Land abandonment: Changes in the land use patterns around the Mediterranean basin

Pinto Correia T.

Etat de l'Agriculture en Méditerranée. Les sols dans la région méditerranéenne : utilisation, gestion et perspectives d'évolution

Zaragoza : CIHEAM
Cahiers Options Méditerranéennes; n. 1(2)

1993
pages 97-112

Land abandonment: Changes in the land use patterns around the Mediterranean basin

T. PINTO CORREIA
UNIVERSITY OF COPENHAGEN
INSTITUTE OF GEOGRAPHY
COPENHAGEN
DENMARK

SUMMARY - This paper focuses on land abandonment in the EEC Mediterranean regions, where the phenomenon, in its actual extension and its trends towards aggravation, demands urgent monitoring and management. The causes and processes of land abandonment are analyzed, as well as the consequences at landscape and ecological level. Depending also on the socio-economic context, new strategies for land management are outlined.

Key words: Land abandonment, extensification, marginalization, landscape, Mediterranean.

RESUME - Cet article traite de l'abandon des terres au sein des régions méditerranéennes de la CEE, où ce phénomène nécessite d'urgence un contrôle et une gestion, étant donné son ampleur actuelle et sa tendance vers l'aggravation. Les causes et les processus de l'abandon des terres son analysés, ainsi que les conséquences au niveau écologique et du paysage. En fonction également du contexte socio-économique, de nouvelles stratégies sont présentées pour la gestion des terres.

Mots-clés: *Abandon des terres, extensification, marginalisation, paysage, méditerranéen.*

Introduction

When considering agricultural landscapes, we refer to land normally used for agricultural purposes and managed to provide adequate and durable production capacity (Meeus *et al.*, 1990). In this context, the concept of land abandonment is applied to land where the traditional or recent use by agriculture has stopped.

The exact meaning of abandonment is relative, like it happens with extensification, or marginalization. What is in fact abandoned? There can be an activity, and in this case there is normally a change towards a less intensive pattern in the land concerned (Baudry, 1991), or there can be the land itself, and here the soil stops being managed and used. The last type is the one actually affecting most Mediterranean regions: landscapes which traditionally were exploited in a mixed, often extensive system, are abandoned and left to their own spontaneous dynamics. Also in these regions, plantations of fast growing tree species (eucalyptus) appear often in land previously exploited for agriculture, but submitted to abandonment trends; in this case we have the first type of process.

Mediterranean agricultural landscapes are specific cultural landscapes, resulting from a long history of human management adapted to restrictive environmental conditions and biological diversity (Naveh and Lieberman, 1984), and optimizing the annual fluctuations in productivity (according to the yearly rainfall amount and distribution), without causing ecological degradation (Pérez, 1990).

However, Mediterranean agriculture is faced with severe problems: Naveh (1991) estimates that more than 50% of the Mediterranean land has marginal characteristics: here, the limiting environmental factors (steep and rocky uplands, poor and shallow soils) often represent insurmountable obstacles for the introduction of modern agricultural techniques. Neither significant scale increase nor vigorous intensification are effective measures to modernize production and improve the standard of income of farmers (Meeus *et al.*, 1990), and land is thus neglected, and progressively abandoned. These handicaps are stressed by the situation of periphery of the region and by common structural problems (Le Coz, 1990).

For the Mediterranean regions integrated in the EEC, the trend towards land abandonment, already detected before, is actually accentuated by the strengthening of the market forces and increasing competition with the highly productive agriculture of Northwestern Europe. In the Mediterranean, the phenomenon attains large proportions, not only in terms of landscape, but also in the socio-economic dimension, demanding urgent measures both at national and at EEC level.

Integrated in a totally different context, the regions situated in the Southern bank of the Mediterranean are not considered in this paper. The North African countries still register high rates of population growth, increasing the pressure on the land and on agricultural production (Le Coz, 1990); without adequate management, land resources and the environment in general are deteriorated under this pressure. While forest is expanding in the EEC Mediterranean regions, in the Southern bank it is diminishing at an accelerated rhythm (Barbero *et al.*, 1990).

In fact, contrasting trends are taking place on each side of the Mediterranean, opposing the countries integrated in the EEC context, which affects their economic, technical, agricultural and social situation, and the countries of North Africa, not integrated in this type of ensemble, but generally characterized by similar specific problems.

Marginalization as a cause of abandonment

The agricultural land which is abandoned is, as a rule, land with marginal characteristics in relation to production, in a determined context. In a strict sense, the designation of marginal indicates that the productivity level in the concerned land is situated close to the margin beyond which management expenses and risks are not compensated by the profit obtained with production.

In Northwestern Europe, marginal land, defined in relation to agriculture, is the land where intensive cultivation is not rentable under the present and foreseeable market conditions, normally due to specific soil characteristics (Skov-og Naturstyrelsen, 1987). In these regions of intensive agriculture, with a rational structure, when prices are lowered, cultivation in the less profitable land is replaced by a more extensive use, often grazing, or nature conservation purposes.

This type of marginalization at the local level can take place inside the farm unit, being the abandonment of the less profitable land part of the management strategies of the farmer in the actual market context. Often, it is accompanied by an intensification of exploitation in the best soils, in order to maintain the income level of the farm. Abandonment of the less fertile soils is also incentivated and supported by EEC programmes concerned by over-production/environment objectives. Even if the farmer would anyway abandon cultivation in these marginal soils, due to his own economic reasons, the EEC support helps taking the decision.

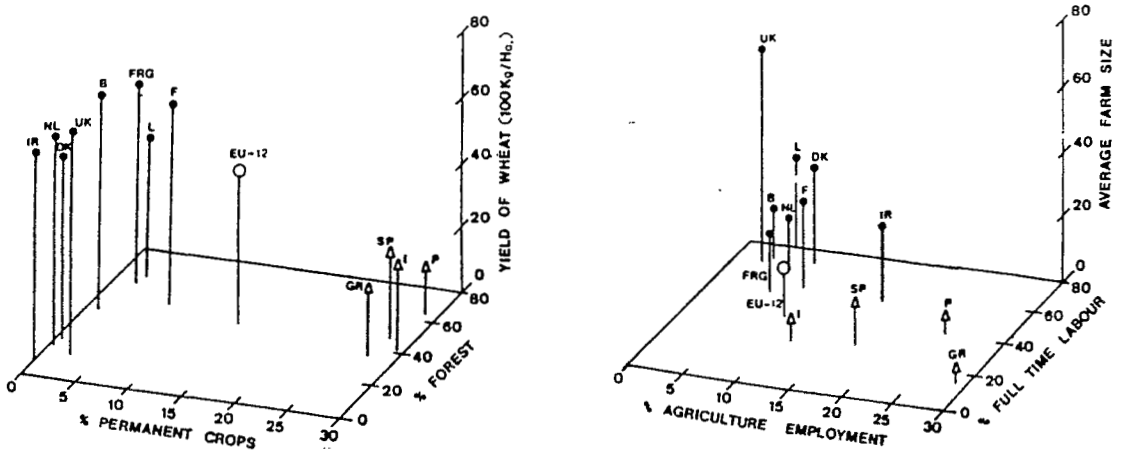
From the beginning of 1993, set-aside rules require that European farmers, producing cereals or other products which market is subsidized by the EEC, must have 15% of their land outside cultivation. In the Northwestern European pattern, the areas concerned won't be abandoned, even if cultivation is suspended, since the land will be used for other objectives inside the exploitation. Environment nature conservation interests are secondary goal of this regulation, but nevertheless in the areas of specialized agriculture and fertile soils, farmers are already discussing about the alternative productions (in intensive form) possible for these 15% land. In the Mediterranean, the set-aside effects will certainly

depend on the regional, and even local, variations in natural and agricultural context. Portugal is exempt from this regulation, until the end (31.12.95) of the special transition period for the integration of its agriculture in the Community.

In Mediterranean Europe, marginalization has another meaning: we can find it at the farm level, but the abandonment *de facto* of the land is more a result of an global marginalization (concerning agriculture, but also economic and social factors) at a larger scale, at sub-regional or regional level, and also at national or European level.

The marginalization occurring at the EEC level is connected with the specific characteristics of the Mediterranean natural environment and its agricultural productions and structure. In response to the diversity of habitats, poor and stony soils, and climatic fluctuations, Mediterranean agriculture has developed mixed land use systems, mainly based in permanent crops (olive groves, vineyards, orchards) and integrating open wooded areas. The variety of crops is thus very high, but they can not compete with the productivity levels in areas of specialized agriculture.

As an example, wheat, the cereal most cultivated in the EEC, has in Atlantic Europe an average productivity of 6,170 kg/ha, and of 2,700 kg/ha in Mediterranean Europe; at the same time, the livestock carrying capacity of pastures in this last region is only 10-50% of that of Northwestern regions (Pérez, 1990). The differentiation of the four Mediterranean countries in the EEC agricultural frame is illustrated in Fig. 1. Greece, Italy, Portugal and Spain present both much lower cereal yields and higher rate of forest and permanent crops than the other eighth countries (Fig. 1 a); these four countries have also another type of structure, less rational, with smaller farm units and more labour in agriculture (Fig. 1 b).



a) b)

Fig. 1. Position of the EEC countries considering: a) Wheat yields, percentage of permanent crops and percentage of wooded land; b) Percentage of agricultural employment and of full-time labour, and average farm size (Pérez, 1988).

Submitted to an almost free competitivity and to the same rules inside the Common Agricultural Policy, in a context of overproduction and prices lowering, Mediterranean regions are in a weak position. A spontaneous process, according to market rules, leads to a global marginalization of these regions, with consequent accentuated land abandonment.

Inside the Mediterranean area, which land is affected? Once again, the first land to be abandoned, which in a high rate has already been abandoned, is the area marginal at regional or sub-regional scale.

Some regions are globally characterized by extremely poor and stony soils, and/or longer, dryer summers. It is for instance the case of the area of *dehesa* in central Spain (Bernáldez, 1991; Hubert, 1991), and of the Alentejo region, in Southern Portugal, corresponding to 30% of the country's territory (Pinto-Correia, 1992 a).

In this region of *montado*, soils are little developed and closely related to the parent rock, granite or schists. According to the Portuguese classification of soil use capability, only 13% of the soils in the region have agricultural capacity (Table 1), and even there, with strong restrictions due to water storage problems (Silva, 1985). As a measure of the productivity in these soils, it can be referred that the average yield of wheat in Alentejo is 1,200 kg/ha, less than half of the Mediterranean average referred above.

Table 1. Distribution of soil capability in Alentejo according to the Portuguese classification system (Silva, 1985).

Soil type	Area	
	ha	%
A - Very high use capability, no limitation or erosion risks, adequate for intensive cultivation.	112,197	4.3
B - High use capability, some limitations and erosion risks, adequate for intensive use.	267,505	10.4
C - Medium use capability, accentuated limitations and possible high erosion risks, conservation practices required, non intensive agric. exploitation.	490,862	18.6
A + B + C	870,576	33.0
D - Low use capability, high rate of coarse elements in the soil, severe limitations, high erosion risks, only indicated for pastures, brushwoods or forests.	678,974	25.7
E - Not susceptible of any economic utilisation - very thin soils, close to parent rock, severe erosion, accentuated slopes, water deficiency during practically all year.	1,051,514	39.9
D + E	1,730,478	65.5
Stone outcrops	38,834	1.5
Total	2,639,878	100.0

This region, together with the mountain areas in the North of the country, is thus marginal in relation to the more fertile coastal areas, where the efforts of intensification are concentrated. In Alentejo, land has traditionally been exploited in agrosilvo pastoral systems, which agro and pastoral components can no longer resist to the competitivity with specialized regions. The system is thus disturbed, income decreases, and land is progressively abandoned. There is first a process of extensification, where shrub invade the most stony or inaccessible lots, but at the end it is generally all farmland which ceases being exploited, by leave or death of the owner. At this level, land abandonment, landscape simplification and human desertification are all causes, and at the same time effects, of the marginalization trends.

After abandonment of the agricultural activity, the open forest formations are often replaced by plantations of eucalyptus (fast growing species destined to timber production), which accentuate the processes of ecological degradation and human depopulation. Since 1970, the area planted with eucalyptus in Alentejo has increased with 200% (Salinas and Marques, 1985), and this species, introduced in the country just a few decades ago, occupied in 1991 already 14% of the Portuguese forestry area.

At a lower level, inside each region, or at sub-regional scale, the marginalization process presents the same global characteristics; it results often in the contrast mentioned by Hubert (1991), between the agricultural plains and valleys, intensively cultivated with vineyards, fruit trees, vegetables, flowers, etc., and the hilly areas which are becoming covered by shrub, since both the traditional exploitation forms and the land are abandoned.

From the broad spectrum of mixed land use, changes start by the intensification of production in the fertile plains, as an effort to answer to the specialization tendency at a higher level (Pérez, 1990); on the other hand, there is extensification, and further on abandonment, in slopes and thinner soils.

With the strengthening of market competitivity and migration of the population to the urban or coast areas (to work on the tourism sector), this tendency is accentuated: the fine-grained pattern of the traditional landscape is replaced by a coarse and monotonous pattern in which production and erosion-control forests, on one hand, and intensive agriculture, on the other, dominate (Vos and Stortelder, 1992).

Examples of this dichotomy are actually present in all Mediterranean countries:

In the Portuguese Southern region of Algarve, mass tourism and intensive agriculture (fruits, vegetables) dispute fresh water and the soil, in the plain near the coast, offering at the same time attractive jobs; at the same time, the inland hilly area is depopulated, its land abandoned and transformed in shrubland.

Alés (1991) and Alés *et al.* (1992) describe the same type of situation in Southwestern Spain, in the Guadalquivir Valley (Table 2). Analyzing landscape changes since 1958, they register: 1) intensification of agriculture in the valley bottom, with increase in the area of herbaceous crops and irrigated areas, and decrease in natural vegetation, in the number and size of the patches; 2) in the Northern mountain ranges, the traditional shifting cultivation disappeared, livestock reduced, grasslands abandoned: there is a reduction in the area of open oak forests (agrosilvo pastoral systems), an improvement in shrublands and tree plantations, and simultaneously a decline in population, today made up of older inhabitants; 3) in the coastal ranges, where the soil was traditionally used for extensive livestock grazing and hunting, shrubland became the dominant vegetation and pine trees plantations appear in large patches: landscape was simplified and risks of fire increased.

For Northern Italy, the same trends are described by Farina (1991) and by Vos and Stortelder (1992). These last authors, concerning the Tuscan Apennines, refer to land abandonment in the uplands as a consequence of dramatic decrease in the number of people active in agriculture and forestry, in the last decades. Emigration takes place because there is no longer an economic base for the traditional activities, as they are too laborious and there is little demand for their products. These activities were: mixed cultures on small, man-made terracettes with stone walls; chestnut forestry with sheep and pig grazing; beech coppice for charcoal burning; and sheep grazing on high pastures with seasonal migration to lower pastures, even reaching the coastal area. Actually, pastures and fields

(mainly on terracettes) have been abandoned, coppice is changing into high forest, chestnut forests have become neglected and monocultures have been introduced in forestry.

Table 2. Land uses at different dates in two contrasting and representative areas of the Seville province: in the valley bottom, there is a tendency to intensification, while in the Sierra, non-cultivated land is under increase (Alés, 1991).

Date	1750	1853	1956	1980
VALLEY BOTTOM (150,000 ha)				
Cultivated land	75.4	82.7	83.9	94.1
Irrigated	0.3	0.3	6.6	16.3
Herbaceous crops	61.8	53.3	43.3	67.1
Olive trees	13.3	29.0	34.0	10.7
Non-cultivated land (forest, grassland, shrubland)	24.6	17.3	16.1	5.9
Total	100.0	100.0	100.0	100.0
SIERRA MORENA (140,000 ha)				
Cultivated land	42.0	31.0	-	11.7
Continuous	1.0	1.5	1.0	1.8
Shifting	35.0	25.0	-	5.0
Olive trees	6.0	4.5	4.7	4.9
Non-cultivated land	58.0	69.0	-	88.3
Total	100.0	100.0	100.0	100.0
Open forest with grassland	53.0	60.0	60.0	46.0
Shrubland	38.0	33.0	34.0	40.0
Pine and Eucalyptus	2.0	1.0	1.0	7.5

Once again, the process of marginalization of the less favoured land must here be analyzed in an holistic perspective. At the same time, in the more fertile land, agriculture is intensified, and "the former ecotopes resulting from traditional land use are replaced by man-controlled units" (Vos and Stortelder, 1992).

For Southern France, Hubert (1991) refers to land marginalization as a consequence of a specialization of both farming systems and land, occurring along this century. After having been used to the limit of its production potential, some uplands are now under a very extensive use, or abandoned; landscape pattern gets more and more monotonous, shrub formations dominate, and in consequence, the risks of fire increase. The average has been 35,000 ha/year in the 15 French Mediterranean departments over the past decade, i.e. 4% of the wooded area.

At a more local scale, the dichotomy plain/hills has been registered in Southwestern France, in the Haute-Garonne department, by Sauget and Balent (1992). Analyzing landscape at the farm level, these authors refer to trends evolving during the 80's in opposite directions: intensive cultivation of corn and sunflower in the valleys, with acceleration in hedgerow removal; by contrast, local decrease in the number of cattle and sheep, more extensive grazing use and development of overgrown fallow land, invaded by *Juniperus communis*, in the slopes.

Land abandonment is thus resulting of a phenomenon of marginalization repeated at different scales, where less favoured land is marginalized in relation to the most favoured areas, where investments and efforts for intensification of production are concentrated. At local level, the phenomenon has a more strict agricultural dimension, differentiating land according to soil quality and slope - and it can be compared to what also happens in Northern Europe.

The integration in the EEC frame stressed both the large scale dichotomy between Northern and Southern Europe, between more and less favoured areas, and the marginalization at the local level, by a strengthening of competition for a limited market and investment capacity.

The process of land abandonment

Land abandonment can take place by abrupt suspension of the exploitation activity, by death or retirement of a farmer without succession.

But the process can be progressive, corresponding in the first phase to an extensification: if there was cultivation, even if only periodic, this one is suspended; grazing becomes more extensive, by less care concerning the pastures or reduction in the livestock density; permanent crops are not maintained or improved by regular management measures, even if they are still being exploited. Progressively, the area concerned is invaded by shrubs, at the same time as there is a decrease in the productivity of the permanent crops. As exploiting the lot becomes more difficult and yields lower, while market forces are strengthened, the direct consequence of these changes is abandonment of the land.

The first step can also be intensification of the traditional land use (Naveh and Lieberman, 1984): the traditional land use systems are replaced by highly intensive and mechanized exploitation models, imported from specialized regions, but not adapted to the natural conditions of Mediterranean areas. In consequence, yields remain too low, soil erosion increases, and the previously existing balance is disrupted in an irreversible way. After a variable period of time, land is abandoned and the traditional system can not be implemented again.

In the landscape of *montado*, characteristic from the region of Alentejo, in Southern Portugal, and from Southwestern Spain (where it takes the designation of *dehesa*), the two opposite processes leading to land abandonment can be observed.

The *montado* is an almost closed system, where the components, trees, animal grazing and cultures, are complementary (Pinto-Correia, 1992 b): cork or holm oaks (*Quercus suber* or *Quercus rotundifolia*) are dispersed in non-ribbon shaped plantations, in a density varying from 20 to 120 trees/ha. The trees furnish the direct outputs, cork and wood (mainly for charcoal), and also shelter and their fruits, masts and acorns. These ones, together with the young oak shoots, are an important complement to the natural grass in the livestock nourishment.

Animals are kept in the *montado* all year round; the most adapted are the iberian pig and the black goat, but cattle and sheep are also used. Every 6/8 years, depending on the soil quality, livestock is moved to other pastures, and the soil is cultivated for one or two years, normally in the first year with wheat, in the second with oats, rye or barley. Cultures are the less important part of the exploitation, but regular ploughing is nevertheless necessary, as an efficient measure against the development of shrub. The manuring necessary for a minimum yield of the cultures is ensured by the livestock, which also contribute to maintain shrub under control. It is important that the density of grazing animals corresponds to the carrying capacity of the *montado*, i.e. to the number of units/ha which the resources available are able to nourish, while the number of young oat shoots necessary for natural renovation is preserved. Human management is necessary only in order to control the adjustment of the different components (trees and animals density, shrub control), and to gather the outputs.

Besides having assured a sustainable production in almost two hundred years, the *montados*, cultural landscapes of seminatural vegetation, grazed over long time scales, are characterized by: 1)

high biodiversity (Naveh and Whittaker, 1979; Bernáldez, 1991); 2) richness in Mediterranean bush species, including some aromatics; 3) variety of habitats and trophic resources, leading to a high animal diversity (Palma *et al.*, 1985), including many game species; 4) resistance to wild fires; 5) scenic quality (Ruíz, 1986; Bernáldez and Gallardo, 1989).

Despite its qualities, the *montado* has recently been under a process of degradation, starting normally by the disappearance or change of one of the components in the system; the fragile balance is then broken, and without alternatives or capacity of reconversion, the land use type degenerates and land is progressively abandoned.

Fig. 2 illustrates the process of degeneration by intensification, as it happens in Alentejo: essays of intensifying crop production, following models imported from areas of fertile soils and specialized agriculture. In the first phase, trees are reduced to a minimum (10-20/ha), and mechanization + artificial fertilization increased. Made without concern for the fragility and low quality of the soils, this changes result in too low yields and accelerated erosion. At the same time, the oaks are severely affected by the mechanized work, attaining their roots, and by the use of chemicals; their production decreases, they become more vulnerable to diseases, and the cycle of natural regeneration is broken by the intensive yearly ploughing.

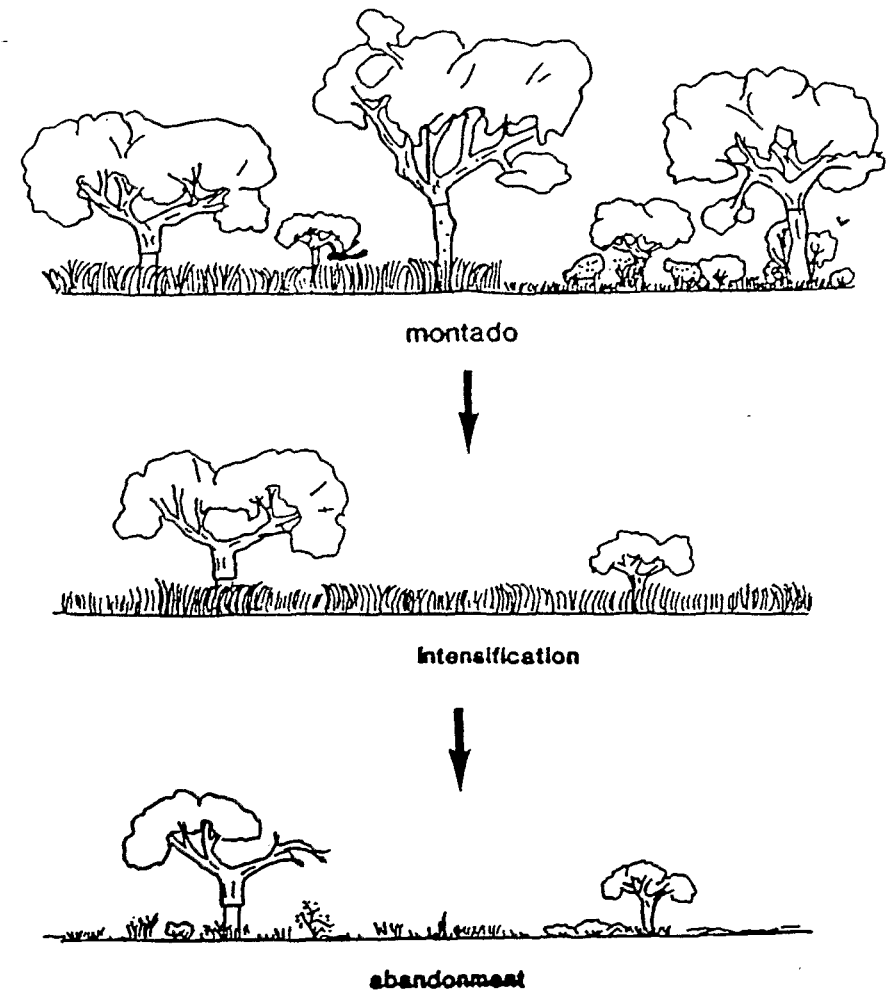


Fig. 2. Disturbance in the *montado* by intensification (Pinto-Correia, 1992 b). In order to intensify crop production, oak density is reduced, the soil work mechanized, and grazing excluded. Trees are severely damaged, soil erosion increases, and crop yields remain too low. The fragile complementarity of the *montado* is broken and the resources deteriorated. The final result is abandonment, since there is no capacity of regeneration. In a further phase eucalyptus trees will probably be planted in this area.

The crop yields remain too low and non-competitive in a open market, and the return of animal grazing is excluded, because the valuable grasses and legumes have been replaced by impalatable nitrophilous vegetation (Bernáldez, 1991); as a consequence, in the last phase these areas end being abandoned, their soils depleted, their tree cover highly degraded and the biological divers.

Landscape changes according to an extensification process is illustrated in Fig. 3. The first disturbance in that sense was the African swine fever, diffused in Portugal during the sixties and making impossible the outdoor pig raising. Goats are also well adapted to the resources of the *montado*, but their commercial value is too low. For other livestock, the natural pastures are of too low quality, supporting in average only 0,2 to 2 sheep or cattle unit per hectare per year (Gaspar *et al.*, 1988); even with liming and fertiliser application, the production increase is very limited. With the increasing strength of market forces, animal production become progressively more difficult to maintain.

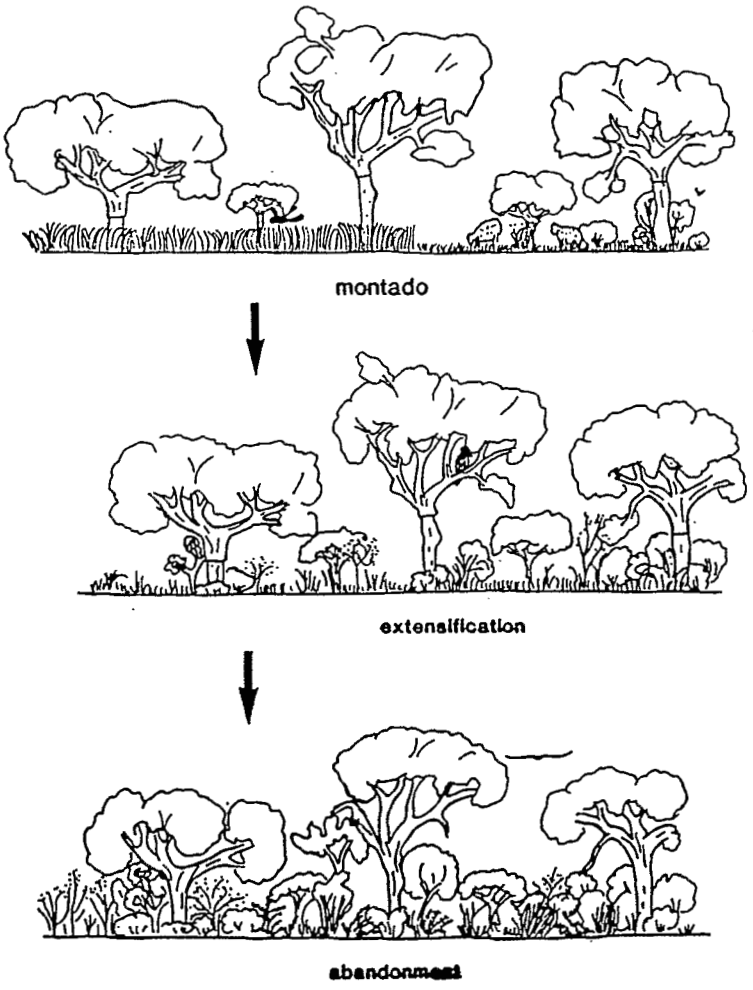


Fig. 3. Disturbance in the *montado* by extensification (Pinto-Correia, 1992 b). Due to the end of pig raising caused by the African swine pest, to a decrease in prices for cereals or to a more open competitivity, the soil of the *montado* is progressively used in a more extensive way. Cultivation and sometimes grazing disappear. The density of the under cover vegetation increases, until it forms a new macquis, where trees exploitation must be abandoned. Such formations of *mattoral* and weeds correspond to a simplification and loss of specificity of the landscape, present high risks of fire and are not exploited.

Concerning crop production, yields are also too low: in Castelo de Vide, a region of *montado* analyzed by the author (Pinto-Correia, 1992 b), the yields for oats and rye are 0,5 and 0,4 tons/ha (Direcção Regional da Agricultura do Alentejo, 1990), ten times less than the average in Denmark (Danmarks Statistik, 1988).

In a first phase, cultivation disappears and grazing is extensificated, since management strategies are less strength. There is an increase in the bushes density, and it can be referred to a beginning of brush encroachment (Naveh, 1991). In a second phase, grazing has also been suspended, sometimes because shrub development made too difficult the livestock access; shrub dominates, and cork, or wood, is no longer extracted from the trees. When the *montado* is abandoned, there are increased risks of fire, which release an increased amount of energy, damaging the soil and inhibiting many species to regrowth. The landscape resulting from abandonment is in this case a monotonous closed formation of *mattoral* and weeds.

The example of Castelo de Vide, a municipality of 26,000 ha in Northern Alentejo, demonstrate the extension of land abandonment in Alentejo (Pinto-Correia, 1992 b). Since 1970, there have been important changes in land use distribution (Fig. 4): open fields under cultivation or grazing, and *montados* in exploitation, register a considerable reduction; the area of *montado* with signs of extensification or abandonment (an increased density of bushes, covering 20 to 50% of the soil - fallow, or >50% - shrub), raises from 2 to 32% of the municipality area; there has been an increase in abandoned open fields, which the figures do not show because a large area of previous fallow land has been planted with eucalyptus; these trees, which occupied 100 ha in 1970, cover today more than 1,800 ha; the area of dense shrub and brushwoods increased also; the less representative land use types, as vineyards, orchards or systems of mixed trees (others) have generally decreased or even disappeared. In general, there has been a transformation towards a coarse pattern and more monotonous landscape.

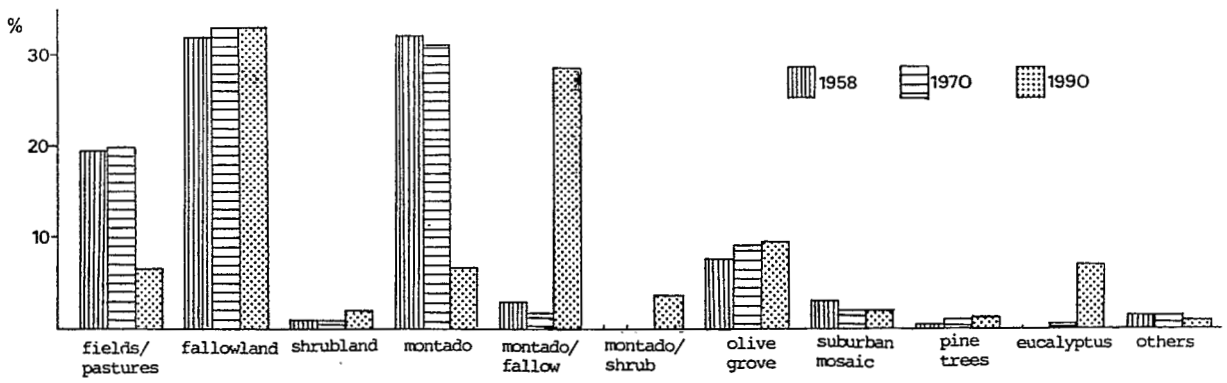


Fig. 4. Evolution in land use types in Castelo de Vide (%). The pattern changes in the rate of occupation of the different land use types show the trends towards land abandonment and in particular the de degeneration of the *montado*. This trends appear in the period 1970-1990, where the area of *montado* under exploitation decreases and the same system associated with fallow or shrub increases. Eucalyptus, an imported species for timber production, is under improvement. Cultivated fields, or pastures, non associated with tree cover, are under decrease.

If we consider the land under extensification or abandoned + the plantations of fast growing species, we have a rate of abandonment to agriculture of approximately 40% of the municipality, in the last 20 years. Together with the 30% of the area with very poor and stony soils, which traditionally has been fallowland, we have 70% of this municipality which is, or is becoming, marginal. The remaining 30% are still under exploitation, but, having mainly the same characteristics, and being surrounded by abandoned land, it can be expected that they will also be marginalized in a more or less lose future, if nothing is done to modify this tendency.

Consequences of land abandonment

Consequences of land abandonment may be analyzed from two perspectives, the human and the ecological; even if they are connected, they set up different questions and may determine different strategies.

If we take in consideration areas as Castelo de Vide, where the process of land abandonment has attained large dimensions, the negative aspect of marginalization is determinant from the social point of view. There is human depopulation, and the socio-economic dynamism of the area concerned is affected, since there is no production, no work, the young and active population leaves, the commercial activity is reduced to a minimum. Socio-economic problems in marginal areas are so closely connected with human depopulation, and this with land abandonment, that they can in fact be considered both an effect and a cause.

Concerning cultural aspects of the environment, we have seen above how land abandonment means deterioration (Naveh, 1979).The attractive and diversified landscapes characteristic of Mediterranean regions are cultural landscapes, resulting of a long history of a man-maintained agropastoral, or agrosilvo pastoral equilibrium, wisely adapted to the natural potentialities and limitations of the region. When man management changes, towards a stronger or a weaker pressure on the environment, this delicate equilibrium is disrupted, and landscape changes towards a less attractive and culturally representative pattern. Furthermore, the traditional balance has not, until now, been replaced by other forms of integration between the human occupation and a sustainable use of the natural resources.

If land use is highly intensified, the fragile environment is severely affected, by pollution of the limited water resources, soil erosion and reduction of species variety, and the system is condemned to collapse after a variable delay. If use is extensified, and land abandoned, the spontaneous vegetation dynamics will lead to formations which are neither diverse, nor productive, nor stable (Naveh and Lieberman, 1984).

When land is abandoned, the consequences from the ecological perspective can also be considered under different points of view. The creation of Mediterranean landscapes has had strong and positive ecological consequences, but the original vegetation characteristics have been changed; these were man-maintained cultural landscapes, which specific characteristics appeared following human disturbance and opening of the landscape. And it is not known how much, and how far, human activities over millennia may have changed biogeographical boundaries, and in what way species dynamics has progressively adapted to human activity. Some authors have showed that mature stages of succession tend to resemble those of central Europe, for example for birds (Blondel and Farré, 1988) and plants (Tatoni, 1992). But Barbero *et al.* (1990) defend that early assessment of "mature stages" of vegetation are inadequate, since abandonment takes place at a large scale.

Consequences can be evaluated in relation to the traditional land use systems and their man-maintained diversity, or in relation to the original formations, actually difficult to restore. And they can refer both to biodiversity at a fine scale level, or in a large scale. Besides, succession stages depend on soil, topography, previous exploitation system, and scale and rhythm of the abandonment process.

In general, the diversity of mixed traditional land uses, and of different components inside each land use system, is simplified, less significant land use types disappear (Pinto-Correia, 1992 b), patches become larger, small-scale heterogeneity decreases (Alés, 1991; Vos and Stortelder, 1992). Shrub formations, of the same type within the same climatic zone and on the same parent materials, progressively dominate, increasing homogeneity both in the scenic perspective and in the biological composition (Naveh, 1991).

Concerning fire, in the early stages of succession, the risks raise up to create a fire prone vegetation that increases hazards; progressively, erosion risks become higher, since the increased amount of energy released during fire damages the soil and inhibits the otherwise vigorous regrowth of vegetation (Bernáldez, 1991). But, on the other side, Tatoni (1992) notes that, in abandoned Provence terraces, less than 50% of plant species in mature unburned forest are Mediterranean, while there is as many

as 80% in burned plots.

In Castelo de Vide, in a managed *montado*, there are several species of spontaneous grass, some dispersed Mediterranean bushes, and oaks. After abandonment, the first stage leads to recovery in height and density of herbaceous and woody plant cover, dominated by shrubs of small unpalatable and indigestible leaves (*Cistus ladaniferus, Cistus monspeliensis, Lavandula stoechas, Rosmarinus officinalis, Ulex*). Soon after, aggressive tall grasses and perennial thistles crowd out the smaller herbs, and a dense, highly combustible brush ticket is established; this closed shrub formations are poor in species, being almost exclusively dominated by *Quercus coccifera, Quercus lusitanica* or *Quercus pyrenaica*, with a few subordinated shrubs and very few, shade-tolerant perennial grasses and geophytes. This succession found in Alentejo, corresponds to others described by Naveh and Lieberman (1984), or by Alés (1991) in different Mediterranean areas.

Comparing the semi-open oak forests under management with the sclerophyllous shrub formed after abandonment, Naveh (1991) refers to a reduction in species richness of about more than 70% (to less than 30 species/0,1 ha). The first species to be extinguished are endemic plants, namely small shrubs and herbs; the Mediterranean flora comprises many endemics extremely localized. If their local support conditions disappear, they simply extinguish. Light-demanding, flowering geophytes, many of them endemic or rare species, are especially endangered (Ruíz, 1985).

In the shrub formations of reduced vegetation diversity, the variety of habitats is also limited to a minimum, and less trophic resources are available (Basanta and Sancho, 1983). Several authors (Marañón *et al.*, 1983; Naveh and Lieberman, 1984; Palma *et al.*, 1985) refer to fewer vertebrate species in these formations than in the preceding open oak forests. This impoverishment is accelerated when the shrubland is replaced by monocultures of trees destined to timber production (Marañón *et al.*, 1983). Eucalyptus forests, for instance, constitute the support for just a few bird species; the expansion of these plantations in Portugal is actually considered as the most serious threat to the endangered animal species which were traditionally found in the open oak forests (C.E.I.E., 1989): black and white stork (*Ciconia nigra, Ciconia ciconia*), eagles (*Hieraetus pennatus, Circaetus gallicus*), kites (*Milnus elaphus*), iberian lynx (*Lynx pardina*), weasel (*Mustela nivalis*), etc.

But, on the other side, at a large scale, abandonment may lead to an improvement in landscape heterogeneity, and thus biodiversity, through the constitution of a mosaic of elements that are relatively poorer in species, but are diversified according to different levels of degradation due to fires, grazing and loggings. Under certain conditions, for instance in areas where agriculture exploitation has gone through a phase of intensification, the reduction of habitat fragmentation, namely forest habitat, due to abandonment, may lead to a restoration of the support conditions for forest-interior species. Farina (1991) refers to the actual abundance of the wild boar (*Sus scrofa*) and of the roe deer (*Capreolus capreolus*) in Northwestern Italy, as a result of a recent increase in the woodland area and a diminution of the man-made fragmentation in the landscape.

Consequences of land abandonment at the ecological level can thus not be generalized, and not so clearly classified negative as they are at the human and cultural level. The different evaluations depend mainly on scale, and on the goals of conservation which have the priority.

New requirements for land management

The opposition which has been developed in Western Europe between landscape interests and conservation, and the agricultural sector, opposition which has been the base for the conservation strategies formulated, can not be used in the Mediterranean. Here, a high ecological diversity has until recently been a function of the agricultural exploitation of the resources, resulting in the mentioned diversified man-made landscapes, being production integrated with conservation.

Strategies concerning abandoned land can thus be based in the restoration of plant communities according to "natural" processes (Bellot, 1989), but they can also be based in a conservation and

landscape ecology approach combined with the agriculture knowledge and traditional land use strategies, constituting these ones inspirations for new forms of management.

An example from Portugal shows that, with hunting development and exploitation, it is possible to preserve the landscape structure of the traditional agrosilvo pastoral systems, assuring the economic viability of the area. In Castelo de Vide, the experience has been made by a land owner with 600 ha as a hunting reserve, with profit objectives. He manages his open oak forest, maintaining some shrubland areas together with open spaces, cultivating nourishing crops, as lupine, improving the pastures, combining different oak trees with olives and three types of fig-trees (with figs in Summer, respectively in July, August and September, while other nourishments are more rare), and sometimes also deposing in the area fruits (apple, melon) he produces in another property. The dominant species exploited are deer and wild boar, economically highly valuable. The perspectives for the rentability of this exploitation system are positive, and, at the same time, landscape heterogeneity and biodiversity are maintained, if not improved.

This case is of private initiative, motivated by the need of land use alternative with economic viability. From the planners perspective, this aspect must not be forgotten, since the participation of farmers and land owners is fundamental, and potential subsidies are always limited, but conservation interests must support the strategies defined.

Different steps must be considered in the management of areas under land abandonment:

i. Research into the vanishing ecosystems, their components and environmental characteristics; research for improvement of these ecosystems, for instance by pastures or livestock improvement.

ii. Assessment of the historical dimension of land abandonment, and of its current trends and dimension; understanding of causes, connected with: natural conditions, depopulation, socio-economic depression, etc.; monitoring landscape changes.

iii. Combining the aspects above, a prediction of foreseeable trends should be done, in order to better determine strategies.

iv. Evaluation of the viability of the improved traditional systems, and of alternative land uses, respecting the traditional landscape pattern but economically productive: hunting development, alternative productions as honey (apiculture).

v. Evaluation of the possibilities of supporting these or other sustainable activities through national or EEC financing, so that they will easily constitute an attractive alternative for land owners.

vi. Definition of intervention strategies for the most sensitive and rich landscapes, exclusively based on conservation parameters and supported by State (or EEC ?); conservation can be based on the maintenance of fine-scale heterogeneity, and on restoration in the areas intended for conservation, succession should be favoured by the introduction of mature species in order to avoid the degradation of the ecosystems; conservation can also be based in large scale heterogeneity of the landscape, it depends of the area considered.

vii. Application of the different strategies defined, based on conversion of abandoned land to new land use forms integrated in the traditional landscape pattern, or in conservation measures for areas where the abandonment of land will not be contradicted, but can be managed.

viii. Last but not least, limitation of the process of large scale plantation of trees destined to timber production, which changes in landscape are irreversible, at the same time as depopulation and marginalization are stressed.

The development and application of each of these steps depends fundamentally on the size and position of the area, on the management regime and funds available, and on the politically and socially defined goals.

Conclusion: what policies to implement

In marginal areas, the ones most affected by land abandonment, rural management is faced also with a socio-economic depression and population aging or depopulation. These questions are closely connected, and, needing both an urgent solution, at a higher level it is necessary to consider them together.

Mediterranean national governments need to concentrate on the marginal areas of their countries, until now neglected, and to be aware of the problems they are facing. Even if they consider not having capacity and means enough to improve the situation, they can be supported by the EEC intentions and policies concerning the rural world.

There are Community programmes aiming at rural development, support to the less favoured areas, preservation of the environment, etc., but they need to be implemented in an effective way. As it has been until now, the EEC support, for instance for agriculture, has been concentrated in the most dynamic and productive regions, the ones where there is the hope of reaching a reasonable level of competitivity in the market context.

On the other side, concerning the Common policies, they ought to be regionalized, if the problems of the less favoured areas are to be solved and the socio-economic cohesion attained. We have seen how land abandonment has different characteristics in Northern and Southern Europe. Being the Mediterranean regions under the same CAP regulations and market conditions that the productive Northwestern agriculture, the process of marginalization will continually be stressed, inside these regions and of them in relation to the rest of Europe.

Conservation measures can be developed, sustainable activities supported, but global resolution of marginalization, and thus land abandonment at a large scale, can only be solved at a high level, with an holistic perspective.

Acknowledgements

The author would like to thank Dr. Jacques Baudry for his critical discussion of the ideas developed in this paper, his pertinent comments, and his contribution to a most comprehensive analysis of the problems concerned.

References

ALÉS, R.F. (1991): Effect of economic development on landscape structure and function in the Province of Seville (SW Spain) and its consequences on conservation. Baudry, J. and Bunce, R.G.H. (eds.), Land abandonment and its role in conservation, CIHEAM, Options Méditerranéennes, série A, *15:* 61-69.

ALÉS, R.F., MARTIN, A., ORTEGA, F. and ALES, E.E. (1992): Recent changes in landscape structure and function in a Mediterranean region of Spain (1950-1984), Landscape Ecology *7(1):* 3-18.

BARBERO, M., BONIW, G., LOISEL, R. and QUEZEL, P. (1990): Changes and disturbances of forest ecosystems caused by human activities in the western part of the Mediterranean basin. Vegetation *87:* 151-173.

BASANTA, A. and SANCHO, F. (1983): Comunidades vegetales y recursos cinegéticos en el Coto nacional de las Patas del Caballo. *In:* Proceedings of the XIV Congress on Game Biology, Sierra Morena, Huelva, España, p. 315-320.

BAUDRY, J. (1991): Ecological consequences of grazing, extensification and land abandonment: Role of interactions between environment, society and techniques. Baudry, J. and Bunce, R.G.H. (eds.), Land abandonment and its role in conservation, CIHEAM, Options Méditerranéennes, série A, *15:* 13-19.

BELLOT, J. (ed.)(1989): Jornadas sobre las bases ecológicas para la gestión en ecosistemas terrestres, Options Méditerranéennes, série A, nº 3, 360 p.

BERNALDEZ, F.G. (1991): Ecological consequences of the abandonment of traditional land use systems in central Spain. Baudry, J. and Bunce, R.G.H. (eds.), Land abandonment and its role in conservation, CIHEAM, Options Méditerranéennes, série A, *15:* 23-30.

BERNALDEZ, F.G. and GALLARDO, D. (1989): Environmental preference and environmental challenge. Jr. of Environmental Management *28:* 52-70.

BLONDEL, J. and FARRE, H. (1988): The convergent trajectories of bird communities along ecological succession in European forests, Oecologia *75:* 83-93.

C.E.I.E. (1989): A Eucaliptização em Portugal; Análise da situação e propostas de resolução. Comissão de Estudo sobre Impactes da Eucaliptização, Lisboa, 29 p.

DANMARKS STATISTIK (1988): Landbrugsstatistik, 1988; Copenhagen.

DIRECÇÃO REGIONAL DA AGRICULTURA DO ALENTEJO (1990): Ordenamento cultural da região: orientações regionais para a produção (unpublished report).

FARINA, A. (1991): Recent changes of the mosaic patterns in montane landscape (North Italy) and consequences on vertebrate fauna. Baudry, J. and Bunce, R.G.H. (eds.), Land abandonment and its role in conservation, CIHEAM, Options Méditerranéennes, série A, *15:* 121-134.

GASPAR, A.M., SEQUEIRA, E.M. and DORDIO, A.M. (1988): National Report, Portugal. Park, J. (ed.), Environmental management in agriculture-European perspective, Belhaven Press, London, p. 75-83.

HUBERT, B. (1991): Changing land uses in Provence (France). Multiple use as a management tool. Baudry, J. and Bunce, R.G.H. (eds.), Land abandonment and its role in conservation, CIHEAM, Options Méditerranéennes, série A, *15:* 31-52.

LE COZ, J. (1990): Espaces méditerranéens et dynamiques agraires - Etat territorial et communautés rurales. CIHEAM, Options Méditerranéenes, série B, nº 2, 393 p.

MARAÑON, T., ALES, R.F. and FIGUEROA, M.E. (1983): Modelo de explotación de recursos naturales en un sistema de dehesa. *In:* Proceedings of the XIV Congress on Game Biology, Sierra Morena, Huelva, España, p. 675-680.

MEEUS, J.H.A., WIJERMANS, M.P. and VROOM, M.J. (1990): Agricultural landscapes in Europe and their transformation. Landscape and Urban Planning, *18:* 289-352.

NAVEH, Z. (1979): A model of multiple-use management strategies of marginal and untillable Mediterranean upland ecosystems. Cairns, J. *et al.* (eds.), Environmental biomonitoring, assessment, prediction, and management - certain case studies and related quantitative issues, Statistical Ecology Series, Maryland, USA, *11:* 269-286.

NAVEH, Z. (1991): Mediterranean uplands as anthropogenic perturbation-dependent systems and their dynamic conservation management. Ravera, O. (ed.), Terrestrial and aquatic ecosystems: Perturbation and recovery, Ellis Horwood, New York, p. 545-556.

NAVEH, Z. and LIEBERMAN, A.S. (1984): Landscape ecology, theory and application. Springer Verlag, New York, USA, 356 p.

NAVEH, Z. and WHITTAKER, R.H. (1979): Structural and floristic diversity of shrublands and woodlands in northern Israel and other Mediterranean areas. Vegetation *41:* 171-190.

PALMA, L., ONOFRE, N. and OLIVEIRA, L. (1985): Situação actual e perspectivas de conservação da fauna silvestre nos povoamentos de sobro e azinho - sua importância como factor de valorização ecológica e económica. *In:* Proceedings of the I Congresso sobre o Alentejo, Évora, *2:* 1487-1502.

PEREZ, M.R. (1988): Agriculture and the environment in less favoured areas, EEC Agriculture and the Environment, Bruxelles, p. 29-37.

PEREZ, M.R. (1990): Development of Mediterranean agriculture: An ecological approach. Landscape and Urban Planning, *18:* 211-220.

PINTO-CORREIA, T. (1992 a): The process of land marginalization in Portugal. Primdahl, J. (ed.), Marginal Jorderne og Landskabet, Copenhagen (in press).

PINTO-CORREIA, T. (1992 b): Threatened landscape in Alentejo, Portugal: the *montado* and other *agro-silvo pastoral* systems, Landscape and Urban Planning (accepted for publication).

RUIZ, J.R.T. (1985): Conservation of plant within their native ecosystems. Gómez-Campo, C. (ed.), Plant conservation in the Mediterranean, Junk, The Hague, p. 197-219.

RUIZ, M. (1986): Sustainable food and energy production in the Spanish *dehesa*. United Nations University, Paris, 53 p.

SALINAS, F. and MARQUES, H. (1985): A expansão do eucalipto em Portugal: seu enquadramento legal. *In:* Proceedings of the I Congresso sobre o Alentejo, Évora, *2:* 590-594.

SAUGET, N. and BALENT, G. (1992): The diversity of agricultural practices and landscape dynamics: the case of a hill-region in the South West of France. Landscape Ecology (accepted to publication).

SILVA, L.F. (1985): A região Alentejo: 1/3 do território nacional sem perspectivas de desenvolvimento? *In:* Proceedings of the I Congresso sobre o Alentejo, Évora, *3:* 1651-1666.

SKOV-OG NATURSTYRELSEN (1987): Marginal jorder og miljø interesser - en sammenfatning. Miljøministeriet, Copenhagen, 276 p.

TATONI, Th. (1992): Evolution post culturale des agrosystèmes de terraces en Provence calcaire : Phyto-écologie et impact humain. Thèse Université de Provence, 167 p. + annexes.

VOS, W. and STORTELDER, A.H.F. (1992): Vanishing Tuscan landscapes - Landscape Ecology of a Submediterranean-Montane area (Solano Basin, Tuscany, Italy). Pudoc, The Netherlands, 400 p.