



Review

# Socioeconomic Aspects of the Forests in Portugal: Recent Evolution and Perspectives of Sustainability of the Resource

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**Abstract:** Portuguese forests have always played an essential role in the socioeconomic development of national rural areas, but also in several forest-based industrial sectors, such as the cork, pulp and paper, and wood panels industries. In addition to these dominant sectors, there are also several other uses for forest timber, such as being the major raw materials to the production of furniture or devoted to the growing biomass pellets production industry. This review article presents the evolution of the forest industrial sector throughout the recent past, and its impact on the development of the rural environment, from a socioeconomic perspective, namely concerning the jobs and value-added creation, as well as the importance of the forest in national industrial development. It shows the importance of sustainable forest management for the development of the rural environment, as an essential sector for the creation of wealth and for the establishment of populations in the interior regions of the country.

**Keywords:** forest resource; forests management; sustainable development; rural environment

## 1. Introduction

Throughout the path that humans traced in their evolution until reaching the current civilizational state, especially in the countries that constitute the so-called First World, societies always used the resources that the natural environment made available to the communities [1–3]. In a first phase, these resources were simply collected and used in a primitive and direct way, without any kind of processing, and the communities lived or tried to live as close as possible to the resources needed for their subsistence, moving in search of new sources as soon as a particular place exhausted the possibility of satisfying the demand, essentially, for food [4–6].

Forests have always been privileged spaces to meet the basic needs of humans, being the place where primitive populations could find provisions that guaranteed their survival, but also refuge and other products such as wood, bark, and leaves for the construction of shelters, and later fuel, after the discovery of fire [7–9].

As time passed by, humans learned how to use forest resources in their advantage, even destroying the area occupied by the forest for other purposes, namely agriculture. However, this connection with the forest space remained until the present day, and it is inseparable from the need that the current societies maintain for forest products [10,11].

This long journey of thousands of years that humans covered and the established connection with forests have radically and definitively transformed the development of this natural space, and this is probably the reason there is a predominance of certain species at the expense of others. That is, and can be said that, with some exceptions, most of the forests that exist today had their development in some way conditioned by the action of humans [12,13].

Portugal, as a country that saw its territory occupied by humans at an early stage, is one of the best examples to analyze this evolution of forests over time, both in terms of human occupation and the impacts caused by the use of the natural space, but also in a more ecological perspective of the environment, where it is clearly possible to verify the way in which forest species were selected for having more or less interest to satisfy human communities' needs [14].

One of the best examples of this evolution and conditioning of the forest space by human activity is the "Montado Alentejano", the traditional cork oak forest in Alentejo, which results from the adaptation of the Mediterranean natural forest to the needs of the populations that inhabited this territory of southern Portugal, the "agro-silvo-pastoril" system, since it covers agricultural, forestry and livestock use, and it is this overlapping of uses that made it sustainable for thousands of years, and clearly one of the most prosperous [15–19].

This model, which has been distributed a little throughout the country, always adapted to the characteristics of each region, was the model that defined the rural world throughout the times and that even reached the present days, proving the diversity that it is possible to identify among Portuguese regions. However, as the resident population grew, so did the need for more resources, leading to the overexploitation of forest resources, causing a significant reduction in the area occupied by forests in the national territory [20].

It was this slow but consistent reduction over an extended period of time which forced the Portuguese government at the beginning of the twentieth century, during the so-called "Estado Novo" regime (literally, New State), which was a form of authoritarian, autocratic, and corporatist state political regime that controlled Portugal for 41 years without interruption, from the approval of the Constitution in 1933 until its overthrow by the Revolution of April 25th 1974, to take measures to reforest the country, initiating the process that led definitively to the creation of a forest-based industrial sector, with focus for the great reforestation projects that begun in the 1960s but that had an impact mainly in the years following the revolution that established democracy in Portugal [21,22].

This review article intends to make a historical approach of the evolution of the forests in Portugal through recent times, highlighting how forests' development and management influenced rural environment in the period after the revolution of April 25th, 1974 until today, giving at the same time a perspective of sustainable development of the resource.

## 2. The Evolution of Portuguese Forests

As mentioned previously, Portuguese forests underwent a set of changes of anthropic nature that conditioned its evolution throughout historical times and served as a basis for many important landmarks in the History of Portugal, such as the Portuguese discoveries and the maritime expansion. In this period, forests served mainly as a source of raw materials for shipbuilding, in addition to all the other more common and frequent functions [3,23,24].

Due to this excessive use, and without organized policies to replace the resources used, Portuguese forests reached the beginning of the 20th century with an area of approximately 640,000 hectares, most likely corresponding to the smallest area ever. It is from this starting point that the recovery process begins, mainly after the establishment of the republican regime in 1910, with specific policies for the reforestation of the country [23,25].

However, it was necessary to reach the "Estado Novo" period, in 1933, to start a real forest recovering policy that attained great development from the end of the decade of 1950 and during the decade of 1960, with a large forest expansion at national level, with the plantation of hundreds of thousands of hectares of maritime pine (*Pinus pinaster* Aiton) in the inland mountains and coastal areas

of Central and Northern Portugal, defining the beginning of landscape evolution to what it is known today. This new forestry order, based on the maritime pine culture, allowed the development of a set of associated industries that contributed greatly to the creation of jobs in rural areas, but also to the establishment of a new industrial sector in which Portugal was a world leader for decades, the resin and rosin derivatives sector [26,27].

It was this maritime pine priority as forest culture, decades later, in the post-revolution period, that became the basis for the development of other types of industries, namely the production of wood panels and biomass pellets. However, it was another type of crop that played a determining role in the evolution of the forest organization and which also began in this period. This was the beginning of the large-scale plantation of eucalyptus (mainly the species *Eucalyptus globulus* Labill.), destined to feed the pulp and paper industry, in which Portugal also became one of the world leaders, namely in the production of bleached pulp [28–30].

On the other hand, in Southern Portugal, where the dominant species is cork oak (*Quercus suber* L.), the occupation rate of the soil has remained more or less stabilized, most probably due to the millenarian use of the soil with the tripartite agriculture–forestry–livestock components, which have always guaranteed the sustainability of the system. The silvicultural component played an increasingly important role, mainly due to the high value attributed to cork, since it started to have other applications than the traditional production of wine stoppers. Thus, there was an increasing interest in maintaining the cork oak forests, thus ensuring continuity of the remaining components of the system, since they only added value and did not interfere with cork oak productivity [19,31].

In recent years, forest structure has changed significantly, but it can be seen that maritime pine (*Pinus pinaster*), cork oak (*Quercus suber*), and eucalyptus (*Eucalyptus globulus*) are the most representative species, occupying around 75% of the forest area, and those with greater economic interest as well. In other words, those are the species predominantly used for industrial applications, such as the pulp and paper, wood panels, biomass pellets, and cork industries [32]. Eucalyptus became the main forest culture in mainland Portugal in occupied area and percentage (812 thousand hectares, 26%), followed by cork oak in the second place (737 thousand hectares, 23%), and maritime pine (714 thousand hectares, 23%) went from the first to the third species. The main change in areas of forest species between 1995 and 2010 occurred with pine tree, which saw a decrease of about 263 thousand hectares, and in the area of eucalyptus, increasing by about 95 thousand hectares [33]. However, in this context, the pine tree area in Portugal continues to be particularly important and presents a worrying trend of reduction and difficulties in supplying the established value chain for its products and derivatives, and it is necessary to develop specific policies for its recovery. In order to exploit this immense potential, several conditions must be met, namely:

- Consistent policies, tailored to their targets and operationalized in long-term stable programs that solve the problems that threaten the regions of North and Center Portugal, ensuring the maintenance and sustainability of the forest and its resources;
- A disruptive approach to the development of new forest/territorial management models that reduce risks and enable investment and forest profitability in areas of smallholdings;
- A clear strategy to promote the circular bioeconomy and sustainability in rural areas.

### 3. Socioeconomic Aspects of the Forest Industry

This new paradigm of forest evolution, as a source of resources in an intensive perspective of supply of a set of industries that have been developed due to the abundance of raw materials, led to a forest management model based on the plantation of a restrict number of species, which occupy significant areas of the country [34,35].

In fact, according to the most up-to-date data available on land use in Portugal, which refer to 2015, the forest occupies about 39% of the total area, and of this area, 72% is occupied just by 3 species,

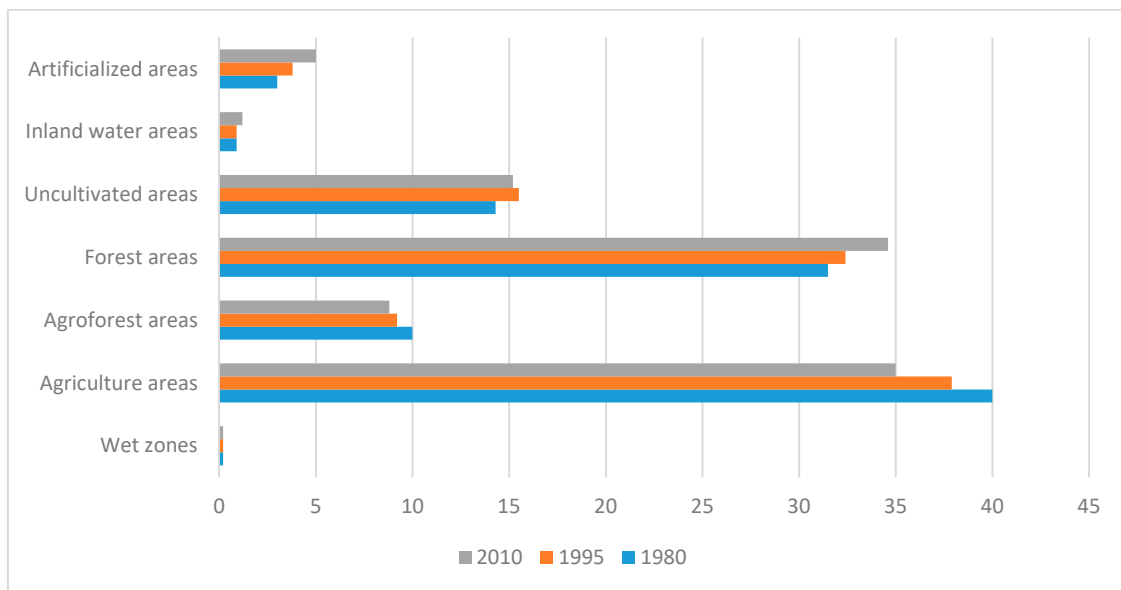
namely maritime pine with 23%, eucalyptus with 26%, and cork oak with 23%. That is, 28% remains for all other forest species that can be found in Portugal [36].

The combination of this forest organization contributed to the growth and development of several industrial activities mentioned previously, and which occurred in the years immediately after the revolution of 1974. Forest-based industrial sectors actually represent 2% of the national Gross Domestic Product (GDP), contribute with 2.6 billion euro to the national trade balance, and as a work base for seven thousand companies, responsible for 115 thousand direct jobs. It was precisely in this post-revolutionary period that Portugal reached the leadership of the pine resin industry and in the production of pine rosin derivatives. It was a prosperous industry which saw an increasing use of these compounds as raw material for the production of a large number of products, and which had its peak exponent during the 80s of the twentieth century. During this period, resin extraction functioned as a seasonal complement to rural workers, who intercalated agricultural exploitation with resin collection, being the forestry management model mainly directed towards this end [37].

With the admission of Portugal into the European Community, a new period of economic growth and development emerged, which will definitively change the current situation. With the arrival of European community funds for the development of infrastructures, civil construction became the country's main economic activity, creating hundreds of thousands of new jobs, which were filled mainly by former agricultural and forestry workers, leaving both sectors practically abandoned. This was the beginning of the end of the resin sector in Portugal, which only survives today due to the importation of raw materials from new producing countries like Brazil or China [38].

This abandoned land was the ideal stage for the emergence of a "solution" that promised income with little or no management at all, and a rapid return when compared to other forest crops. It was in this way that in the late 1980s and throughout the 1990s, the great expansion of eucalyptus occurred in Portugal. This species had a number of unbeatable advantages, namely a faster growth when compared to traditional forest species, and a growing demand from the pulp and paper industry, which ensured its flow and created a value chain. However, perhaps the most important argument was that the pulp and paper companies were willing to lease the land and support the costs of investing in the plantation of eucalyptus, allowing land owners to continue to have some kind of income from the forest, without the need of a nonexistent labor force that shifted to coastal regions to work in the construction industry [38,39].

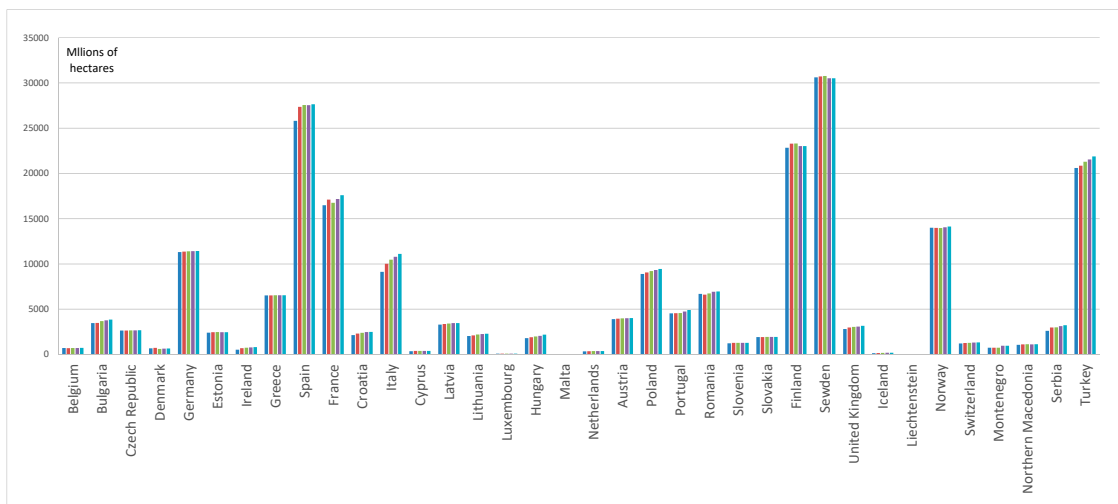
According to data presented in IFN6—National Forest Inventory 6, Portugal has an area of about 35% of its territory covered by forests. However, according to the same IFN6, this represents a decrease of approximately 150 thousand hectares in the period 1995 to 2010, corresponding to a net loss of 0.3% per year. This decrease is felt especially in the North and Central regions, with the conversion of forest soil use to urban use (around 28 thousand hectares) [33]. Presently, the forest area corresponding to cork oak has shown a slight growth, as the data presented in the Portuguese Soil Use and Occupancy Mapping, COS 2015, indicate, and corresponds to an increasing need of cork, which has become the fundamental raw material for several industrial applications. This collection of cork has allowed rural populations to adapt to seasonality and specific rotation, combining this with other economic activities in a sustainable way [40]. From the analysis of data provided by the Institute of Nature Conservation and Forests (ICNF), through several documents available on its website—[www.icnf.pt](http://www.icnf.pt)—it is possible to verify that forest area in mainland Portugal continues in a downward trend, with a reduction estimated in 254,000 hectares in 2015, although these data are still provisional, as the results of the IFN7 are not known yet, nor the expected date for their presentation. This reduction in forest area goes against the trend of the previous period, where it was possible to see a continuous growth (Figure 1).



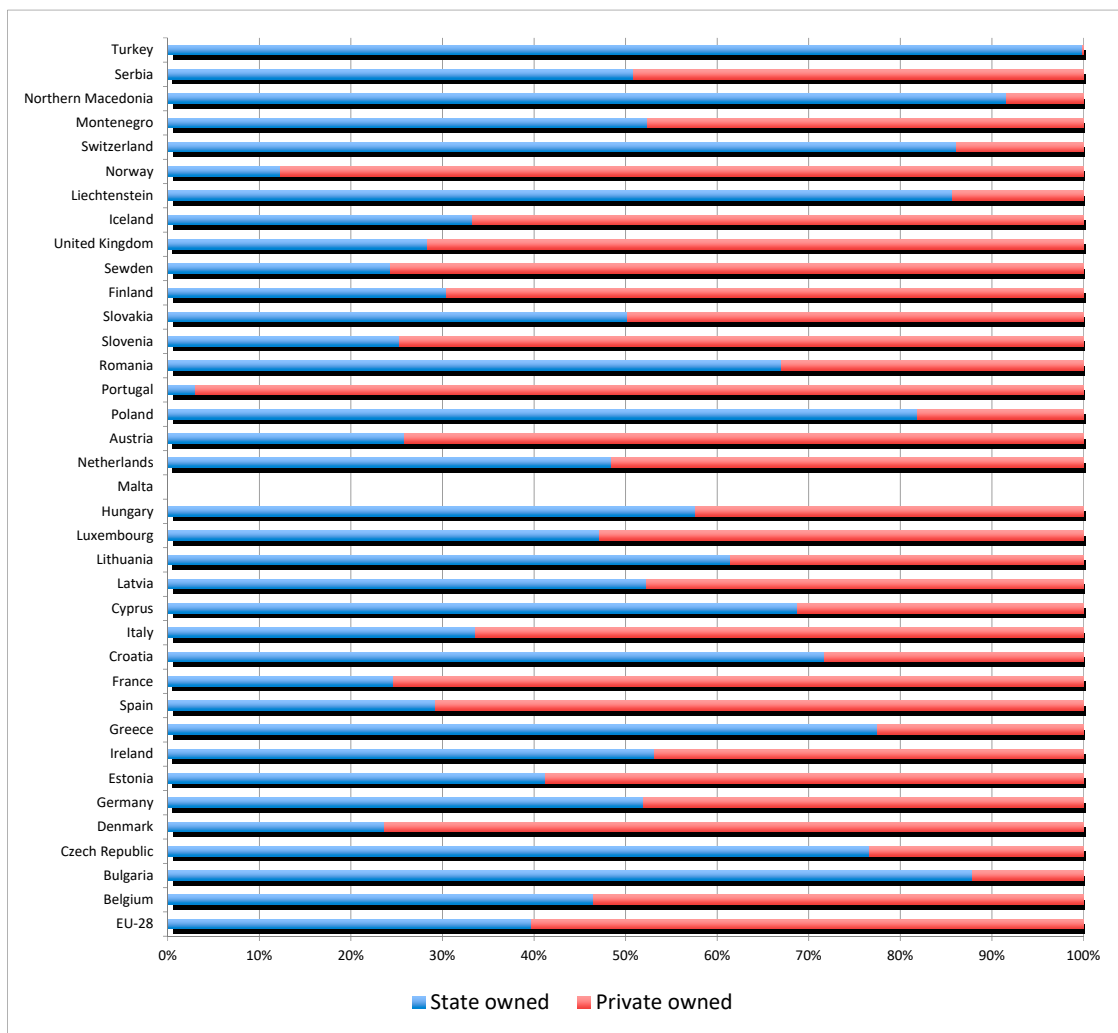
**Figure 1.** Areas of occupation for different land uses in Portugal (adapted from Reference [41]).

In this same perspective, it can be seen that in comparison with its European counterparts, Portugal has had a decrease in the total forest area, completely against a counter cycle, since, as can be seen in the analysis of EUROSTAT data [42], the trend in the main European countries is the growth of forest areas. In the same referred document, especially when comparing the variations which occurred between 1990 and 2015, it is verified that the general trend is to increase the forest area, except for Portugal, Estonia, North Macedonia, and Sweden. In this circumstance, Portugal presents the greatest negative variation, most probably due to the action of rural fires that seasonally affect the national territory and that periodically occur with a frighteningly large scale [43]. Sweden, as one of the precursors of the use of biomass for energy, showed a decrease in its forest area, which, however, had already begun to be the subject of a recovery and intensive reforestation project, in order to maintain its sustainability. This plan already led to the stabilization of the forest area, with a similar trend in other countries [44]. Estonia, for similar reasons to those identified for Sweden, also saw its forest area reduced, most likely caused by the country's entrance into the international market of biomass pellets as one of the leading producers [45]. However, as can be seen, this decrease has already stabilized, and it is expected that the trend will be reversed (Figure 2).

Regarding forest ownership in Portugal, ICNF describes in the "Forest Profile" [46] that "Portugal occupies a sui generis place regarding forest property regime, with only about 3% of forest lands being owned by public entities (State and other public entities), being the remainder held by local communities (the so-called "baldios", about 6%) and private owners (92%, 4% of which are managed by industrial companies)" (Figure 3).



**Figure 2.** Evolution of forest area in European countries for the periods 1990, 2000, 2005, 2010, and 2015 (adapted from [42]).



**Figure 3.** Distribution (%) of ownership of forest property in European countries (adapted from [42]).

The same “Forest Profile” states that “there are 11.7 million rustic buildings registered in the matrix (therefore with agricultural or forest use), and only 46% of forest areas have a land register. It is

estimated that more than 20% of the territory has no or unknown owner." This situation contrasts with countries such as Spain or Greece where, respectively, public forests reach 30% and 75% of the total forest area. The average size of forest property in Portugal, which is around 2 to 4 hectares, is small, which also justifies the great fragmentation of forest property [47]. According to the Global Forest Resource Assessment 2010, Portugal is among the countries in Europe with the highest percentage of private forest area, where private property corresponds to 3.4 million hectares of forest areas, 98.4% of the total, of which 5.2% belong to industrial companies [47].

#### 4. Forest Induced Development

The dynamics of territorial evolution and transformation can be considered one of the most important components in the evaluation of terrestrial environmental systems, since they reflect the impact of human activities on the global environment [48]. Thus, in the evaluation of territorial dynamics two different perspectives of analysis can be used, one being the identification of the dynamics or, on the other hand, the identification of the driving forces that cause these dynamics of transformation and/or evolution [49]. Recent literature has identified three essential elements in the transformation process of land occupation: Driving forces, actors, and land use [50,51]. While the last two are specific to each territory, the analysis of driving forces is more diffuse and can be divided into five areas, specifically, politics, economics, culture, technology, and natural/spatial. Due to the specific diversity of each area and the objectives of each assessment, different approaches can be used to study the transformations of land use and the evolution that these can present, namely in the concrete situation of the forest occupation, its development, determination of trends, the sustainability of the resource and the expected impact of the different socioeconomic descriptors [52,53]. These approaches can be spatial vs. nonspatial, dynamic vs. static, descriptive vs. prescriptive, deductive vs. inductive, global vs. regional. However, other approaches can be chosen, as demonstrated by several papers published by many authors, adopting a great variety of methodologies [54].

As was verified in the previous sections and giving focus to the analysis of the driving forces that caused it, the recent evolution of the Portuguese forest can be divided in 3 distinct periods. The first corresponds to a period of forest decline, in which the forest regenerates almost exclusively in a natural way, ending approximately after the implantation of the republican regime in 1910, and the beginning of the period known as the "Estado Novo" in 1933. The second period corresponds to the duration of the "Estado Novo", where reforestation policies were planned and where the forest came to be seen as a resource that has to be managed, mainly with the development and incentive to plant extensive areas of maritime pine, as a way to minimize the recurring shortage of construction timber and firewood that the country was experiencing. The third period corresponds to the time interval that began with the revolution of 25th April 1974 until today, where forests were definitively seen as a source of resources for several industries, among which the pulp and paper, wood panels, and cork industries, but also for other emerging industries such as the production of biomass pellets for energy [3,55,56].

The rural world evolved within these periods, following the different developments that occurred in the forest, which somehow became mutually conditioned but that allowed rural populations to subsist in a sustainable way, mainly due to the complementarity of activities, which were interspersed and created a sequence of interconnected tasks [57].

The emergence of new activities, such as those that began with the construction boom after Portugal's admission to the European Union, and which encouraged the greater migration of people to coastal regions, which took place in the post-revolutionary period, came as the result of the depopulation of the rural world, during the 1960s and 1970s, mainly as the result of the mass immigration of young people, at the age of compulsory military service, during the colonial war in Africa. This sequence of events contributed significantly to the change in the forest management paradigm, particularly with justification and acceptance as an alternative and almost unique solution to the proliferation of eucalyptus [57–59].

This development contributed to forests following a path of virtual self-management in the post-revolutionary period, since the lack of labor for forestry activities led to the abandonment of forest land. These lands became the scenario for the rural fires that have ever occurred, and which are an integral part of the Mediterranean forest, but which, due to the abandonment of the land and subsequently the lack of management of the forest area, led to an increase in the seasonal rural fires [60].

In Portugal, there has been a continuous growth of forests only interrupted in the most recent period, especially after 2010, most probably due to the occurrence of rural fires in the summer, which in recent years have reached very significant proportions. This growth was mainly due to the abandonment of agricultural areas, reflected in the conversion of these areas into zones of spontaneous growth and natural regeneration. This trend is justified by the existence of driving forces fostered by the economic exploitation and the importance of these areas for the rural populations. Forests are the basis of a sector of the economy that generates thousands of direct jobs [46]. This number has suffered a significant reduction over the last two decades, motivated mainly by the exodus verified from the populations of the interior to the coast, and for the near-extinction of activities like resination [61]. Despite these indicators, but with the increase in production that has occurred, an increase in labor productivity in the sector is suggested [43]. In the context of forest-based industries, i.e., the industries that obtain their raw materials from the forest and its by-products, the following are noteworthy:

- The sawmills industry has been witnessing a phenomenon of concentration, with the disappearance of small sawmills. It is estimated, however, that the total sales volume has been maintained. In 2009, it contributed to around 1.5% of total exports [62].
- The pulp and paper industry contributes about 4 thousand direct jobs, but its main evolution has been in increasing vertical integration in the sector, with higher production of paper and paper, which leads to a notable increase in the value of the product, a trend which is still increasing. It is the second sector with the national highest value added and corresponds to 5% of national exports [57,63].
- The cork industry represents an important fraction of the national external trade, with around one third of the total exports of products of forest origin. The number of companies in this sector was 685 in 2018, with more than 8 thousand direct jobs [64–66].

However, despite all the difficulties and problems that exist in Portuguese forests, the impact that these have from the point of view of the national economy and, consequently, also from a social point of view, is very large. As evidence of this impact, it can be seen that the three largest national business groups have their industrial base in the forest and are world leaders in their sectors of activity, namely in the production of bleached pulp, cork products, and wood panels.

The importance of these issues is that Portugal still has a very high potential for the development of the forest value chain to be explored. Full utilization of the potential of the forest in the framework of a sustainable circular bioeconomy is an extraordinary opportunity to replace a growing number of products made from nonrenewable raw materials with products made from renewable resources. It is true that the rural fires of 2017 were catalysts for many changes already underway in the forest area, which will need time to generate effects. However, the focus was on risk management, which is important but also manifestly insufficient. The future Common Agricultural Policy (CAP) 2021–2027 represents the opportunity for strengthened funding, specific and targeted to these policies and approaches, but must be more ambitious. In this regard, the involvement of the State Budget must also be reinforced. Only with a clear and cohesive stake in the forest, with a combination of public and private investment, will national water availability and quality increase, will the rural economy be strengthened, will exports increase, and will climate changes be mitigated [67,68].

## 5. Conclusions

Portuguese forests play a fundamental role in the sustainable development of the country, since they are the basis of an entire value chain creation, which begins in the primary productive sector,



but which mainly has as a destination the export of products with high added value, such as those derived from cork or bleached pulp.

Management based on the sustainability of the resource allows the rural environment, where forests are inserted, to be able to establish populations, creating the conditions for them to thrive and contribute consistently to the creation of value and wealth for the country, and to alleviate imbalances between urban and rural areas.

However, it is necessary for the forest management policies undertaken in the period following the revolution of 25 April 1974 to be reviewed and adapted to the new reality, be it the supply of raw materials for industry, or the fight against rural fires, or an increasingly important adaptation to the phenomenon of climate changes, where the management perspective cannot be purely economic but must include the other components of sustainability, that is, the social and the environmental aspects.

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