Produção de carne de bovino em sistemas silvo-pastoris tradicionais – uma boa opção para a proteção ambiental?”

Beef Production in traditional silvopastoral systems – A second best for the environment?

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Resumo: Algumas produções silvo-pastoris Europeias podem ser consideradas sustentáveis e responsáveis por benefícios sociais, económicos e ambientais. Considerando o seu potencial abandono e as suas principais causas, propomos soluções empíricas possíveis para a sua preservação. Uma estratégia possível é a intensificação, uma solução prejudicial do ponto de vista ambiental. Uma segunda estratégia envolve uma abordagem de engenharia de sistemas, que não preserva os valores culturais ou patrimoniais. A estratégia mais favorável pode ser a preservação de sistemas de pastoreio de bovinos, garantindo a sustentabilidade ambiental e económica baseada em produtos alimentares diferenciados com potencial de sucesso no mercado. Esses produtos devem ser incluídos em estratégias de certificação regional ou ambiental, e em conjunto com os pagamentos agro-ambientais, podem compensar os esforços de gestão sustentável dos agricultores.

Palavras-chave: Sistemas silvopastoris, produção animal sustentável; preferências dos consumidores

Summary: Some European silvopastoral productions can be considered sustainable, with increased social, economic and environmental benefits. Regarding their abandonment and its main drivers, we propose possible empirical preservation solutions. A possible strategy is intensification, a damaging solution from the environmental perspective. A second strategy involves a systems engineering approach, which doesn’t preserve cultural or heritage values. The most favourable strategy may be the preservation of grazing systems, ensuring environmental and economic sustainability based on food products with expectable economic success. Such products should be included in eco-friendly or regional certification strategies, which together with agri-environmental payments, may compensate farmers’ management efforts.

Keywords: Silvopastoral; livestock production; sustainability; consumer preferences

Introduction

Portuguese Montados (as well as other similar silvo-pastoral systems) are one of the European agricultural systems that can be considered as “semi-natural”. These can be defined as sustainable land management operations, integrating agricultural and / or livestock production (predominantly sheep but also cattle and pigs) with forestry practices, with increased social, economic and environmental benefits for land users at all levels (Eichhorn, Paris et al. 2006; Mosquera Losada, McAdam et al. 2009; Riguero-Rodríguez, Fernández-Núñez et al. 2009).

In many European regions, such traditional systems are also an important part of the cultural heritage and are considered important recreational areas as well (Pinto-Correia and Vos 2004; Hadjigeorgiou, Osoro et al. 2005; Eichhorn, Paris et al. 2006; McAdam, Burgess et al. 2009; Riguero-Rodríguez, Fernández-Núñez et al. 2009).

There are also use- and non-use values to humans for preserving this cultural heritage very often associated with traditional livestock breeds. In addition, from the biological and production point of view, this genetic pool can be a source of characteristics associated with consumer preferences (Steinfeld, Gerber et al. 2006). Associated with these traditional production systems there has been an increase in high quality food production arising together with certification schemes (Hadjigeorgiou, Osoro et al. 2005; Riguero-Rodríguez, Fernández-Núñez et al. 2009), such as Protected Designation of Origin (PDO).

It is therefore clear that there is an increasing interest in these systems as means of maintaining economic viability of rural populations, through agriculture but also through the diversification of economic activities (Milne 2005).

However, many of the services (cultural, social, environmental, etc) aren’t usually paid for, so only the land owners’ private interests drive land use decisions.
These positive externalities (consequences of economic activities that benefit unrelated third parties who do not participate in the market) can therefore be lost and, as a consequence, high costs can be imposed on society due to their disappearance.

Within such context, this article focuses its attention on the abandonment of systems like Montados and the main drivers leading to this situation (including climate change). Furthermore, the goal is to identify empirical sustainable preservation solutions. It will be suggested that it is possible that the best way to guarantee the preservation of these traditional systems is to adopt a second best solution, by fomenting beef cattle production for Montados.

The proposed solution is recognized not to be the best in environmental terms (cattle isn’t the ideal species to produce if the aim is to ensure the preservation of the ecosystem because of the heavy load it imposes on the soil), but it should prove itself to be the one that guarantees the preservation of cultural and landscape values, while maximizing economic viability. The production of beef cattle of indigenous breeds is the only one with prospects for market share so that there is sufficient economic viability.

As such, this empirical second best solution to be proposed is based on a product with expected economic success, which nevertheless ensures environmental and sustainability measures that preserve the ecosystem. The maintenance of such systems associated with a desirable economic viability is probably the best way to prevent their abandonment.

As this article is included in a broader research on Portuguese consumers’ preferences and willingness to pay for environmentally friendlier beef production, it should nevertheless be stressed that the environmental impact of livestock production isn’t the authors’ area of expertise or research and that this article has no intention of representing more than a speculative background review for the design of stated preference surveys’ scenarios. As such, the goal is to present a sustainable silvopastoral production system that also meets consumer preferences while allowing economic viability.

Some of the recent literature on the mitigation of the environmental impacts of livestock production tends to suggest and support intensification (and confinement) as the best possible approach (Steinfeld, Gerber et al. 2006; Capper, Cady et al. 2009). However, as it will be shown, Europe’s societies and agricultural policy trends are somewhat divergent from that perspective, fomenting more extensive and non-confined production systems.

More specifically the trend denoted for the agricultural policy at least partly tries to meet the expectations of many consumers who are increasingly concerned not only with health problems associated with animal products, but also with the environmental problems associated with such productive sectors. Many consumers’ choose to either reduce consumption levels, or to select certified products, looking very often for “green” or “eco-friendly” products (Steinfeld, Gerber et al. 2006). Across Europe, some of the above mentioned traditional silvopastoral production methods, which are considered sustainable and even environmentally friendly, would fit this demand, but many of them are lacking economic viability.

As such, the stimulus of environmentally friendly livestock production methods is much needed, either through market or policy-driven demand. It may therefore be relevant to analyze production methods that can result in food products which are considered quality products by consumers and are produced by environmentally, economically and socially sustainable methods.

This article’s next section makes a brief overview of the characteristics of traditional silvopastoral systems in Mediterranean areas of Europe. The following sections (sections 2 to 4) include an overview of Portuguese traditional silvopastoral systems, namely Montados, and an analysis of the problems related with marginalisation, land abandonment and desertification of these territories. Section 5 proposes strategies to avoid land abandonment and promote the sustainable preservation of Montados and section 6 concludes by associating such strategies with high quality food production together with specific certification schemes.

Traditional silvopastoral systems in Mediterranean areas of Europe – a brief overview

There is a long tradition of silvopasture (as a practice of agroforestry) in Europe, in a wide variety of regions and climates, although during the 20th century its implementation has greatly declined, mainly due to agriculture’s intensification and specialization (Mosquera Losada, McAdam et al. 2009). However, in today’s Europe traditional grazing is believed to have positive effects in pastures biodiversity.

In the Mediterranean area some of these mature systems are considered to be high nature value ecosystems and one of the most biodiverse man-made landscapes, providing habitat for a large variety of flora and fauna, including insects and birds (Reidsma, Tekelenburg et al. 2006). Vegetation and animal richness and variability is most likely the result of relations between high spatial and temporal diversity, soil and climate conditions, grazing by domestic and wild animals and other human management activities (Pinto-Correia and Vos 2004; Hadjigeorgiou, Osoro et al. 2005; Proença, Queiroz et al. 2009).

As it can be seen in figure 1, the tree component of silvopastoral systems is responsible for the production of fruits, fodder and wood for fuel, litter or timber (Eichhorn, Paris et al. 2006). Trees have also been responsible for many non-marketed products, such as
recreation, hunting, watershed protection and carbon sequestration (Steinfeld, Gerber et al. 2006). Very often, trees themselves define the landscape, as they are often spread throughout fields with no planned pattern or density across the landscape (Eichhorn, Paris et al. 2006).

Trees also shade the pasture, which is particularly important in Mediterranean warm areas, not only for provision of shelter for animals, but also for higher persistence of the herbaceous layer under trees at the end of spring, important for animal feeding (Pinto-Correia and Vos 2004; Eichhorn, Paris et al. 2006; Riguero-Rodríguez, Fernández-Núñez et al. 2009). Finally, this component also promotes soil conservation, as windbreak and reduces evaporative water losses and nutrient leaching from the topsoil (Pinto-Correia and Mascarenhas 1999; Eichhorn, Paris et al. 2006).

Furthermore, pesticide and herbicide are used to a quite lower extent in agro-forestry systems, reducing soil and water contamination (Riguero-Rodríguez, Fernández-Núñez et al. 2009). Positive mechanisms also include maintaining soil structure and heterogeneity (Steinfeld, Gerber et al. 2006). Fertilisers are also much less used, thus minimizing greenhouse gases’ emissions. Finally, as low tree density promotes tree roots to reach deeper soil areas, carbon sequestration per tree is more efficient (Riguero-Rodríguez, Fernández-Núñez et al. 2009) when compared with exclusive agrarian systems.

Regarding these systems’ livestock component, the usual production output is meat. As long as the system’s existing trees are large enough and animal density isn’t high, cattle can be used (McAdam, Burgess et al. 2009). Positive effects of grazing include, besides soil fertilisation, the removal of much of the dry vegetation which can act as fuel, thus reducing the risk of wild fires (Pinto-Correia and Mascarenhas 1999; Hadjigeorgiou, Osoro et al. 2005; Castro 2009; Riguero-Rodríguez, Fernández-Núñez et al. 2009). In addition, animals are responsible for positive effects on biodiversity preservation due to the heterogeneity derived from animal presence at an appropriate stocking rate (Dumont, Rook et al. 2007; Mosquera Losada, McAdam et al. 2009). Livestock can improve species composition by controlling shrub growth, by dispersing seeds through their hoofs and manure and by stimulating seed germination.

In fact, agriculture is recognized to play a very important role in biodiversity across Europe and it seems that the best conditions for maintaining biological and landscape diversity of European farmland are those created by extensive / traditional agricultural systems (EEA 2006; Reidsma, Tekelenburg et al. 2006).

Considering that livestock genetic diversity is considered to be threatened, and that many European breeds currently face high extinction risks (EEA 2006), there are additional arguments in favour of strategies for conservation of livestock genetic resources in silvopastoral traditional systems, as domestic autochthonous animal breeds tend to be well adapted (Riguero-Rodríguez, Fernández-Núñez et al. 2009). It is this genetic pool that potentially allows livestock to adapt to different environments and increasing environmental changes (Steinfeld, Gerber et al. 2006). Due to the predictable temperature increase in Mediterranean areas due to climate change, heat tolerant breeds should be preferred (EC 2008), as are many Portuguese native cattle.

Portuguese traditional silvopastoral systems

Analyzing the Portuguese reality, several different agro-forestry systems were long ago established due to different biophysical and climatic conditions and for historical reasons. There are very different land use and ownership patterns, with smaller and scattered
properties in the North and larger estates in the South (Castro 2009). There are many types of land management, often determined by the tree and animal species used (Rosas, Teixeira et al. 2009). Many of them have very high socio-cultural, historical and biodiversity values (Belo, Pereira et al. 2009; Proença, Queiroz et al. 2009; Rosas, Teixeira et al. 2009).

Most traditional agro-forestry systems include trees of the genus Quercus, often associated with animal grazing (Pinto-Correia and Vos 2004; Mosquera Losada, McAdam et al. 2009). These autochthonous species are well adapted to irregular rainfall and long dry summers (Belo, Pereira et al. 2009).

One of the most important tree products in Portugal is cork (extracted from cork-oaks Quercus suber), very often being produced in quite old systems. These systems generally consist of scattered trees (Belo, Pereira et al. 2009; Castro 2009; McAdam, Burgess et al. 2009). Cork-oak montados are considered a sustainable system and have high economic value, as well as special cultural and ecological value (Pereira, Domingos et al. 2004; Belo, Pereira et al. 2009; Rebelo, Correia et al. 2009). Moreover, as cork is an insulating material, these trees are very resistant to fire (Belo, Pereira et al. 2009; Rebelo, Correia et al. 2009).

Quercus ilex subsp. rotundifolia trees produce acorn, a very important feedstuff during autumn and winter. The system is often called holm-oak montado (Pinto-Correia and Mascarenhas 1999). This system is considered better for livestock production, as its acorns are more nutritive and palatable than those of other Quercus (Pinto-Correia and Mascarenhas 1999; Pinto-Correia and Vos 2004).

Both holm and cork oaks can be found predominantly in the South of the country (Castro 2009). Yet, other Quercus tree species are particularly found in the northeast of the country, and may be used for firewood and charcoal production, such as the oak Quercus pyrenaica (Castro 2009). There are also small areas of Q.pyrenaica montados in the north-east of Alentejo, which are mostly grazed by cattle.

In addition, other tree species commonly found in agro-forestry systems in Portugal include Castanea sativa and Olea europaea. The first one is cultivated for timber and nut production, and it is an important landscape component in northern Portugal, often in silvopastoral systems called lameiros (Pinto-Correia and Vos 2004; Castro 2009). Nuts can be a valuable food resource for grazing animals (Castro 2009). Olive trees can be found all over the Portuguese territory, and have a great economic and socio-cultural significance. Olive trees by-products, such as those resulting from pruning, are a useful foodstuff. Also, animals can eat left-over fruits from the soil (Castro 2009).

The livestock component traditionally used in silvopastoral systems in Portugal includes native species of beef cattle, sheep, goats and pigs. The cattle have very specific characteristics, which vary from one region to the other. The existing breeds are the consequence of the great Portuguese biotype and ecosystems diversity (Belo, Pereira et al. 2009; Proença, Queiroz et al. 2009).

The autochthonous breeds’ characteristics include very good maternal aptitude, high rusticity and exceptional adaptability to the environment they live in and, especially to the food products locally and naturally available (meaning poor pastures, very often). They are therefore the best alternative in unfavoured areas such as many of the Portuguese interior ones (Pinto de Andrade, Várzea Rodrigues et al. 1999), even though their productivity levels may be inferior to commercial breeds under better conditions (INE 2009). However, many of these autochthonous breeds are at the risk of extinction (INE 2009).

It must however be stressed that traditionally the grazing of these systems depended mostly on sheep. As there has been a massive conversion from sheep to cows, during the last decades, there has been some biodiversity loss (reduced shrub patches and reduced spatial heterogeneity of the under-growth) as well as tree regeneration problems (Santos, Carvalho et al. 2008).

This conversion of sheep production systems into beef cattle systems isn’t therefore the best possible solution for the ecosystem’s management.

There are several possible reasons behind this change in the producers’ productive options. On the one hand, the Common Agricultural Policy (CAP) supports have encouraged producers’ to make such conversion for economical reasons. Even with the current decoupling rules for the beef sector, the incentives for producing beef have long been higher than the incentives for sheep production (Dýrmundsson 2004; EC 2006; EC 2008). Producers and landowners have thus opted for the more subsidized beef production.

On the other hand, the Portuguese meat sector (namely consumers’ demand) also favours beef production. Regarding data since 1999, beef per capita consumption has been consistently at least five times superior to sheep per capita consumption (INE 2004; INE 2005; INE 2006; INE 2007; INE 2008; INE 2008). In 2009, beef per capita consumption was 18.7kg, while sheep per capita consumption was 2.5kg.

Finally, sheep production requires much more manpower than beef production, which also favours the later if economic efficiency is considered. Sheep production often requires shepherds, which is a declining occupation, making it often very difficult to find people to work in this activity.

In addition, the number of animals needed to ensure economic viability is higher for sheep than for beef cattle. From this perspective, sheep production eventually entails several times more procedures (e.g. veterinary treatments, identification procedures, etc.) than a beef herd.

In spite of the economical advantages the usage of cattle in silvopastoral systems like montados may not
come without problems, as mentioned above. Tree regeneration problems can be associated with high stocking densities and overgrazing. Excessive number of animals can result in soil compression and degradation and in the destruction of younger, more fragile trees (Santos, Carvalho et al. 2008). Another author found that many of these systems’ trees in Spain are quite old, showing the lack of holm oaks’ regeneration and associating it with excessive animal grazing (Pleninger 2007). It must therefore be guaranteed that, especially if cattle is used, montados’ management includes proper stocking density and probably the maintenance of some non-grazed areas, on a long-rotational basis, to allow tree regeneration (Plieninger 2007), thus assuring the system’s long term sustainability.

Having overviewed the characteristics of Portuguese traditional silvopastoral systems, this article now looks at the consequences of land abandonment, a specific environmental problem more commonly related to extensive agricultural and livestock production systems, especially in developed countries, particularly in upland or dry areas (where these systems usually are both more environmentally valuable and economically marginal). The next section will specifically address this issue.

Marginalisation, land abandonment and desertification of agricultural territories: environmental and societal problems

As the future of agricultural systems across the world will progressively face climate change impacts (IPCC 2007), the expected effects on systems like Montados are the starting point for the analysis of some of the most serious threats they face.

Climate change effects will be noticed in agricultural yields through changes in temperature, rainfall, CO2 concentration, ultra-violet radiation and pest distribution, as well as soil chemistry and composition changes. Extreme weather conditions and disease outbreaks can also be expected (Parry, Rosenzweig et al. 2004; Steinfeld, Gerber et al. 2006; IPCC 2007; EC 2008).

Although there may be expected positive effects in yields in some areas of the globe, the expected overall effect is a net reduction in agricultural production. Many negative social and economic consequences can therefore be expected in many parts of the world in a not very distant future (Parry, Rosenzweig et al. 2004; Steinfeld, Gerber et al. 2006).

Considering livestock production, non-confined grazing systems are expected to be more easily damaged by climate changes, not only because of the mentioned impacts on crops and pasture, but also because diseases and parasites’ distribution are expected to change and thus have stronger deleterious effects (Parry, Rosenzweig et al. 2004; Steinfeld, Gerber et al. 2006).

In Europe, positive and negative impacts on agricultural activities can also be predicted, affecting volume, quality and stability of agricultural production (EC 2008). Longer growing seasons and warmer temperatures may bring some benefits to some regions (AEA 2007). However, changes in rainfall patterns may lead to drought situations, which in turn can lead to soil degradation. This alone is considered to be a major threat to Europe’s land resources sustainability (AEA 2007).

Mediterranean zones are particularly at risk (AEA 2007; IPCC 2007) and extreme situations, with degradation of agricultural ecosystems, can even lead to desertification processes (EC 2008). Many of these sensitive Mediterranean areas are natural and semi natural grasslands which are important biodiversity and landscape resources. Nevertheless they are threatened by ongoing intensification and excessive stocking densities, or, more frequently, in many Portuguese locations, by “set-aside” practices and even land abandonment due to loss of economic viability of agricultural practices (Pereira, Domingos et al. 2004). Traditional silvopastoral systems have experienced gradual abandonment in many marginal areas, whereas in more productive soils, monocultures and intensive production systems have been taking place (MacDonald, Crabtree et al. 2000; Eichhorn, Paris et al. 2006).

Marginalisation of rural areas can occur as they become less attractive than core productive agricultural areas for people to work in. Lower agricultural productivity together with social, economic, political and environmental factors lead to a redistribution of agricultural activity and population across the territory. Increased labour costs, decreased agricultural prices, less economically viable farming activities in lower productivity areas, are very strong contributing factors, which can be joined by aging rural populations (MacDonald, Crabtree et al. 2000; EEA 2004; Pereira, Domingos et al. 2004; EEA 2006). Land abandonment (partial or total abandonment of farms) is a common consequence of such marginalisation (MacDonald, Crabtree et al. 2000; EEA 2004; EEA 2006).

In Portugal, for the last 50 years, there has been a very significant conversion of agricultural land into pastures, forests and unmanaged land (Domingos, Sequeira et al. 2009; Rosas, Teixeira et al. 2009). Today, land abandonment risk is very high in many Portuguese regions, especially in the hinterland. Factors strongly contributing to this risk include a high proportion (over 40%) of producers aged above 55 and a high proportion of farms (above 50%) with a low net value added per agricultural work unit (Pinto de Andrade, Várzea Rodrigues et al. 1999; EEA 2006; INE 2009).

Portugal experienced, between 1989 and 2007, a very significant reduction of the arable land (to less than half of the original hectares). Permanent pastures increased 276% in the same period (INE 2009). These figures may mean there is a trend towards extensi-
cation, as 51% of the Portuguese agricultural surface was already occupied by permanent pastures in 2007 (although there are regional variations) (Domingos, Sequeira et al. 2009; INE 2009; Rosas, Teixeira et al. 2009). However, this extensification may not represent an environmental friendly conversion, as often this process is followed by land abandonment.

The available data also shows a strong decrease in the share of agricultural area managed by non-specialised farming (EEA 2006). Specialization (the production of a single crop or livestock species) although not meaning intensification has its own environmental problems, as it usually represents the end of natural cycles for nutrients and organic matter. A common situation is the substitution of agricultural land by unmanaged (pine and eucalyptus) forests (Rosas, Teixeira et al. 2009), often associated with abandonment (Pereira, Domingos et al. 2004). It can represent the loss of some quality agricultural habitats and landscapes associated with traditional non-specialised farms (Rosas, Teixeira et al. 2009).

Abandoned land faces losses of landscape and biodiversity values and other environmental complications, such as increased soil erosion, resulting into further environmental and economic problems (MacDonald, Crabtree et al. 2000; Steinfeld, Gerber et al. 2006). Wildfires are an example, which can occur over larger areas due to the existence of abandoned land.

Biodiversity losses are closely related with natural habitat fragmentation, which can happen when traditional agricultural land is abandoned (MacDonald, Crabtree et al. 2000). In Portugal (which is part of one of the 25 world hotspots for biodiversity (Pereira, Domingos et al. 2004)), many semi-natural agricultural habitats are dependent on the maintenance of appropriate management (MacDonald, Crabtree et al. 2000; INE 2009).

Soil erosion is a severe consequence of land abandonment and rural fires. Both erosion and fires cause a net loss of carbon to the atmosphere (MacDonald, Crabtree et al. 2000; Pitesky, Stackhouse et al. 2009). This is an acute situation in southern European countries (which experience long dry periods followed by heavy rainfall) (EEA 2002; EEA 2006) and it represents an important socio-economic and environmental problem per se. Moreover, erosion and fire problems are expected to worsen with rainfall and temperature alterations due to climate change (IPCC 2007; INE 2009; Riguero-Rodriguez, Fernández-Núñez et al. 2009).

Dry Mediterranean areas facing severe climate change impacts therefore face desertification, a process derived from irreversibly degraded soil, with permanent loss of vegetation and productivity (MacDonald, Crabtree et al. 2000; IPCC 2007). However, as it will be latter suggested, the appropriate management and maintenance of these areas can help reduce the consequences of climate change.

Abandoned or improperly managed land (including the above mentioned forests) faces a much more severe wildfire risk, as lack of maintenance facilitates the establishment of shrubs, generating fuel accumulation (especially in dry Mediterranean areas) (Moreira, Rego et al. 2001; Belo, Pereira et al. 2009; Riguero-Rodriguez, Fernández-Núñez et al. 2009).

In Portugal, fire frequency has increased along the 20th century, accompanying rural exodus, agricultural land redistribution and abandonment and afforestation policies (Moreira, Rego et al. 2001). The equivalent to 18% of national territory has been burnt between 1998 and 2007, which makes fire one of the most significant causes of habitat destruction in Portugal (Domingos, Sequeira et al. 2009). It is thus clear this is a “circular problem”, where land abandonment may contribute to environmental degradation and climate change (through greenhouse gas emissions due to fire, for example) and climate change consequences may increase land abandonment.

All these land degradation causes and consequences can ultimately lead to desertification. Many Portuguese areas are classified as of high risk of desertification (MacDonald, Crabtree et al. 2000) (many of which are located in southern regions where Montados are established).

Indeed, the Mediterranean region has been experiencing an increase in the extension of dry and arid lands, and in Portugal and Spain there are already minor areas so arid as to be considered pre-deserts (EEA 2002). On the other hand, some Mediterranean areas have faced more frequent periods of severe precipitation (APA 2009), which can also result in soil deterioration, especially if there are already erosion phenomena associated (EEA 2002).

The Mediterranean region is considered a climate change hot spot, which means the probable changes occurring in this region are expected to be more severe than the global average (IPCC 2007; Belo, Pereira et al. 2009; Domingos, Sequeira et al. 2009). As climate changes, non-confined grazing systems will also be affected by increasing temperatures (expected general increase of 2-4°C), lower precipitation and decreased forage production, further encouraging land abandonment (EEA 2002; IPCC 2007; EC 2008). Fire risk cannot, obviously, be expected to decrease (Domingos, Sequeira et al. 2009).

There is, however, a growing consciousness that grassland and silvopastoral ecosystems provide many services beyond livestock production, such as biodiversity conservation, climate change mitigation, desertification prevention and recreation. These can all be considered major issues, as important as food or animal products provision, and they are a key element of EU’s subsidy policy (Steinfeld, Gerber et al. 2006; EC 2008; McAdam, Burgess et al. 2009). The possible advantages of this kind of agricultural system considering the Portuguese reality will therefore be analysed in the following section.
Empirical strategies to avoid land abandonment and protect biodiversity in traditional agricultural systems

Stopping biodiversity loss has been a priority within the European Union for some time as it is clear by the large amount of legislation around this issue (the Biodiversity Action Plan, the Habitats Directive and the Conservation of Wild Birds Directive, just to name a few).

One of the main mechanisms for integrating environmental and biodiversity protection and agricultural practices is the CAP (Milne 2005; Reidsma, Telegeburg et al. 2006). However, even if one of CAP’s priority areas is the preservation and development of ‘natural’ farming and forestry systems (as stated in European Commission’s Agriculture and Rural Development website, http://ec.europa.eu/agriculture/envir/index_en.htm), there is also the need to guarantee (or at least encourage) food self-sufficiency and the economic stability of the agricultural sector and its actors.

In order to try to put together these goals within the Portuguese silvopastoral systems context, several solutions can be pointed out.

The intensification route

The intensification option as the solution that allows matching human demand for food on less land and thus helps saving land for natural ecosystem conservation and biodiversity promotion has been defended by many authors (see, e.g., (Green, Cornell et al. 2005; Steinfeld, Gerber et al. 2006)). As such, the intensification option for a given agricultural system needs to be considered, and even more so when such system faces economical sustainability issues.

Therefore, it is possible to propose the intensification of beef production in traditional silvopastoral systems in Portugal based on autochthonous breeds taking advantage of already implemented certification schemes (e.g. PDO). This vision seeks only the highest economic return. It also assumes that the long-term environmental sustainability is not possible by not allowing the systems’ natural regeneration. It would nevertheless allow increased beef outputs without increasing the area under beef cattle grazing. This would enable the preservation of larger land areas as natural habitats.

The unpreserved areas would nevertheless face severe environmental impacts. The degradation of overgrazed land often arises from excessive stocking rates, resulting in mechanical deterioration of soils and overgrazed vegetation. These have impacts associated with soil erosion, carbon release, loss of biodiversity and impaired water cycles (Steinfeld, Gerber et al. 2006).

Agricultural intensification (in terms of input intensity and overall productivity) tends to diminish local biodiversity, namely through excessive loads of fertilizers and pesticides, and is historically associated with habitat pollution and deterioration. Other negative consequences include increased soil erosion, ground water pollution, rivers eutrophication, among others (Steinfeld, Gerber et al. 2006).

Putting together the advantages and disadvantages of the intensification possibility, and remembering that many of such traditional silvopastoral systems are also an important part of the cultural heritage, this may not be an advisable option. This solution does not guarantee long term environmental sustainability, and would therefore represent the loss of many non-use values associated with these systems.

Sown Biodiverse Permanent Pastures

The second proposed alternative ensures soil conservation and sustainability by completely replacing the current natural pastures for introduced species in systems engineering perspective. This kind of pasture is based on the introduction of different mixtures of improved and selected seeds of resilient species and it is much more productive than natural grasslands (Domingos 2007).

These are considered permanent biodiverse pastures as they are self-maintained with up to 20 species or varieties (originally sown) during at least 10 years. Also, these pastures contribute more to carbon sequestration and higher animal stocking rates can be introduced (Teixeira, Domingos et al. 2008). Due to increased resilience of the selected species, sustainable growth of pasture can be ensured in different conditions (seasons, rainfall, etc.) (Domingos 2007).

Considering that feedstuff prices can represent as much as 80% of total costs in beef production (GPPAA 2007), having access to productive pastures would certainly allow a more economically efficient production (Domingos 2007). Moreover, as these pastures are more productive and resilient, the need for autochthonous breeds would not be justified. It would be possible to resort on more productive commercial breeds.

However, some critics can be pointed out to this solution. Despite being environmentally sustainable, this is not a traditional system and it does not represent any cultural and heritage values. In addition, there is little spontaneous biodiversity as most of it originates in introduced exotic species. Therefore, it does not necessarily promote the preservation of local autochthonous breeds and seeds, potentially contributing to the loss of this biological patrimony.

Preserving Montados together with beef cattle production

Montados are in many cases century-old land-use patterns for livestock production and long established ecosystems with very rich biodiversity (Pitesky, Stackhouse et al. 2009), whose deterioration per se (due to abandonment) should not be overlooked.
Montados abandonment may be prevented by the maintenance of cattle grazed production systems, based on PDO breeds. The beef products’ certification should include a sustainability guarantee. As suggested in the introduction, this would represent the second-best solution from the environmental perspective, but could nevertheless be the key for the preservation of such valuable systems while fomenting their economic viability.

Insisting in cattle production for a system when the potential deleterious effects derived from these animals’ introduction is well known may seem senseless. However, if the consumption levels described previously are remembered, this proves to be the only economically viable production. The following reasoning justifies this affirmation. The PDO certified beef production that is suggested here as the best possible solution for Montados preservation would always represent a niche market. If the Portuguese beef per capita consumption has been consistently at least five times superior to sheep meat per capita consumption, sheep meat representing a niche market would correspond to insignificant quantities and values.

There are several incentives for the use of autochthonous breeds under PDO certification schemes. These local cattle breeds are more resistant to the climate conditions and better adapted to the feeding available in the Montados. Also, their production meets the efforts to preserve regional genetic and cultural patrimony. Finally, the beef products originating from these animals can be considered premium products by consumers who value not only the beef quality but also the heritage values associated with such breeds.

Nevertheless, the environmental impacts derived from the introduction of cattle in Montados can’t be overlooked. Therefore, impact mitigation strategies should be suggested.

The probably best mitigation strategy that can be suggested involves both guaranteeing the appropriate stocking rate and the maintenance of fallow non grazed areas. The low stocking rate is the way to guarantee that the environmental impact of cattle grazing is nevertheless minimized. However, the only way to ensure the long-term regeneration of the tree and shrub component is to allow the existence of areas with no animals.

It should be recognized that the existence of areas with no animals grazing may be associated with an increased fire occurrence. However, fires are a natural phenomenon in ecosystems such as Montados and can even be considered as favourable from the biodiversity point of view (Pereira dos Santos 2010).

Finally, this solution would also imply the availability of production areas large enough to guarantee the maintenance of non grazed plots. As such unproductive land necessarily implies an opportunity cost for producers, the premiums derived from the certified beef products would need to be high enough to offset these additional production costs.

Conclusions

European sustainable silvopastoral systems (among which Portuguese Montados can be included) gather agriculture, forestry and livestock production with social, economic, cultural and environmental benefits. In the Mediterranean area, systems like Montados are considered to be high nature value ecosystems, with a very important function in biodiversity preservation. However, many of the values generated by this kind of agricultural system are often not paid for, generating potential losses for land owners, consumers and societies in general.

Regarding the Portuguese silvopastoral systems in particular, the main threats for their preservation are represented by either intensification or land abandonment processes. The later is somewhat more common in areas considered to be more marginal and less productive, leading to increased environmental, social and economic problems for the local populations.

Land abandonment is a strong degradation factor for soils, habitats and biodiversity. In addition, it can be considered a contributing factor for rural and forest wild fires. When all these factors come together in a region already prone to marginalisation, desertification phenomena can emerge. Therefore, strategies which promote sustainable land occupation and preservation for silvopastoral systems are relevant.

A possible strategy to guarantee the preservation of natural land (which would remain unproductive) could be the intensification of some already existing production, thus promoting increased food productivity at the same time. This approach could be supported by the fact that the Portuguese meat market is not self-sufficient, showing that there is room to accommodate additional national production to the existing demand. However, this solution proves not to be the most desirable one. From the environmental perspective, the intensification would without a doubt come with local environmental problems. Furthermore, by preserving land in natural unproductive condition, non-use values (such as those related with the cultural heritage) associated with silvopastoral systems would nevertheless most likely be lost.

A second possible strategy for avoiding land abandonment could involve a systems engineering approach, replacing natural pastures by more productive and resilient species. This approach would allow increased land productivity (both agricultural and pastoral) while avoiding the environmental impacts traditionally associated with intensification. Notwithstanding, this solution does not represent a preservation of any cultural and heritage values. Furthermore, questions can be raised regarding the lack of spontaneous biodiversity.

Empirically, the most favourable strategy thus points out to the preservation of the existing extensive cattle grazing systems as a route for both ensuring...
environmental protection and guarantee economic viability. These systems can be seen not as purely productive systems, but mainly as systems which generate territorial occupation and management, representing possibly one of the best possible land-use options for these regions.

This would nevertheless represent a second-best option as it is recognized that cattle can be very damaging to these systems, particularly if high stocking densities and overgrazing are allowed. To avoid the problems these systems can represent, appropriate management must be kept. This means respecting the systems’ main assets, the soil and the trees, and their equilibrium, by fulfilling appropriate stocking densities and allowing for some areas to remain un-grazed. However, this sort of management usually represents increased production costs.

In order to guarantee that the production costs are paid for and that the system has economic viability, these higher costs must be transferred to consumers through higher prices. Therefore, food products originating from such systems should be included in differentiation strategies, as their characteristics are often valued by consumers.

Promotion strategies can include certification programmes based on eco-friendly agricultural production or on the products regional genuine origin. Other strategies include taking advantage of recreational and touristic values associated with the typical landscape, cultural heritage, eco-tourism, etc. Together with public agri-environmental payments, these may all allow the payment for services provided by silvopastoral systems, therefore properly compensating farmers for their management efforts.

It would seem a contradiction to implement and enforce legislation and support programmes aiming at minimizing environmental impacts of agriculture and livestock production and, at the same time, not to give appropriate attention to traditional silvopastoral systems’ abandonment. Such systems are already close to sustainability from the ecological point of view. Their economic sustainability must therefore be stimulated, along some management constraints to allow for tree cover regeneration as well as spatial heterogeneity of the under-growth, in order to avoid their loss and increase the ecosystem services they provide to society.

References


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