

Deforestation in Portugal: causes, consequences and possible solutions

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Abstract

Deforestation is not a new problem although world-wide population awareness is increasing. This issue has terrible environmental, social and economic consequences due to the over-exploitation of the natural resources and to alternative land uses which are more profitable in the short term. The combat and mitigation of deforestation is one of the biggest challenges for the 21st Century in order to achieve the Millennium Goals and a global sustainable development at all levels of human activities. Therefore this paper will address these concerns focusing on the causes and consequences of deforestation as well as on the actions carried out by the decision makers in order to provide solutions for this increasingly alarming problem. This paper will also approach the concepts of sustainability as well as economy and management of the natural resources aiming at providing an insight of the past deforestation in Portugal, the present situation and a sustainable perspective regarding the future.

Keywords: *Deforestation, Portugal, Sustainability, Economy and Management of Natural Resources.*

Introduction

Since the beginning, forests, as natural ecosystems, have played an essential role by providing the resources required for the human species' survival. Later, man felt the need to control directly these ecosystems and developed Agriculture and Forestry, enabling the population to settle and cities to emerge.

This population concentration in urban areas increased the efficiency of society, thus resulting in more spare time. The spare time was used by the members of the communities to develop culture, art and technical knowledge that could add even more efficiency and value to human activities.

The increase and spread of people, and domestication, took place in largely forested environments, where the axe and fire converted forests into croplands and animal grazing intensification led to massive deforestation, and subsequently to major impacts on the environment. As cities grown in demographic terms, so did the food and forestry production needs and the borders of the urban areas added pressure to the natural ecosystems, aiming at responding to these needs.

This situation led to the over-exploitation of the natural resources and resulted in the degradation of forest lands and woodlands, as well as deforestation, desertification and biodiversity loss, and led, ultimately, to an unsustainable and inefficient affection of these resources. The Earth we know today is therefore much different than it used to be before human activities started shaping the environment, leading to unsustainability.

In recent decades the environmental issues have raised the interest of the public opinion, the scientific community and the decision makers, at all levels.

In 1972, the UN Conference on the Human Environment was held in Stockholm, Sweden, and a framework for future environmental cooperation was created. This led to global and regional monitoring networks as well as to the elaboration of the UN Environment Programme and influenced the environmental policies of the EU.

In 1992, the UN Conference on Environment and Development was held in Rio de Janeiro, Brazil, which led to the creation of the UN Convention on Biologic Diversity and UN Framework Convention on Climate Change, which in turn led to the Kyoto Protocol. The Agenda21 was another result from this conference, regarded as an action plan to be adopted at global, national, regional and local levels.

In 2002, the World Summit on Sustainable Development took place in Johannesburg, South Africa, to discuss sustainable development and the Millennium Goals have been added to the Agenda21. Deforestation and desertification are major obstacles to achieve the Millennium Goals and the mitigation of these problems is perhaps the greatest challenge for the 21st Century.

Forests cover roughly 30% of the world's land area and deliver a multitude of economic and social benefits. They offer major environmental benefits related to biological diversity and climate change. Tropical forests are amongst the most important habitats for biodiversity and provide crucial ecosystem services such as water purification and erosion prevention.

The livelihood of 1,6 billion people worldwide depend on forest resources to some extent and 60 million indigenous people depend directly on forests for their survival.

Forests also store significant amounts of CO₂, thus preventing further increases in concentrations of greenhouse gases in the atmosphere.

The world lost over 3% of its forest cover between 1990 and 2005. The annual loss amounts to 13 million hectares, an area approximately the size of Greece. Some 96% of recent deforestation has occurred in tropical regions and the largest net forest cover loss between 2000 and 2005 was recorded in ten countries (Brazil, Indonesia, Sudan, Myanmar, Zambia, United Republic of Tanzania, Nigeria, Democratic Republic of the Congo, Zimbabwe and Venezuela).

Over the same period, forest cover has increased in other regions, including the EU, Japan and China while it has been relatively stable in India (CEC, 2008).

Although deforestation is decreasing, due to forestation and reforestation programs, net loss of forest is still increasing at a global scale. Forest resulted from forestation and reforestations, however, take time to fully grow and don't have the same biodiversity, erosion prevention capacity, CO₂ storage capacity and productivity of the original forests.

The deforestation process continues as alternative land uses usually bring increased economic revenues in the short term, and this is why the deforestation rate remains so high in many countries.

To address the challenges of deforestation, the EU has proposed the objective to halt global forest cover loss by 2030, at the latest, and to reduce gross tropical deforestation by at least 50% by 2020, compared to current levels; therefore major climate changes as well as biodiversity benefits are expected.

The idea is to increase the forest net gain through reforestation and at the same time to decrease the net loss of forest, obtaining a positive balance from 2030 forward. Another related environmental issue is the global objective proposed by the EU regarding the Kyoto Protocol.

To meet the EU's objective of limiting climate change to 2°C above pre-industrial levels

will require a cut of global emissions by at least 50% below 1990 levels by 2050 and this reduction is impossible without substantial action to combat deforestation. This is very relevant when considering that “deforestation accounts for some 20% of total CO₂ emissions” (CEC, 2008).

Within Europe in the recent years a lot of rural areas have undergone dynamic changes. In many places the importance of agricultural production is declining, while environmental and landscape functions are increasingly valued.

As a result of such ongoing changes in rural areas, the role of forestry is also changing. In the past, most attention was focused on the primary production function of forests in order to contribute to the rural economy. At present, however, greater emphasis is given to its role in maintaining ecological and social values (Elandsa, *et al.*, 2004).

In Portugal, a forestry policy was adopted in 1996, which led to the elaboration of the Sustainable Development Plan for the Portuguese Forest, in 1998. This National Action Plan is inserted in the National Forest Strategy, within the EU Forest Strategy, including a set of objectives to be achieved in the next couple of decades. The guide lines for this strategy are the following (DGRF b, 2006):

- Minimization of the risk of fire and biotic agents;
- Territory specialization;
- Production Improvement through forest sustainable management systems;
- Decrease of market risks and increase the products' value;
- Overall improvement of the sector's efficiency and competitiveness;
- Rationalization and simplification of the political instruments.

Portugal has one of the largest proportional forest areas of the EU, representing 39% of the territory, which resulted from endemic forests or from forestation and reforestation (Leitão, 2008).

Portugal has a population of approximately 10 million and a land area around 8,7 million ha, of which 3,5 million hectares are forest areas. The owners of these forests are mainly private (87%) while public (3%), industry (6%) and local community (6%)

are minor forest land owners (DGRF a, 2006).

About 220 000 ha of forests are managed by the paper industry, while the remaining forest private areas are characterized by a high number of explorations (400 000) with a low average size (5,7 ha), making it very difficult to manage. In Southern Portugal, large area properties are dominated by Montado *Quercus* forests, typical of the Mediterranean basin, which are the source of half of the global cork production. Central and Northern Portugal forests are very different, they are mostly private micro-properties (<5 ha) dominated by maritime pine (*Pinus pinaster*) and by a mix of broadleaf and resinous tree species (DGRF a, 2006).

The paper industry is based on *Eucalyptus globulus* forests, mostly in northern and center littoral Portugal, with sustainable management wood forests, ISO 9 001 and ISO 14 001 certification systems, aiming at a high quality production, mostly for export.

Regarding the timber production, it's mostly based on reforestation and afforestation, mainly of *Eucalyptus globulus*, *Pinus pinaster* and diverse deciduous *Quercus* wood forests in northern and central Portugal, *Pinus pinea* and *Quercus suber* in southern Portugal, and is increasing at an annual growth rate of 14 million m³ (Leitão, 2008; DGRF a, 2006), being also mostly for export.

The Portuguese forestry sector plays an important role in the national economy, providing employment to a significant part of the active population.

This sector is also regarded as an important contributor to external commerce (fig. 1) and national budget, and provides environmental services and activities with a relevant impact on economic and social benefits (*i.e.*, tourism, recreational activities, fishing, bird watching, landscape and non-timber forest products such as mushrooms and fruits).

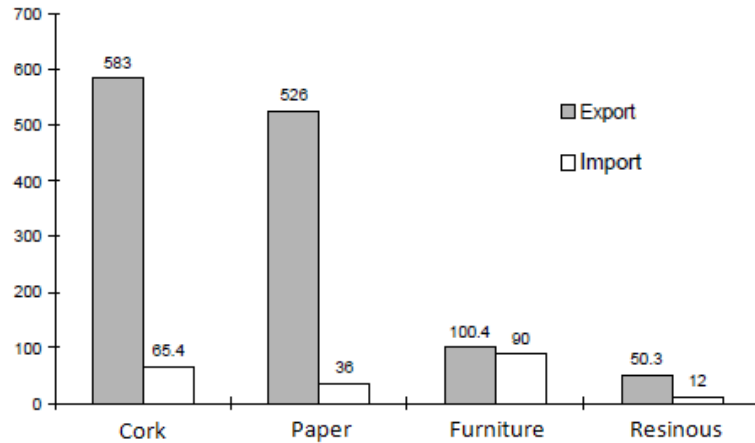


Figure 1 – Forest products production in Portugal in 1992 (in millions of US\$) – adapted (Macedo, 2008).

Causes

The present driving forces of deforestation are diverse, and differ according to various geographic locations where it's occurring.

The most important direct cause of forest destruction is the change in land use. Profitable alternative uses of land with a high market value, such as obtaining commodities, provide incentives for deforestation. In many cases infrastructure development, like river dams and touristic resorts, can also contribute to deforestation. The most important underlying cause is ineffective governance, linked to poorly enforced land use policies and uncertain land tenure regimes. To be effective, any global approach to deforestation will have to address these drivers directly (CEC, 2008).

Modern forestry methods only began to be introduced to Portugal in 1865 originally aiming at checking the loss of remaining broadleaf forests, expanding the areas under Montados and establishing plantations of maritime pine. Tree cover expanded, notably because farmers found the cultivation of cork oaks more profitable than wheat due to the overseas markets for cork (Canaveira *et al.*, 1998).

However, since the beginning of the wheat campaign in 1929, intense soil mobilizations, extensive agriculture mechanization and shortage of land resting periods contributed to the *Quercus* trees debilitation and death. The high charcoal value during the wheat campaign and the 2nd world war also contributed to the cutting of cork and

holm oaks from Montado and subsequent to the inadequate cereal culture in these deforested areas (Oliveira, 1998).

In the 1950s the dictatorship tried to reverse this policy with an imposed programme of afforestation on communal lands. The process was not welcome by local communities which objected to the expropriation of their lands, the loss of pastures and the repressive behaviour of forestry officials. Incendiarism became a growing problem and after the end of the dictatorship in 1975, the forestry service was seriously discredited. That year witnessed extensive fires especially in communal areas. A land reform initiated in 1976 restored communal lands to the villages and began to break up the properties of large landowners (Canaveira *et al.*, 1998).

During the 1980s, the forestry service with the World Bank support pursued policies of afforestation mainly with pine and *Eucalyptus* species but again met local resistance. However, since joining the EU in 1986, a new forestry approach has been adopted which prioritizes the restoration of mixed woodlands and closer collaboration with private forest owners (Canaveira *et al.*, 1998).

The human desertification of the inland rural areas in the recent years, and especially at the primary sector, led to forest degradation. Domestic heating and cooking in developed societies shifted from biomass to fossil fuel, which lead to vertical and horizontal biomass accumulation and the subsequent increase of fire risk.

Forest fires are the most direct cause of deforestation in Portugal. The risk of fire is higher at the resinous and *Eucalyptus* forests and is lower at agro-forestry and pastoral areas. A great effort is put into forest fire fighting every year, and prevention has been emphasized and underlined by institutions that struggle to decrease the effects of this cause on deforestation in Portugal.

On the one hand, the access to the fire sites and to the water resources is the major difficulty when fighting forest fires. On the other hand, the scarce means for an efficient monitoring system associated with the lack of forest care by the population are the main restraints regarding forest fire prevention. Nevertheless, the forest distribution is also highly relevant. The predominance of micro-property and the absence of ownership in

northern and central Portugal make the management of these areas especially difficult. Also, extra care is required when managing *Pinus pinaster* and *Eucalyptus globulus* forests because these trees are very flammable. On the contrary, the *Quercus* trees are remarkably resistant to fire, although economic and ecological negative effects result from burnt cork, which is one of the most valuable resources in the national forest (in bio-economic terms).

Policies have also had a significant impact regarding the mitigation of the causes of deforestation in Portugal.

Forests are often felt as belonging to the people, and recently their ecological and social values have been increasingly regarded by the potential users (the global population in a broader sense). Therefore, considering the current property regimes, in developing countries the areas affected by deforestation and desertification are decreasing in value, leading to biodiversity loss, which is the guarantee for their balanced and sustainable development. The main problem in these countries is related to land use rights and duties that are not clearly settled by property regimes. On the other hand, in developed countries, like Portugal, this issue has to do with the fact that private ownership does not reflect the public interests, only the private ones.

In addition, the poor and inappropriate land and forest management also contribute to forest degradation as well as deforestation. The Alqueva project is considered to be a great national achievement (yet to be fully explored). It is the largest artificial lake in Europe, although this has only been possible at the expense of the cutting down of the largest *Quercus rotundifolia* population in Europe, under the banner of “National Interest”. In return, large plantations have been carried out as a compensation for the damage.

However, the surrounding areas of the Alqueva lake are increasing in land value and urban and mass tourism pressures are rising, despite the socially desired sustainable tourism for these inner regions.

The above mentioned increasingly ecological and social values, regarding forest lands and woodlands, are being underused. The Natura2000 network is not responding to the

increasing public interest for these special areas, because the potential benefits of combining sustainable tourism and leisure with sustainable agro-forestry systems are not sufficiently supported by policies, as national sustainable development guide lines recommend.

In Portugal, there are also other direct causes of forest net loss, such as the plant pests and diseases like *Bursaphelenchus xylophilus* (pine nematode) which is currently attacking the *Pinus pinaster* forests, and the *Phytophthora cinnamomi* and *Phytophthora cambivora*, that threaten the *Castanea sativa* and the Montado *Quercus* trees. The pine nematode problem might encourage private owners to switch the forest composition from the *Pinus pinaster* to the less sustainable *Eucalyptus globulus* species, which could eventually lead to an acute landscape change.

Consequences

Deforestation has enormous environmental, social and economic consequences, particularly on climate, biodiversity and poverty (CEC, 2008).

Environmental consequences

One of the main environmental consequences of deforestation is its huge contribution to global warming and climate change, as deforestation accounts for some 20% of total CO₂ emissions (CEC, 2008). Forests also help to maintain the regional as well as local weather patterns balanced. Therefore deforestation leads to serious environmental consequences, and they are certainly felt at the drylands where aridity and droughts are becoming increasingly severe.

Another very serious environmental consequence is the resultant biodiversity loss. This is most alarming regarding the tropical regions' forest, where deforestation can pose a threat of extinction to a diverse range of plants and animals.

Social-economic consequences

In developing countries deforestation is responsible for major social consequences

because a significant part of the populations depend on forests to live. It also contributes to desertification, and this indicates that poverty increases. But this also implies a major loss of fauna and flora, which is a guarantee for a sustainable development. As to developed countries, the loss of the environmental and landscape services is the main social impact of deforestation. However, in both developing and developed countries, this loss of value (environmental, social and economic) has a negative impact on poverty.

The support from the European Union Common Agricultural Policy (CAP) was inadequate regarding the realities and needs of the Portuguese local forest and was difficult to be accessed by small local land owners; (e.g., subsidized plantation of *Pinus pinea* in the southeast Alentejo region due to its interesting use in recovering soil degraded soils in a mixed forest system with evergreen *Quercus* species, when scheduling *Pinus* cutting in a medium term, which, nevertheless, caused abrupt landscape change without any *Pinus* timber or fruit production) (Branco *et al.*, 2008).

Possible Solutions

Deforestation and desertification are being regarded as determinant issues in order to achieve the Millennium Goals.

Therefore, the multiple uses of forest resources has become a strategy to value forests, as a global initiative from the UN countries, which led to the elaboration of national action plans, aiming at mitigating deforestation.

Meanwhile, the EU has been engaging a fight against illegal logging, although there is no law that prevents the import of illegal logging products into EU countries' markets. Another EU goal is to reinforce policies and institutions, in order to obtain real positive impact by rewarding the services provided by forests and by considering environmental, social and economic values as generators of greater wealth than short term profit based on the over-exploitation of natural resources.

At a global level, the Global Forest Carbon Mechanism (GFCM) is a financial mechanism through which developing countries would be rewarded for emission reductions

achieved by taking action to reduce deforestation and forest degradation. This proposal intends to feed into the ongoing international negotiations on policy approaches to reduce deforestation and forest degradation in developing countries that were launched in December 2007 in the scope of the Bali Action Plan. A major part of the EU contribution to the GFCM could come from proceeds of allowances auctioned in the EU Emissions Trading System. It is estimated that if 5% of auctioning revenue were made available to the GFCM, this would raise €1,5 to 2,5 billion in 2020. These funds would complement and scale up traditional sources such as development aid, the Global Climate Change Alliance, and EU contributions to bilateral and multilateral sources of funding (EU, 2008).

Therefore, there would be a pilot phase to include the avoided deforestation in the carbon markets, in order to compensate for a country's excess of emissions, from 2020 forward. This would allow an excessive pollutant country to be able to proceed to forest plantation as well as afforestation in countries affected by deforestation, as a measure to compensate for the extra pollution and simultaneously contributing to decrease the forest net loss and to increase the forest resources' values.

In underdeveloped countries, one of the major threats to forest is the lack of firewood to cook. Therefore, a possible solution could be a world technological program that would help developing more sustainable cooking devices such as the solar energy based cooks. Additionally, worldwide evidences are being gathered which support that the traditional knowledge can be a huge contribution to sustainability and to forest conservation (*e.g.*, the contributions of Ethnobotany to the sustainable use of native medicinal plants in a proposed protected area in southern Brazil, and, also in Brazil, the government's requirement for reforestation after farming which implied such high costs that in turn the farmers were encouraged to elaborate a list of trees with a high economical value (fruits, shadow, fire resistance, etc.) that are now safe from being cut by the farmers) (Zank *et al.*, 2012).

Bearing in mind the emerging ecological and social values of forests, at the EU level, the Natura2000 network is an approach to protect the most seriously threatened habitats and species in the EU territory. This legislation, from the Habitats Directive, was adopted in 1992, and poses a complement to the Birds Directive of 1979. This network

combines the Special Protection Areas with the Special Areas of Conservation, protecting about 18% of the Member-State's land. In Portugal, the Natura2000 network protects around 20% of the territory. The forests included in the national protected areas network are also safer from other land use pressures. The implementation of the forest National Action Plan, the forest sustainable management plans and the fire defense forest plans, as well as the certification of forest products, are useful tools aiming at the sustainability of the Portuguese forest. However, the multiplicity of existing plans (forest management plans, municipality plans, water basin plans, etc.) could lead to confusion and inefficiency (DGRF, 2006).

The extensity EU LIFE project (Environmental and Sustainability Management Systems in Extensive Agriculture) is another ongoing Portuguese approach to sustainability in agro-forest systems based on pastures complemented with other extensive land uses like olive orchards and Montado forests which aims at the sustainable use of properties and the certification of their products according with the EU Ecolabel (ISA, 2010).

Another step towards the forest sustainable management and the decrease of forest fire risk is the ongoing development of regional biomass energy centrals which will facilitate and enable a profitable way to clean the forests. However, this new biomass business opportunity could encourage the private land owners to change their forest composition from traditional sustainable forest species to less sustainable and rapid growth species and therefore promoting less sustainable forest practices that won't contribute to soil and biodiversity conservation (Celpa, 2004).

Discussion

Comparing wealth that can be generated indefinitely to an immediate wealth within a limited and short period of time, it's obvious that unsustainable ways of development, based only on the short term (and unstable) profit, do not produce as much wealth as sustainable development ways, focused on long term (but stable) profit.

Thus, natural resources' values are no longer regarded as economic only but instead as a convergence of these and the environmental and social values. Therefore, it is only a matter of internalizing externalities, in a way that responsibility and equality do add this

full potential value to human activities, enabling society to achieve a sustainable development path (with maximum wealth and social equilibrium).

Despite the increasing deforestation, at a global level, forest net gain was registered in the EU. In Portugal, there was also a positive evolution of the forest total area (fig. 2). Nevertheless, this positive evolution of the forest total area has been characterized by a significant net loss due to forest fires and biotic agents, which was compensated with plantation as well as forestation national campaigns. This indicates that deforestation is responsible for major forest net loss but plantation and afforestation accounted for a bigger net gain, resulting in an increase of the national forest total area.

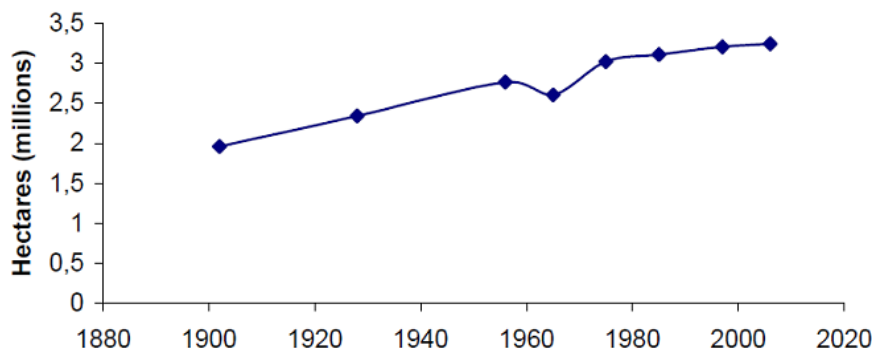


Figure 2 – Evolution of the forest total area in Portugal (ISA, 2006).

The associative organizations, local municipalities and the environmental organizations also have an important role in the present Portuguese forest management (DGRF, 2006). In central and Northern Portugal where the private micro-properties (<1 ha; <5ha) are predominant, the management of the forest can only be possible and profitable if the associative organizations of forest owners are involved and also supported by government agencies.

The national programs to deal with pine nematode (*e.g.*, PROLUMP) and the scientific research and its diffusion are also included in the sustainable forest action plan and could contribute to decrease the risk perception and therefore increase the private investment in forestry.

These last decades, deforestation has been a major concern. However, global policies addressing this issue have not yet shown positive feedback, because at some point in the decision making process (regarding national, regional and local levels) the policies decrease in force, and don't reach the target. This is the EU's main reason to reinforce policies and institutions, at all levels, taking the lead in the pursuit of a global answer to this issues.

On the one hand, the unsustainable development is based on the short term profitability as well as on economic competitiveness. On the other hand, sustainable development is focused on the long term profit and on cooperation. Therefore, the background issue is associated with the need of adding value to the natural resources, in order to achieve a sustainable development for global society.

As an example of a sustainable approach, forests could be valued through global certification systems such as the Forest Stewardship Council and the Programme for the Endorsement of Forest Certification Council that could work as funding channels for the sustainable agro-forestry systems (SAS) and simultaneously as a regulation aiming at responding to the illegal timber trade.

This global certification certainly implies a clear definition of these different systems, depending on geographic location features. A clear definition of rights and duties by the local property regime surely has to be established. Although this would be a very big challenge at the global level, it is indeed a necessary one, because people have to feel responsible (as owners) for the land use in order to use it in a sustainable way.

As a funding channel regarding to the SAS, this global certification would incentive sustainability, and by adding value to the primary sector, the rural areas abandonment could be reversed as the distribution of the population would tend to balance. At the same time, this could be a useful tool to monitor closely the human activities (*e.g.*, forest fires), penalizing unsustainable action through the internalization of the negative externalities (tax), and using the income wisely to improve wealth distribution.

The Portuguese traditionally managed Montado (cork oak and holm oak forests) ecosystem is a very interesting case. This is a good example of sustainable land use in

the Mediterranean area, with a low fire risk. Multifunctional forest land uses aggregating agro-tourism, medicinal and aromatic plants production, mushrooms and wild fruits gathering or game hunting can originate important economic revenues and revitalize the degraded forest areas.

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