th century, the middle of the 18th century and the middle of the 19th century. Information as to the extent of agricultural areas around 1940 is provided by a topographical map 1:50.000 from this date. To assess possible recent changes, we take into account our field observations made between 1985 and 1989, about 15 years after the field work of LISZEWSKI & SULIBORSKI (1977).

1. Main features of the physical environment

The village of Trévelez is situated near the Río Trévelez, at an altitude between 1460 and 1600 m a. s. l., approximately. Its territory comprises the upper part of the catchment of the Río Trévelez (fig. 2) which is tributary to the Río Guadalfeo, the most important watercourse of the southern part of the Provincia de Granada. Altitudes of the communal territory vary between 1370 and 3482 m a. s. l., the highest point being the peak of the Mulhacén, which is the highest elevation of Sierra Nevada, situated at only about 35 km (straight line) from the coast of the Mediterranean Sea. Slopes are steeper than 15 degrees at most places in the territory.

Climate is mediterranean, with marked high altitudes features, i.e., low annual mean temperature and important diurnal and annual variations of temperature. The average length of the summer dry period is about 4 months, at the village of Trévelez, and may be considerably longer in certain years. Mean annual precipitations are 550 to 600 mm, but are supposed to be considerably higher at high altitudes: MESSERLI (in BONO & MOSIMANN, 1987) gives a figure of 2400 mm at the peak of the Mulhacén, but reliable data are lacking, and the resulting altitudinal gradient of 90 mm/100 m appears to be excessively steep. Temperature data are lacking as well: annual mean values are supposed to be of 11 to 12 degrees, at the village, and the 0 degree level of the annual mean temperature is at about 2700 m, according to BONO & MOSIMANN (1987), in Sierra Nevada. Most precipitations fall as snow at high altitudes.

The Geological substratum consists of metamorphous siliceous rocks schists, quartzites and gneisses. At lower altitudes, eutric cambisols and regosols have developed (PÉREZ PUJALTE & PRIETO FERNÁNDEZ, 1980), whereas at higher elevations, due to lower temperatures and to greater humidity, dystric cambisols and regosols can be found. Above 2500-2800 m, soil formation processes are very slow, and physical alteration of the rocks

results in accumulations of boulders. However, at some concave sites with fine materials, hydromorphic soils can be found, due to the influence of melting water or small sources.

Under these climatic and edaphic conditions, forest growth would be possible at least up to 2000-2100 m (ERN, 1966), and the forests would be dominated by the cold deciduous oak *Quercus pyrenaica* and on drier sites with shallow soils and/or southern expositions, by the evergreen holm oak *Quercus ilex var. rotundifolia*. However, only small relics of holm oak forests can be observed at present. However, plantations of scotch pine (*Pinus sylvestris*) have been developed at some places, at altitudes up to 2500 m. At most sites at lower altitudes, forests has been substituted by mediterranean shrub vegetation, but there is no evidence as to when this happened. Above the potential timberline, mediterranean high altitude plant formations can be found (ERN, 1966; LOSA QUINTANA *et al.*, 1986), dominated by low shrubs such as *Cytisus purgans*, *Juniperus nana* and *Genista baetica*. At elevations of above 2800-3000 m, plant communities dominated by hemicryptophytes (*Festuca clementei*, *Trisetum glaciale*, *Galium pyrenaicum* and others) are present. While these communities contain an elevated number of interesting endemic plant species, their pastoral value is poor, in contrast to a vegetation type of hygrophilous, herbaceous plants which are present on the hydromorphic soils (LOSA QUINTANA *et al.*, 1986).

As can be seen in the fig. 2, the lower part of the territory of Trévelez was occupied to a considerable extent by agricultural land in the middle of the 20th century. For this purpose, sites with less steep slopes were preferred. At many places, the relief of agricultural land has been modified by man, by building terraces. In addition to this, channels were constructed in order to carry the water from natural water courses to the agricultural fields (fig. 2).

2. Evidence from historical documents

a) Trévelez in the second half of the 16th century

The Nasrid kingdom of Granada, the last Muslim state on the Iberian Peninsula, was conquered by the Catholic Kings of Spain at the end of the 15th century. In the rural zones of this region, which cover more or less the area of the present-day provinces of Granada, Almería and Málaga, well after this date there were still dwelling "Moriscos", the descendants of the moorish inhabitants of the kingdom of Granada, formally christianized and submitted to growing social and economic pressure under the Spanish rule (MALPICA CUELLO, 1988). Only after the popular insurrection of the Moriscos in 1568/69, its repression, their expulsion and the subsequent establishment of Christian Spanish settlers, the Reconquest of the mountainous zones of Eastern Andalucía was completely finished.

From the first years after the establishment of the new settlers, historical documents are available, the "Libros de Apeos" of 1572/73. They contain

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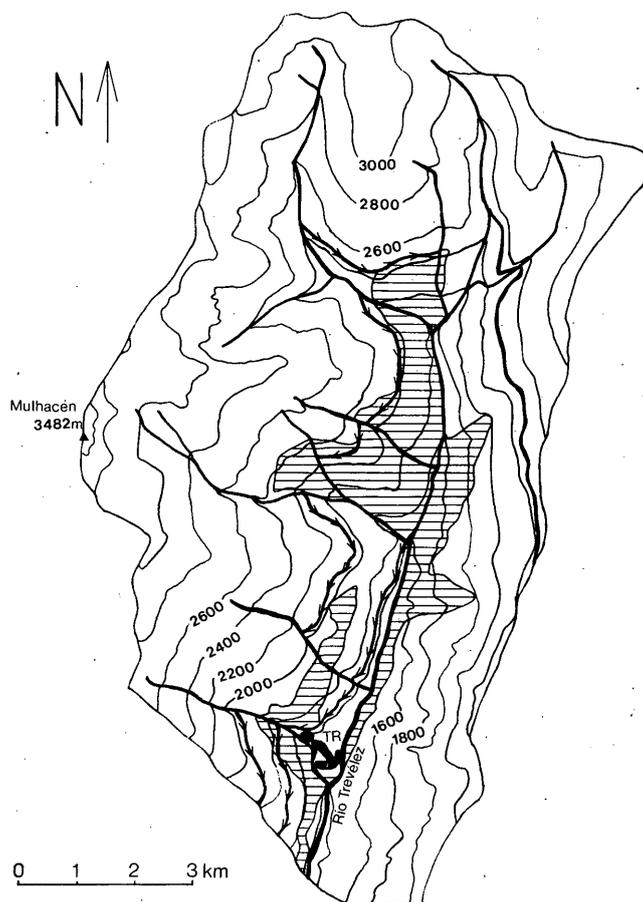


Fig. 2: The territory of Trévez. Hatched area: cultivated land according to the topographical map 1: 50000 of 1940 . TR: village of Trévez. Fat lines with arrows: main water supporting channels, connecting natural water courses and irrigated fields. Isohypsies in distances of 200 altitudinal meters. (*El territorio de Trévez. Área sombreada: espacio cultivado según el mapa topográfico a escala 1:50.000 de 1940. TR: pueblo de Trévez. Líneas gruesas con flechas: canales principales de agua, que conectan los ríos naturales y las áreas regadas. Curvas de nivel cada 200 metros.*)

information on numbers of chiefs of the households ("vecinos"), after and before the expulsion of the Moriscos as well as on the extent and form of utilisation of cultivated land. The image of landscape and land use which can be reconstructed by the information provided by these documents does not correspond necessarily to the situation before the Christian conquest of the kingdom of Granada at the end of the 15th century. It is quite probable that during the eighty years that had passed since, the Morisco society and economy had been influenced to some extent by the Christian rule. Therefore,

it cannot be expected that the "Libros de Apeos" do reflect exactly the land use patterns of moorish Andalucía. However, it is probable that many features had persisted, particularly in refugial zone such as the Alpujarra. Thus, some interesting characteristics of land use may be interpreted as relics of moorish times.

As a measure of cultivated land area, the "marjal" is used, for irrigated as well as for non-irrigated land. This unit is still used in the coastal zone near Motril, and 19,5 marjales are equivalent to 1 hectare.

The number of households in 1572, after the war and the first establishment of new, Christian settlers, had strongly decreased in comparison to the period before the insurrection of the Moriscos (table 1). The decrease of the number of inhabitants was probably even stronger than is reflected by the numbers of 233 and 106 vecinos, respectively: the mean number of persons per household was at about 2,6-2,9 in the Alpujarra during the early 1570 ties which is extremely low; probably considerably lower than during the times of the moriscos (VICENT, 1988).

All cultivated areas were irrigated. However, two types of cultivated land are distinguished: "regadío de vega", which are areas of intensive horticulture near the village, and "regadío de sierra", areas further from the village, cultivated in a more extensive way.

Although the dates of agricultural areas are probably only rough approximations, it is of some interest to calculate the average surface of cultivated land per vecino, that is, per household. The very small value of 0,57 ha per vecino in 1568/69, before the insurrection, of the Moriscos, was only possible because of the intensive character of agriculture in the irrigated "vega", which may be seen a characteristic feature of moorish land use (KRESS, 1968), as well as the importance of fruit trees that did not only provide the alimentary base for silk worm raising (mulberries), but also staple food for humans (walnut and chestnut trees)¹. Apple trees and other tree crops are mentioned¹. Even if there is no direct evidence in the documents, it must be supposed that animal husbandry was of a certain importance, as there is one reference to a holm oak (*Quercus ilex var. rotundifolia*) woodland which was used as pasture². Silk production implies the existence of economic relations with commercial and manufacturing centers outside of the region. Thus, the rural community of Trévelez probably was far from being autosufficient, during the times of the Moriscos.

After the establishment of Spanish settlers, the value of the mean agricultural surface per vecino increased to 1,26 ha, as there were considerably fewer people living there than before the insurrection of the Moriscos. This is in line with the hypothesis of an extensification of the agriculture, after the Spanish conquest (PONCE MOLINA, 1984).

b) *Trévelez in the middle of the 18th century*

From the middle of the 18th century, rather more detailed documents are available which allow reconstruction of an image of land use, human population

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density and landscape: the answers to the questionnaire of the "Unica Contribución", made up of the Spanish Royal administration in the years following 1750. In the case of Trévez, the answers were taken in 1752.

Here, the surface unit used is the "fanega". For conversion to modern, metric units we follow PONCE MOLINA (1984): according to this author, a "fanega" of irrigated land corresponds to 0,2096 hectares, and a "fanega" of non-irrigated land is equivalent to 0,6440 hectares.

The number of vecinos had increased to 172 (table 1). This figure is higher than the number of vecinos immediately after the Christian settlement, but still markedly below the 233 vecinos which had dwelled there before the insurrection of the Moriscos. On the other hand, the agricultural surface in 1752 had increased more than four times, compared to 1572 (table 1). As a consequence, the average area per vecino had greatly increased, not only as related to the times before 1568/69, but as well in comparison to the early Christian settlement. It is evident that agriculture was much more extensive in the mid-18th century than 200 years before. The irrigated surface had become much more restricted, and the overall extent of irrigated land in 1752 corresponds more or less to the surface of "regadío de vega" of 1572.

TABLE 1

Trévez, number of "vecinos", land use and areas. (Trévez, número de vecinos, uso del suelo y superficies).

	1568/69	1572	1752	about 1845	about 1940
"vecinos"	233 ¹	106	172	261 ²	(311)
persons				1185	1400
irrigated land (ha)	30,8 "vega" + 102,6 "sierra"		31,4	no data	no data
annual crop without irrigation (ha)	—		547,4	no data	no data
overall cultivated surface (ha)	133,4		578,8	no data	(920)
overall cultivated surface per vecino (ha per vecino)	0,57	1,26	3,40	no data	(2,96)

1) This number is composed of 163 "vecinos christianos nuevos", that is, moriscos, and 70 "vecinos christianos viejos", Christian Spaniards who had immigrated after 1492.

2) The number that MADDOZ gives is not very reliable, in the case of Trévez. It is mentioned in the dictionary that according to other sources, in the village were dwelling 350 vecinos and 1590 persons.

3) 1400 persons would be equivalent to 311 vecinos, if we suppose a mean number of 4, 5 persons per household.

No difference was made between "regadío de vega" and "regadío de sierra", in 1752. This makes it probable that the more extensive "regadío de sierra" was transformed into rainfed agricultural land. Furthermore, comparing the overall extent of cultivated land in 1572 and 1752, it can be concluded that new rotations were under-taken between the end of the 16th and the middle of the 18th century.

It must be stressed that the productivity per unit area, even of the irrigated land near the village, was very low, in 1752. After each year of cultivation, it was necessary to leave a field in the "vega" without cultivating for one year³. Productivity of non-irrigated agricultural land was still lower: After each year of cultivation, a fallow period of three years was necessary, and even of five years on soils of poor quality³.

Cultivation of annual plants was restricted to two cereal species: maize (*Zea mais*), which was cultivated in the irrigated vega, and rye (*Secale cereale*) which occupied the rainfed agricultural land. Quantitative dates of arboriculture are not available. The existence of mulberry trees, walnut trees and chestnut trees is documented, but there is no evidence of other fruit trees, in contrast to the situation in the 16th century.

It is interesting that the low productivity per surface unit which made the long fallow periods necessary is explained by low temperatures, in the answers to the questionnaire of the "Unica Contribución". There is evidence that the climate may have been cooler than today, in the middle of the 18th century. Holm oaks are reported not to fructify, because of the cold climatic conditions⁴. The "little ice age", comprising the period of mid-16th to mid-19th century, when mean temperatures were lower than today in Central Europe (LAMB, 1982), apparently was relatively cool in Southern Spain as well.

However, long fallow periods and low productivity of agricultural land were also rather generalized features in the lower, coastal mountains of the Granada province, in the middle of the 18th century (MAY, 1989). Thus, a more convincing explanation would be the poor nutrient status of soils which nowadays is a typical feature of soils on paleozoic siliceous metamorphic materials in the region (see for example AGUILAR *et al.*, 1987: 82). This is partly due to the nature of bedrock, but must be seen as well as a consequence of long term degradation of soil fertility, caused by cereal monoculture and possibly by insufficient integration of domestic animals into the nutrient flows of the agricultural ecosystem. At Trévelez, cultivation of leguminous plants which would have been able to carry nitrogen to the impoverished soils by fixation from the air, is not documented. With regard to the low productivity in the vega, it has to be taken into account as well that nutrient demands of maize are high. Possibly, this new world crop was of relatively recent introduction in the Alpujarra in the 18th century.

In general terms, animal husbandry was important (table 2). Labour animals (cattle, donkeys and mules) and pigs were present in almost every household, as an essential component of agricultural exploitation. Cattle, donkeys and mules were used for field labour and for transport in the traditional agricultural system of the Alpujarra (NAVARRO ALCALA-ZAMORA,

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1981), whereas pigs transformed vegetable residues of horticulture and acorns, growing in the oak forests, into meat and fat. On the other hand, large numbers of sheep and goats are documented at Trévez, but these animals belonged only to a restricted number of non-arable uplands—land on steep slopes, stoney soils, high altitude sites—as well as cereal fields after harvesting and during the years when they are not cultivated, producing wool, milk and meat. Even if there is no direct information on this subject, in the questionnaire

TABLE 2.

Trévez, numbers of different types of domestic animals. (*Trévez, número de cabezas de animales domésticos*).

	1752	1959	1974	1978	1982	1986
Cattle	54	600	275	204	561	519
Sheep	2327	2000	300	1000	4442	2440
Goats	523		356	227	426	440
Pigs	228	500	185	158	211	251
Donkeys	110	no data	12	15	6	5
Mules	7	69	34	30	54	35
Bee hives	-	no data	-	-	80	125

Dates of 1752 are from the questionnaire of the "Unica Contribución", of 1959 from SPAHNI, of 1974-1986 from the official statistics of the Ministry of Agriculture.

of the "Unica Contribución", it is probable that the husbandry of sheep and goats was oriented at least partly towards a demanda outside of the village, in the case of wool and meat, as stock numbers are quite high. In the list of the occupations of the habitants, comprised in the "Unica Contribución", no weaver can be found. This indicates that transformation of wool was not carried out in the village, but outside.

TABLE 3.

Structure of ownership of sheep and goats in 1752.
(*Estructura de la propiedad de ovejas y cabras en 1752*)

	sheep	goats
Number of animals	2327	523
Overall number of owners	31	19
Number of owners of more than 30 animals	12	4
Number, of owners of more than 100 animals	6	0

Pasturing of sheep and goats on non-arable, marginal areas can, to some degree, bring about a nutrient transfer from these sites to the intensively cultivated fields near the village, if the animals come back to the village every day and excrement is gathered. However, there is no documentary evidence if this has happened. On the other hand, there is evidence of transhumant movements between Sierra Nevada and the Mediterranean coast, while still in moorish times (CARA BARRIONUEVO & RODRÍGUEZ LÓPEZ, 1990), and until the very recent past (FREBOURG in LISZEWSKI & SULIBORSKI, 1977). With this type of husbandry, as during long periods of the year the animals do not return to the village, nutrient transfer from peripheral upland sites to the "vega" or nutrient recycling on extensive cereal fields further from the village must be supposed to be poor. On the other hand, agricultural extensification must have been a factor leading to a lower degree of recycling of nutrients on croplands, as a growing part of the agricultural area - the extensively cultivated areas farther from the village - probably stayed outside of the nutrient cycle agricultural crops - vegetal waste - domestic animals - cultivated land, during large parts of the year.

c) *Trévelez in the middle of the 19th century*

The "Diccionario geográfico-estadístico-histórico de España y sus posesiones en Ultramar" de Pascual MADOZ, published in 16 volumes between 1845 and 1850, is a comprehensive description of Spain, town by town and village by village. Even if generally the information on agricultural crops and surfaces and on domestic animals are not quantitative, it is possible to reconstruct an image of land use, rural economy and human settlement.

The number of vecinos —that is, of households— had increased in comparison to 1752, and was superior to the number of vecinos before the insurrection of the Moriscos (table 1). With regard to agriculture, it is interesting to note that the major part of cultivated surfaces were irrigated⁶, in contrast to the middle of the 18th century. In addition to walnuts and chestnuts, other fruit trees are cited⁶ - cherry trees, pear trees, apple trees, prune trees, peach trees, abricot trees, while apparently mulberry trees and silk production had disappeared. An important diversification of annual crops can be observed: Rye was still the most important cereal, and corn continues to be cultivated, just as one century before, but in addition to these crops there can also be found wheat, barley, chickpeas, beans, lentils, flax and calabasses⁶.

Potatoes were still not present at Trévelez, in the middle of the 19th century, while their cultivation had considerably increased, in many parts of Europe, at that time (CROSBY, 1972). This is surprising, as yields per area unit of this crop are high and potatoes are well adapted to cool climates, under the condition that there is summer rainfall or sufficient water available for summer irrigation, which is the case in Trévelez.

There is no information on productivity per area unit or on rotation periods. In any case, cultivation of leguminous crops (chickpeas, beans,

lentils) certainly had a beneficial effect on soil fertility and productivity, by contributing nitrogen. In this sense, diversification had certainly contributed to agricultural intensification.

On the other hand, there is indirect evidence that not only agricultural intensification took place, during the 19th century, but also an extension of agricultural area. The topographic map of 1940 (1:50.000, Guéjar Sierra) show an area occupied by agricultural cropland corresponding to about 920 hectares (fig. 2). Based on information from demographic development of Trévelez (RODRÍGUEZ MARTÍNEZ, 1985: 101) and on the average number of persons per household of 4,5 which has been used by other authors working on the 18th century in Southern Spain (e. g. SAENZ LORITE, 1977), it can be calculated that the mean agricultural surface per vecino had only slightly diminished in 1940, as compared to 1752 (table 1). In other words, the mean surface of agricultural land which was necessary to maintain one family was not substantially lower in the middle of the 20th century than about 200 years before (table 1). As population growth between 1845 and 1940 was only relatively slow, in Trévelez, it may be supposed that the increase of agricultural surface was not very important, during this period, and that the relation between numbers of habitants and agricultural area did not change substantially, either.

MADOZ gives only little information on animal husbandry at Trévelez. Sheep, goats and cattle are mentioned, while nothing is said about pig-keeping. The production of hams which have attained great fame in the present century, apparently was still not very important.

3. Attempting a diachronic synthesis - the contrasts between the 16th, 18th, 19th and 20th century

Comparing the features of land uses, landscape and rural economy at Trévelez in the 16th, 18th, 19th and 20th century, some marked differences can be found. We propose the following model historical evolution: Whereas at the end of the Moorish times, under the rule of the Nasrid kingdom of Granada, land use appears to have been intensive and based on irrigated horticulture, cultivation of fruit trees and silk production, during the first centuries after the Christian conquest there was a drop in population density and an extensification of land use. This extensification was related to an important extension of rainfed agricultural areas and cereal monoculture, and probably to a decrease in the importance of arboriculture.

However, this tendency reverted to a certain extent, between the middle of the 18th and the middle of the 19th century. Agricultural crops were diversified, and irrigation became more important again. According to LISZEWSKI & SULIBORSKI (1977), more than 80 % of agricultural land was irrigated, in the early the 1970s. On the other hand, rotation of new surfaces in order to obtain more agricultural land, continued.

What were the reasons for these changes in the models of land use? Was it necessary to intensify and diversify agriculture because of the increasing demographic pressure, when the reserves of cultivable surfaces were used up? Or were there other reasons which incited intensification and diversification, thus allowing an increase of rural population living in Trévelez? Climate warming after the "Little Ice Age", even if there are indications that it was significant in Southern Spain as well, is not likely to be an important reason. Certainly there had been no climatic limitations to cultivation of potatoes, wheat, *phaseolus* beans and peas at Trévelez, during the 18th century, if it was possible to grow maize.

Probably, the exclusive cultivation of cereal crops in the middle of the 18th century was related to the Ancient Regime. Storing of cereal crops is relatively easy, which was an important point when contributions of the landlord or to the state had to be paid in kind naturals. The tributary system of feudalism was still in place, in the middle of the 18th century, even if Trévelez and the surrounding villages of the Alpujarra were administrated directly by the Crown of Castille since the Conquest times. In the 19th century, the feudal tributary system had been completely abolished, and one may suppose that agriculture was oriented more towards local or regional demand. It must be taken into account that the new rotations of agricultural land during the 19th and 20th centuries were probably made at sites near the altitudinal climatic limit of crop cultivation: According to the topographical map of 1940, the upper limit of the agricultural fields at Trévelez was slightly above 2500 m a. s. l. Productivity on these sites must have been limited by the short vegetation period and the low temperatures rather than by nutrient deficiency of soils. This indicates that the reserves of areas that could be cultivated at a reasonable relation between labour expenses and yields had been practically used up.

With regard to animal husbandry, there is a predominance of sheep, in the 20th century, just as two centuries before. However absolute numbers of sheep seem to have been considerably lower, during the 1960s and early 1970s, and only then had increased to values comparable to the situation around 1752. Probably, this is due to a process of remigration: People who had been working in Central and Western Europe came back to their village and invested money into sheep, as it is reported by NAVARRO ALCALÁ-ZAMORA (1981) from Mecina Bombarón, situated more to the east in the Alpujarra.

Sheep keeping in the past and at present is an activity of a relatively restricted number of individuals (SPANHI, 1959) who are owners of middle-sized flocks. The large majority of the inhabitants owns only pigs, mules, donkeys and cattle in small numbers. In the 20th century, pig-raising has taken a semi-commercial orientation, and Trévelez hams have acquired a great fame, throughout Spain. The 500 pigs estimated by SPANHI (1959) appear to be a far too restricted number for such an activity. In the 1950s, some of the hams with the appellation "Trévelez" probably came from nearby villages.

At any case, the important changes of the numbers of sheep and goats within short periods of time (table 2) must be stressed. It may be concluded

that animal numbers taken from historical documents are only instantaneous values, susceptible to swift change during periods of rapid economic and social change.

Land use patterns which could be observed in the 1970s and may have appeared to be "traditional", had been developed in the not too distant past. This does not preclude absolutely that the extended irrigation system near the village as well as on farther off mountain slopes, which could be found at Trévez during the middle and late 19th century and in the 20th century, was an amplification of a much older system of moorish (or even older?) origin. At any rate, land use patterns in the mid-20th century seem to have been more similar to moorish times than they had been in the 18th century.

4. Recent developments and perspectives

Visiting Trévez various times during the second half of the 1980s, we observed considerable contrasts, in comparison to the situation described by LISZEWSKI & SULIBORSKI (1977), somewhat more than a decade before. Tourism, which had just begun in the first half of the 1970s, had become an important economic factor. Instead of small groups of people during the week-ends, now several hundred persons arrive every day in the summer, in busses and individual cars. The number of bars and hotels has multiplied, and selling of regional products to the visitors—hams, honey, craft products, textiles—has become an additional source of income.

Mountain agriculture has lost much of its importance for the village economy. Agricultural lands at 2000–2500 m of altitude, near the climatic limit of rye growing, are almost totally abandoned. Near the village, old terraced irrigation fields are also partly abandoned. These signs of decline in mountain agriculture are in contrast to the prediction of LISZEWSKI & SULIBORSKI (1977), who believed that this type of agriculture, well adapted to the ecological conditions, would maintain itself in the future. Of course, the decline of agricultural activity is not only due to non-agricultural revenues (tourism, construction), but also to the demographic structure of the population (low proportion of young, active people, due to the emigration), as is the case in many rural mountain zones of Eastern Andalucía (GARCÍA MANRIQUE & OCAÑA OCAÑA, 1990).

During a certain period, potatoes and beans were cultivated to produce seeds for the intensive commercial horticulture on the Mediterranean coast, near Motril (DRESCHER, 1988) and in the Campo de Dalías, in the Province of Almería (BREUER, 1986). According to information from local inhabitants, this market has declined due to the concurrence of commercial high response variety seeds. The only branch of agriculture which has been able to maintain itself, up to now, is the cultivation of fruit trees and raspberries.

One consequence of the decline in intensive irrigated agriculture on the southern slope of Sierra Nevada during the last 15 years is the degradation of its physical infrastructure - mainly water channels and terrace walls.

Geomorphological and hydrological consequences of this process have not been studied in detail, for the mediterranean mountain environment of the southern slope of Sierra Nevada. Nor have the processes of plant succession on the abandoned terraces been studied, in this region. Possibly, a significant soil erosion takes place, especially at sites where fire is frequent. Up to now, fires have been infrequent at Trévelez, but this situation might change rapidly in the future.

On the other hand, the abandonment of agricultural fields leads to colonization by herbaceous and arbustive vegetation which provides pasture for sheep, during spring and summer months. Pasturing near the Mediterranean coast during winter, however, is partly subsidised by giving hay and concentrated fodder to the animals.

At any rate, the abandonment of irrigated mountain agriculture and its infrastructure causes a degradation in the potential of agricultural production on the corresponding areas. Eventual restoration, if it were considered desirable or necessary at some moment in the future, would demand huge expenses of labour and money.

There is no doubt that the economic situation of the inhabitants of Trévelez has improved during the last 15 years, (with regard to income and available services) due to the expansion of tourism and the subsidies given by the State and the European Community. However, it has to be taken into account that this development causes an increased dependence on processes and decisions outside the village and the region, and a rise in prices of consummatory goods as well. In the long term, it would be more interesting to develop a more balanced economic structure, based on both tourism and on a specialized agriculture. This agriculture would have to be oriented towards quality products such as chestnuts, walnuts, raspberries and products of extensive pig and goat husbandry.

Acknowledgments. This was carried out within the context of the research project "Cultural ecology and landscape change in Southern Spain" at the Institut für Ur-und Frühgeschichte, University of Freiburg, Germany, sponsored by the Stiftung Volkswagenwerk.

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Annex: Historial documents

- 1 Libro de Apeos, Trévelez, f. 190 v. (Archivos de la Real Chancillería, Granada):
"...En el dicho lugar havia como ciento y cinquenta nogales y abia de cinquenta castaños y mancanos y otros arboles frutales..."
- 2 Libro de Apeos, Trévelez, f. 190 v. (Archivos de la Real Chancillería, Granada):
"...En el dicho lugar ay dos leguas de monte de ensinar que es pasto de todo el ganado..."

3 Unica Contribución, Trévez, pregunta 4 (Archivos de la Real Chancillería, Granada):

"...y las tierras de vega solamente se siembran en ellas un año si otro no porque nezesitan de un año de descanso por su poca calidad y lo frixido del territorio que está pegado a lo alto de la sierra nehada, que se siembran de mais..."

"...y las tierras de secano solamente producen una cosecha de senteno por que otra semilla no puede en ellas subsistir... y para esto parte de ellas nezesitan de tres años de descanso y otras zinco años, y que no ai biñas ni ortalizas..."

4 Unica Contribución, Trévez, pregunta 3 (Archivos de la Real Chancillería, Granada):

"...y en el termino abra tres mill y quinientas enzinas las que por lo frigido del terreno no dan fruto..."

5 Madoz, description of Trévez:

"...el terreno es en su mayor parte de riego..."

6 Madoz, description of Trévez:

"...Hay un chaparra, varias alamedas, un coto y algunas encinas, criandose nogales, castaños, cerezos, manzanos, ciruelos, duraznos, albaricoqueros, perales y guindos, tomillos, manzanillas y otras plantas, sabinas, enebros y abundantes pastos..."

"...Prod.: centeno, que es la principal, trigo, maiz, cebada, garbanzos, habichuelas, chicharos, lentejas, criadillas de tierra, lino, calabazas y frutas, se cría ganado lanar, cabrio y vacuno..."