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THE PORTUGUESE FORESTS

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The Portuguese Forests

Country level report delivered to the EFFE Project
-Evaluating Financing of Forestry in Europe-

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with the research assistance of

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Index

Chapter 1

Introduction

If in some areas this report could not overcome data gaps related to the objectives of the EFFE project, in other areas it goes beyond what it was necessary for the project. There are two reasons why I decided to expand on the version delivered within the deadline of 2002. One reason is that I think this can be providing a good service to those who are interested in the Portuguese forest sector. The other is that this may help to understand better the reasons behind the kind of programmes evaluated in the EFFE project.

Coming back to the first reason for organizing a report like this, I went this way because of what I have learned in a previous project. When I was rapporteur for the CESE group also the reports prepared at that time (CESE, 1996, 1998) were more comprehensive than the mandate of the group. Because of its comprehensiveness in putting together a lot of dispersed and sometimes unpublished data, and because of having filled in some data gaps, the report was welcomed by many people working and interested in the forest sector. The reason is that, in spite of being an important sector in the Portuguese economy, it was hard to find a presentation with that kind of coverage.

This need still exists today because, to my knowledge, since then no one has updated and improved upon that report of 1996. With the work for the EFFE project it was possible to do that and this is why the country report took this form. I hope it will help, now with the advantage of being accessible to a wider audience since it is written in English.

There are four areas that were covered in the CESE report but are not covered here: non wood forest products, policies related to forest fires, forest industries and forest education and research. One reason why these areas are not included it is because the updating is still not finished. The other reason is that most of the work I have been doing in these other areas falls outside the support provided by the EFFE, so that it would not be correct to report that work here in the first place.

One word about the title. As the report shows, there is not one, but, at least, three or four Portuguese forest sub-sectors, very different from each other in terms of the main tree species (maritime pine, eucalyptus, and cork oak), the socioeconomic characteristics of forestry and the structure and dynamics of the markets and related industries. The programmes evaluated for the EFFE project were major steps in the way forest policy dealt with each of those sub-sectors.

Finally, I cannot help closing this introduction without acknowledging the support from all the team of the EFFE project. I will start with all the great people at the European Forest Institute who made this possible and well conducted, in particular the project

coordinators, Andreas Ottitsch who got this ship going, and Krzysztof Kaczmarek, who so gently led the ship for most of the remaining journey, until the final destination. About the EFI team also a special word to Ilpo Tikkanen and Olga Zyrina. A special and very thankful to my home institution and my colleagues, Rafael Dias, Marisa Tavares and Diana Feliciano, who, in various occasions, and through different forms, provided good research assistance, Madalena Araújo who helped with the secretariat and Nuno Afonso who took good care of the financial matters. One word of appreciation for three persons in the Forest Services: Anabela Teixeira and Zita Costa , who provided valuable testimonies and information about the Portuguese programmes evaluated in this project, and João Teixeira, who participated in the Geneva workshop of the project..

Without the help of all this people and others that I may have forgotten this work would not have been possible as is. For the errors, omissions and other shortcomings this work may have, the responsibility is entirely mine.

Américo M. S. Carvalho Mendes

Chapter

2

Economic importance of forests

An important sector as a whole, but weakended by heterogeneity and fragmentation

Considered in the aggregate, the forest sector is one of the main sectors in the Portuguese economy on several counts:

- its share of the GDP is high by international standards (third in the EU after Finland and Sweden);
- the same is true about the share in total workforce;
- for more than one century the share of total exports has been consistently high;
- the forest sector includes the only activities where Portugal has a leading position at world level (raw cork production and manufacturing).

This importance, as a whole, is very hard to translate into collective and cooperative force at the policy level and at the level of coordinated strategies by major private stakeholders in the sector. The reason is that, in fact, there are not **ONE** Portuguese forest sector, but **THREE**, at least, all very different from each other in terms of species, forest ownership and management and forest industries and market structures:

- the sub-sector based on pine;
- the sub-sector based on eucalyptus;
- the sub sector based on cork.

To these three we can add a fourth one including the non wood forest products besides cork, and the forest public goods.

Another complicating factor has to do with the very high risks threatening forest resources, namely the risk of forest fires. The effective prevention and fighting of this risk demands intensive coordination and cooperation among all stakeholders, which are not easy to bring about given what we have just said, complicated by the unskipable fact that fire fighting, in Portugal, is the responsibility of a large number of local associations of volunteer fire fighters, not professional, and difficult to coordinate.

Another relevant fact to point out hindering entrepreneurship in the forest sector is that the current state of property rights in forestry is such that a significative amount of the total economic value of forest production is not internalised in revenues for the forest owners, as we

have shown in the previous chapter. What many of them actually get as revenues is too low to motivate and finance active management behaviours.

Gross total value of forest production in 2001[1]

Overview

According to our own estimates (Mendes, 2005a), non wood forest products and services (NWFP&S) represent the main component of the gross total value of forest production (wood, NWFP, recreation and environmental services):

a) Wood: 26, 96 %

b) NWFP&S: 73, 04 %

- Cork: 23, 21%

- other NWFP (resin, honey, fruits, mushrooms, plants, grazing and acorns): 25,54 %

- hunting: 7,91 %

- recreation: 0,62 %

- environmental services (carbon sequestration, soil, water and landscape protection): 15,76%.

Most of this value of NWFP&S corresponds to **marketable** goods which are already on the market, with the internalisation of the corresponding benefits by the forest owners, namely cork, resin, honey, fruits (pine nuts, chestnuts and carob), grazing and acorns for livestock production and some of the hunting. With the exceptions of mushrooms and some of the honey and game production, the main issue here is not so much to secure the property rights of the forest owners to ensure they can get a revenue from these products, but the fact that they are very unevenly distributed across the country. In fact, they are a significant component of the forest owners' income only in the Alentejo region where most of the cork production is located, as well as a good deal of the forestry based livestock production and hunting in areas with excludable access rights. This region is also the one where forestland ownership is more concentrated.

Another cautionary note to make about the economic importance of NWFPs is the same as for timber: they are all subject to a relatively high risk of destruction by forest fires. Given the level of this type of risk, the main priority for public policies and private stakeholders' strategies should be the protection of the existing resources against forest fires. Next may come securing forest owners' property rights on those products where they don't get benefits and there is a risk of overexploitation, namely mushrooms and game production. The other major front for action in terms of promoting the value of NFWP&S is in recreation. There is more and more "informal recreation" in forest areas which is not translated into increasing revenues for the forest owners and often ends up in aggravated risks for forest resources (careless behaviours of forest visitors contributing for the ignition of forest fires).

Finally there is the situation of the forest environmental services. Currently there is not yet any direct internalisation mechanism to pay forest owners for this kind of services. One may argue that there is a sort of indirect and partial internalisation through the public incentives allocated to the forest owners who apply for (re)afforestation grants. Also, a direct

[1] This section is a more detailed version of Mendes (2005a).

mechanism is in the pipeline, since the approval, in 1996, of the Forest Policy Law where it was established a Forest Fund to pay for this kind of services. The actual implementation of this fund had to wait until the aftermath of the large catastrophe of forest fires, in the summer of 2003. In the State Budget for 2004, the Parliament voted favourably an additional to the tax on fuels earmarked for the financing of this fund. The issue that is in the process of settlement is the institutional mechanisms for the management of this fund, which will rely on the Directorate General of Forests and Natural Resources and on the public institute in charge of the financial management of the EU structural funds for agriculture, forest and fisheries (IFADAP).

Economic value of forest products in Continental Portugal (2001)

Outputs	Physical production (intermediate or final)	Valuation method	Unit value (euros per physical unit)	Value of production (000 euros)
DIRECT USE VALUES				
WOOD FOREST PRODUCTS				543,594
Timber harvested				430,604
Pulpwood				
Coniferous	2,153,000 m^3 o.b.	Roadside market price	€19.54/m^3 o.b.	42,070
Broad-leaved	6,684,000 m^3 o.b.	Roadside market price	€31.70/m^3 o.b.	211,883
Saw-logs				
Coniferous	4,733,000 m^3 o.b.	Roadside market price	€33.42/m^3 o.b.	158,177
Broad-leaved	221,000 m^3 o.b.	Roadside market price	€41.89/m^3 o.b.	9,258
Other industrial wood	220,000 m^3 o.b.	Roadside market price	€41.89/m^3 o.b.	9,216
Fuelwood				37,273
Coniferous	286,000 m^3 o.b.	Roadside market price	€38.22/m^3 o.b.	10,931
Broad-leaved	488,000 m^3 o.b.	Roadside market price	€53.98/m^3 o.b.	26,342
Net growth in standing timber stock				75,717
Coniferous	2,060,000 m^3 o.b.	50% of the stumpage price	€19.53/m^3 o.b.	40,232
Broad-leaved	1,794,000 m^3 o.b.	50% of the stumpage price	€19.78/m^3 o.b.	35,485
NON WOOD FOREST GOODS				584,771
Cork harvested				390,726
Reproduction cork	128,000 t	Roadside market price	€2,937/t	375,936
Virgin cork	30,000 t	Roadside market price	€493 /t	14,790
Resin	15,444 t	Roadside market price	€200/t	3,089
Honey				7,619
Origin labelled honey production	172.5 t	Market price at producer group gate	€3,970/t	684
Other honey production	4,361.5 t	Average export price	€1,590/t	6,935
Fruits collected				53,310
Pine nuts	70,000,000 cones	Market price at farm gate	€0.20/cone	14,000
Chestnuts	26,118 t	Market price at farm gate	€997,6/t	26,055
Carob	31,500 t	Market price at farm gate	€272,3/t	8,577
Arbutus berries (Arbutus unedo)	15,130 ha x 200 kg/ha	Market price paid to pickers at distillery gate	€1,125/t	3,404
Elderberries (Sambucus nicra)	650 t	Market price paid to pickers	€1,960/t	1,274
Edible wild mushrooms picked up for sale	6,500 t	Market price paid to pickers	€2,500/t	16,250
Plants picked up for sale				1,400
Thyme, laurel and other cooking plants	80 t	Market price paid to pickers	€3,750/t	300
Aromatic and medicinal plants	1,100 t	Market price paid to pickers	€1,000/t	1,100
Forest goods for intermediate consumption in animal production				112,377
Acorns grazed by pigs in extensive rearing	51,450,000 FU	Surrogate market price	€0.1303/FU	6,704
Grazing resources under forest cover	673,900,000 FU	Surrogate market price	€0.1303/FU	87,809
Grazing resources in scrub land (consumption by goats)	137,100,000 FU	Surrogate market price	€0.1303/FU	17,864
Acorns and other products grazed by other animal species				No estimate
Net growth in the production capacity of non wood forest goods				No estimate, but probably positive
RECREATIONAL SERVICES				37,883
Hunting	219,005 hunters	Cost-based method		21,383
Informal forest recreation	6,000,000 day-visits	CVM	€2.75/day-visit	16,500
TOTAL DIRECT USE VALUES				1,166,248
INDIRECT USE VALUES				
Carbon storage	1,450,000 tC	Shadow pricing	€20/tC	29,000
Protection of agricultural soil				49,209
Protection of water resources	8,772,520 ha	Cost avoided method	€3.30/ha	28,934
Forest landscape and biodiversity conservation	594,509 ha	Cost based method	€95.36/ha	56,695
TOTAL INDIRECT USE VALUES				163,838
NEGATIVE EXTERNALITIES				
Damages caused by forest fires		Cost based method		136,850
Costs of fire prevention				17,350
Social costs of fire fighting				35,853
Losses of forest products burnt				38,320
Reforestation costs				45,327
Other forest externalities				No estimate
TOTAL NEGATIVE EXTERNALITIES				136,850

TOTAL ECONOMIC VALUE				1,193,236

Scope of the estimates

The scope of this estimation is the economic valuation of forestry **outputs** in Continental Portugal, including the non marketed ones. Some of these outputs contribute positively to the society's well being and therefore are counted as **social benefits**, while others contribute negatively, being counted as **social costs**. So, most of what we are doing here is to estimate the "resources" side of a forestry production account (in the national accounting sense of the word), extended to include some forest public goods and other non marketed forest goods and services (Bergen, 2001). In our case, there are also estimates of some of the "uses" side of the forestry production account when we evaluate the depreciation in forestry capital due to forest fires. With this exception, there are no estimates for the other items in the "uses" side of the production account. So we will not end up with an estimation of the net social value added of forestry, but only with partial information contributing for this type of value.

Timber and cork harvested production is evaluated at road side prices. This implies that we are dealing with the "resources" side of the consolidated production of forestry, logging and cork extraction activities. With this exception, there is no further consolidation of forestry with other related activities. More precisely, this means that we leave out of our production account hunting and animal production based on acorns and grazing resources from forest areas. What we will estimate here is the value of forest **outputs** which are intermediate consumption for those activities.

Timber harvested

Data for production of the different types of timber harvested come from the official agricultural statistics (INE, 2003e). These data published in cubic meters under bark were converted in cubic meters over bark using the following coefficients:

a) conifers: 1 m3 o.b. = 0,7 m3 u.b.

b) broadleaves: 1 m3 o.b. = 0,82 m3 u.b.

The source for prices is SICOP (SICOP, 2003), with the following notes:

they are road side prices for 2001;

price for coniferous pulpwood, saw-logs and fuelwood refers to maritime pine;

price for broadleaved pulpwood refers to eucalyptus;

price for broadleaved saw-logs refers to oak saw-logs[2];

price for other industrial wood refers to oak saw-logs;

price for broadleaves fuelwood is a weighted average of the roadside prices for eucalyptus, chestnut and oak fuelwood.

Net growth in timber stock

The following table presents our estimate of the net growth in timber stock based on data reported by DGF (DGF, 1999).

[2] Probably due to the small number of observations, the road side price reported in SICOP's leaflet for oak saw-logs in 2001 is lower than the stumpage price. However the information reported in SICOP's website gives a price lower than those two prices, but does not provide data on road side prices. So we kept the road side price reported in the SICOP's leaflet.

Net growth in timber stock in 1998 (1000 m3 o.b.)

	Increment	Timber harvested in 1998	Net growth in timber stock
Forest and trees out of forest	15 195	11 341	3 854
Coniferous	8 323	6 263	2 060
Broadleaved	6 872	5 078	1 794

We assumed that the net growth in timber stock in 2001 was the same as in 1998. Data for the timber harvested in 1998 come from the official agricultural statistics (INE, 2002d), after converting the cubic meters u.b. into cubic meters o.b., using the same coefficients as for timber harvested. For the evaluation of this flow we used half the stumpage prices for saw-logs, in order to take into consideration the fact that not all of the net growth in timber stock has an exchange value. This valuation does not include the annual variation in the value of timber stock as a carbon sink, which is a public good. This value will be taken into account in the estimate of the forest environmental services. The source for the stumpage price is SICOP (as reported in SICOP's website, http://cryptomeria.dgf.min-agricultura.pt, updated as of April 12, 2004), considering the price of maritime pine for the coniferous growing stock (SICOP, 2003) and the price of oak for the broadleaved growing stock.

Cork

Data for production of virgin and reproduction cork in 2001 come from the official agricultural statistics (INE, 2003e). The source for the road side market price ("preço de venda na pilha") of reproduction cork is SICOP's leaflet (SICOP, 2003). The price for the virgin cork is also SICOP, but the information was taken from SICOP's website, updated as of April 12, 2004. We assumed that the price reported there for virgin cork is a road side price.

Resin

Data for production come from the official agricultural statistics (INE, 2003e). The producer market price per kg for 2001 was calculated considering the producer market price per incision for 2001, according to SICOP (2003), and a production of 1,8 kg of resin per incision (Goes, 1991).

Honey

Valuation of honey distinguishes between origin labelled production and the other production. Production and price for the former (production and price) in 2001 come from the answers to questionnaires sent by Instituto de Desenvolvimento Rural e Hidráulica (Oliveira, 2004) to producer groups. The price refers to sales of those groups to wholesalers and other buyers.

Data for the other production were obtained by subtracting the origin labelled production from the total production of the country in 2001 (except 4 tons of production in Azores), as reported by official agricultural statistics (INE, 2003e). The price is the average export price in 2001 according to these statistics (INE, 2002d).

Pine nuts

There are no official data on the production of pine nuts since 1972. The volume of production used here is an estimate made by Alpuim *et al.* (1998), and not the actual production for 2001. The price for 2001 is the producer market price, according to SICOP (2003).

Chestnuts

The data for production and the market producer price in 2001 come from the official agricultural statistics (INE, 2003e).

Carob

There are no official data on carob production since 1977. According to the official agricultural statistics, the average annual production for 1968/77 was 43193 tons. Current opinions of local experts give estimations ranging from 28000 to 35000 tons. Here we will consider the average of these two bounds, that is, 31350 tons.

The producer market price for 2001 comes from the official agricultural statistics (INE, 2003e).

Arbutus berries

The area of the species comes from the first revision of the Forest Inventory referring to the period of 1969/74 (DGOGF, 1979). There is no published information for a more recent date. The production of berries per hectare comes from the book by Goes (1991).

The price paid to pickers at distillery gate is our own estimate based on a price of 15 € per litre of arbutus brandy, a transformation ratio of 100 kg of berries per 15 litres of brandy (Goes, 1991), and about 50% of the price of the brandy corresponding to the cost of berries at distillery gate.

Elderberries

Data on quantity is our own estimate of the average annual production for Continental Portugal based on local informants from the area where this species is more frequent (Vale do Varosa) presented in our contributions for the CESE report (CESE, 1996; Mendes, 1997c).

The market price paid to pickers is the price for 1995 obtained from local informants in that area inflated to 2001 according to the producer price index for agricultural products (INE, 2002d).

Mushrooms

Production is our own estimate for the average quantity of mushrooms picked and sold in the period 1997/99, based on information provided in the report prepared by ICN *et al.* (2001). The price paid to pickers is based on information collected in October 2000, from local sources, in the border regions with Spain where this activity is more intense (Paulino, 2000). This price is less than half the export price.

Plants

The production is our own conservative estimate based on the quantities exported in the period 1988-92, under positions 0910 and 1211 of the Foreign Trade Statistics. The averages for this period were 60,58 tons for cooking plants (with a maximum of 75,3 tons in 1992) and 822,58 tons for the aromatic and medicinal plants (with a maximum of 1027,5 tons in 1992). The market prices paid to pickers in 2001 are our own estimates.

Forest products for intermediate consumption in animal production

There are three types of forest goods to be considered as intermediate consumption for animal production:

- acorns;
- grazing resources under forest cover;
- grazing resources in scrub land;
- litter lying on forest ground.

Acorns

The main sources of acorns currently grazed by animals are the cork oak and holm oak stands in the Southern regions. For these stands the Forest Inventory of 1995 (DGF, 2001) give data on the total and the mean annual production of acorns which is reported in the following table. Not all this production is actually grazed by animals. For the farms surveyed in the project carried out by Moreira *et al.* (1995), the production of acorns grazed by pigs in extensive regime (*"porco de montanheira"*) is 37 kg/ha.year. This is about 5,5% of the mean production reported in the following table. Applying this percentage to the total production reported in that table, we get 22714 tons for the cork oak stands and 16903 tons for the holm oak stands which makes a total of 39617 tons. This estimate is possibly a lower bound of the amount of acorns grazed by pigs in extensive rearing. Another estimate can be made based on the number of pigs in this regime and their feeding needs. Still according to the same research project (Moreira *et al.*, 1995), in 1989 there were 6000 sows, each of these animals giving birth to 10 sucking-pigs per year. If 8 out of these 10 sucking-pigs go on for fattening up to the age of 2, this gives 48000 fattening pigs per year. If each of these pigs needs 1400 kg of acorns, we get a total of 67200 tons of acorns grazed by fattening pigs in extensive regime. We will take as an estimate for this kind of use of acorn production the quantity of 70000 tons per year.

Total and mean annual production of acorns in cork oak and holm oak stands in 1995

Species	Type of stand	Tons/year	Kg/ha.year
Cork oak	Pure	343034	579
	Mixed dominant	49517	411
	Mixed dominated	20424	177
Holm oak	Pure	266428	688
	Mixed dominant	31789	428
	Mixed dominated	9107	130

Source: DGF (2001)

To convert this quantity into forage units, we take as a basis the coefficients proposed by Vieira da Natividade (1950, p.317): 730 FU/ton for acorns from cork oak and 743 FU/ton for acorns from holm oak. Considering an intermediate value of 735 FU/ton, 70000 tons/year of grazed acorns correspond to 51450000 FU/year. This quantity of grazed acorns is a lower bound of the amount of acorns used in animal production because there are other animal species, besides pigs, in extensive regime, fed with this type of forest good. We will not attempt to estimate this kind of intermediate consumption of acorns. To value this forest good we used, as a surrogate market price, the price of barley for animal consumption in 2001, according to the official agricultural statistics (INE, 2002b), assuming the equivalence 1 kg of barley = 1 FU.

Grazing resources under forest cover

Based on information provided by the 1995 Forest Inventory (DGF, 2001) on natural and artificial grasslands under forest cover, we estimated their forage production, as reported in the following table. These areas were obtained from the Forest Inventory data by combining the areas per species, in table 107 of the DGF publication, for pure and dominant mixed stands only, with the distribution of land uses under forest cover (agriculture, natural grasslands, artificial grasslands and scrub lands) for those kinds of stands (table 210 in the DGF publication).

The mean annual production of forage in terms of dry matter (DM) is our own estimate, based on the information provided by Moreira (1980). The ratio of FU per kg of DM is also our own estimate: 0,3 FU/kg DM for the natural grasslands and 0,45 FU/kg DM for the artificial grasslands.

Estimate of the forage production of grasslands under forest cover in Continental Portugal, in 1995

Forest species	Natural grasslands				Artificial grasslands			
	ha	Tons DM/ha.year	Tons DM/year	10^3 FU/year	ha	Tons DM/ha.year	Tons DM/year	10^3 FU/year
Maritime pine	0		0	0	9761	3	29283	13177
Cork oak	46282	1	46282	13885	257715	2,5	644287,5	289929
Holm oak	22336	1	22336	6701	13443	2,5	623130	280409
Eucalyptus	0		0	0	249252	2,5	33607,5	15123
Other oaks	4690	2	9380	2814	8945	4	35780	16101
Stone pine	4101	1,5	6151,5	1845	6956	3	20868	9391
Chestnut	0		0	0	6670	4	26680	12006
Other broadleaves	0		0	0	6955	4	27820	12519
Other conifers	0		0	0	0	3	0	0
TOTAL	77409		84149,5	25245	559697		1441456	648655

With a total of 1441456 tons DM/year, 1365319 of which for cork oak and holm oak stands, it is possible to raise livestock equivalent to 1441456 heads of sheep. According to Moreira *et al.* (1995), in 1989, the livestock in the southern regions of *"montados"* (forest stands dominated by cork oak and holm oak trees), pigs excluded, corresponding to autochthonous races usually in extensive regime, amounted to a number of female adult animals equivalent to 1540330 heads of sheep. This is an indication that the estimate of forage production presented in the table above is probably of the same magnitude of the forage production actually used by livestock (pigs excluded) in extensive regime, at least for the Southern regions. To value this forest good we used, as a surrogate market price, the price of barley for animal consumption in

2001, according to the official agricultural statistics (INE, 2003e), assuming the equivalence 1 kg of barley = 1 FU.

Grazing resources in scrub land

According to Rego (1991) the mean forage production of scrub lands is 1,5 tons DM/ha.year. According to the 1995 Forest Inventory there were 2054571 ha of scrub lands. Applying that coefficient we get a total of 3081857 tons DM/year. Considering a ratio of 0,5 FU/kg DM (Sá, 1978), we get a total of 1540928500 FU/year. Most of this production is left without use by animals, contributing to forest fires. The animals more likely to consume this type of vegetation are goats. In Continental Portugal, in 2001, there were 544000 animals of this species (INE, 2002d). Assuming that each of them consumes 300 FU per year from this kind of grazing ground, we get a total of 137100000 FU. It is this amount that we considered to have been used in 2001 for animal production.

Litter lying on forest ground

Litter made of leaves and fallen branches lying on forest ground is a product that can be consumed by livestock, at least partially. Another part of those materials are needed to maintain the fertility of the forest soils. What is unused for these purposes contributes to the risk of forest fires.

Based on the coefficients proposed by Rego (1991) and the areas of forest in the 1995 Forest Inventory, the annual production of litter is the following:

a) production in cork oak and holm stands

1174390 ha X 1 tons DM/ha.year = 1174390 tons DM/year

b) production in other forest stands

2026741 ha X 2,5 tons DM/ha.year = 5066853 tons DM/year

We get a total of 6241243 tons DM/year. The equivalent in FU using the coefficient of 0,6 FU/kg DM (Sá, 1978) is 3744745800 FU/year. We will assume that all this production is left on the ground, or burns in forest fires.

Comparison between the value of forest goods used as intermediate consumption in animal production and the value of animal production

Since grazing resources are the non wood forest goods with more value, after cork, it is a good idea to verify, with a different method, whether the order of magnitude of our estimate is reasonable or not. In national accounts, the 112377 thousand euros of estimated value of forest products used in animal production in 2001 are part of the value of animal production and not part of the value of forest production. That amount should be compared to the following components of animal production:

a) value of meat, milk and cheese from goats;

b) value of origin labelled meat and cheese;

c) value of origin labelled meat from bovines;

d) value of origin labelled meat from pigs.

According to the official agricultural statistics (INE, 2003e), the value of meat production from sheep and goats in 2001 was 162950 thousand euros. According the to

questionnaires sent by Instituto de Desenvolvimento Rural e Hidráulica (Oliveira, 2004) to the producers' groups of origin labelled products, we get the following information for 2001:

a) value of origin labelled meat products from bovines and pigs: 11720 thousand euros;

b) value of origin labelled cheese from sheep and goats: 12757 thousand euros.

Adding up these values, we get a total of 187427 thousand euros for the animal production likely to be dependent grazing products from forests and scrub lands. In this case, the 112377 thousand euros we estimated for the value of these forest products may be a reasonable approximation.

Net growth in the production capacity of non wood forest goods

The net growth in the production capacity of non wood forest goods was not estimated. Here, we will provide only some qualitative information about the trends in this forest resource.

Cork harvesting is an activity subject to regulations preventing removals from going beyond the level required for the sustainable management of the species. Since industrial demand for this product takes all that can be harvested in this way, there are no reasons to believe that there is a significant amount of cork remaining in the forest which could have been harvested in a sustainable manner. Since the end of the 1930s the area of this species did not change substantially, but there were considerable improvements in the quality of the stands during a programme carried out by the Forest Services in the late 1950s. Also, since the mid of the 1980s, there has been a renewal and expansion of the cork oak stands due to favourable financial incentives provided by EU co-funded programmes. So, due to these factors, the future trends in the productive capacity of cork oak stands are likely to be positive.

Concerning pine nuts, chestnuts and carob, the demand is in tandem with production harvested, with no reasons to believe that harvest is going beyond levels required for sustainable management. These species have also benefited from the public financial incentives existing since mid 1980s. So, the conclusion, for this group of products, is similar to the case of cork.

As far as mushrooms are concerned, there are situations of overpicking, but there are also areas of underpicking where there are no workers available and willing to do this job. Therefore it is difficult to make a well founded guess about the trend in the production capacity of this product.

With respect to resin, honey, arbutus berries, elderberries, plants, acorns and grazing resources, there are reasons to believe that the trends in production harvested may not be following the trends in the production capacity. Starting with resin, the situation is the following:

a) a sharp decline in resin tapping since the mid 1980s: from 115243 tons on average per year in the period 1980/86 to 21326 tons in the period 1996/2002;

b) a decline in the area of maritime pine not as large as the decline in resin tapping: from 1252300 ha in the second revision of the Forest Inventory (1980/85) to 976060 ha in the third revision (1995/98), the declining continuing in more recent years because of forest fires (47264 ha of maritime pine burnt from 1996 to 1999, according to the Forest Services).

So, in the case of resin, there is a decline in production capacity due to this reduction in the area of pine caused manly by forest fires, with no overuse of the resource.

For the other products (honey, berries, plants, acorns and grazing resources), production harvested is below potential production. So production capacity is probably growing, not only because there no overuse of the resource, but also because of the growth in forest and other wooded land related to farmland abandonment.

The global conclusion is that the net change in production capacity of non wood forest goods is probably positive.

Value of gaming resources imputable to forests

We are going to estimate here the value of forest outputs used by hunters. A lower bound of this value can be obtained through a cost based approach which includes the amounts paid by hunters to have access to forest areas for hunting (hunting permits, membership fees paid to be part of associative hunting areas and amounts paid for game and gaming services in hunting zones with excludable access).

Value paid for hunting permits

The values paid by hunters for the different types of hunting permits in the hunting season 2001/02 are the following, based on the prices of those permits and the numbers of permits issued for that season, according to DGF:

a) National hunting permits for residents: 24,94 €/permit X 133593 permits = 3331809 €

b) Regional hunting permits for residents: 12,47 €/permit X 85412 permits = 1065088 €

c) Hunting permits for non residents: 44,89 €/permit X 1857 permits = 83361 €

d) Special hunting permits for big game: 29,93 €/permit X 32851 permits = 983230 €

This makes a total of **5463488 €**.

Gates, posts and other gaming services paid by hunters in hunting zones with excludable access

The main basis for this estimate is the survey carried out by Cipriano (1999), referring to the hunting season 1996/97. The values reported by Cipriano were converted from escudos into euros and then inflated to 2001 using the consumer price index for leisure, recreation and culture, as of December 2001, base 100=1997, which is equal to 103,9, according to official statistics. From Cipriano's survey we get the following values for 1996/97 concerning the average expenditures per hunter in hunting zones with excludable access (touristic, associative and social), that is the amounts paid by hunters for gates, posts, game management and other gaming goods and services:

- touristic zones: 130 thousand escudos per year (673,70 € in 2001/02);

- associative zones: 60 thousand escudos per year (310,95 € in 2001/02);

- social zones: 20 thousand escudos per year (103,65 € in 2001/02).

- national zones: no data.

To complete this calculation we need to know how many hunters go to each type of hunting zone. We will assume that the distribution reported by Cipriano for 1996/97 is the same as for 2001/02. This may yield a conservative estimate of the value for this item because the associative zones expanded since 1996. The data reported in the annex of Cipriano's thesis

provide the following pieces of information about the respondents to this question in his sample:

a) 17 % go only to zones with excludable access (touristic, associative, social or national);

b) 44, 4 % go only to zones in the "general" regime (free access);

c) 38, 6 % go to both types of zones.

The distribution of hunters by the different types of hunting zones with excludable access, as reported in the annex of Cipriano's thesis is ambiguous because it may include some double counting. Assuming that it is not the case, the distribution is the following for the total of respondents:

a) touristic: 16,7 %;

b) associative: 64,7 %;

c) social: 2,5%;

d) national: 16,1%.

Cipriano does not report the combined result of these two distributions. So to proceed with the calculation we need to rely on some assumptions. The assumptions we made are explicit in the following calculations where we consider the total number of 219005 hunters with permits in the hunting season 2001/02, as reported by DGF.

a) expenditures for hunters who only go to one type of zone with excludable access:

0, 17 X 0,167 X 219005 X 673, 70 € = 4188765 €

0, 17 X 0,647 X 219005 X 310, 95 € = 7490275 €

0, 17 X 0,025 X 219005 X 103, 65 € = 96474 €

0, 17 X 0,161 X 219005 X 103, 65 € = 621295 €

b) expenditures for hunters who go to both types of zones (with excludable and non excludable access):

0,386 X 0,167 X 219005 X 0,5 X 673,70 € = 4755480 €

0,386 X 0,647 X 219005 X 0,5 X 310,95 € = 8503666 €

0,386 X 0,025 X 219005 X 0,5 X 103,65 € = 109527 €

0,386 X 0,161 X 219005 X 0,5 X 103,65 € = 705353 €

This makes a total of **26470835 €**.

Membership fees paid by hunters in associative hunting areas

Each hunter in Cipriano's survey who was member of an associative hunting area paid no more than 40 thousand escudos per year (207, 30 € in 2001/02) in membership fees. For a total of 96072 hunters belonging to these zones in 2001 (Bugalho & Carvalho, 2001), this amounts to **19915725 €**.

Value of hunting imputable to forests

Forests are very important for game feeding, but they are not the only places where game goes for eating. Agricultural areas and uncultivated lands also have that function. A crude, but simple criterion to impute the value of hunting to forests, is to multiply it by the

percentage of forests and other wooded lands in the total area with hunting capacity, which is 8121969 ha, according to DGF (Bugalho & Carvalho, 2001). This amounts to 41,24%, for the 1995 forest area.

Adding up the different components estimated above we get a total of 51850048 €. Considering 41, 24% as imputable to forests, this amounts to **21382959 €**.

Informal forest recreation

Number of day.visits to forest areas

There are no surveys providing data for the whole country about the number of day.visits to forest and other wooded lands for recreational purposes. Based on data obtained from the official statistics on tourism, for 2001 (INE, 2002e, 2003f), we have the following information about camping and rural tourism:

- the number of days of stay in camping grounds;

- the number of nights spent by guests in rural touristic facilities.

It is reasonable to assume that one of the motivations of most campers is to look for a tree covered place, since almost all camping grounds are under forest cover. Certainly they may have other motivations such as going to a beach near by, or meeting with friends who go to the same camping ground. In order not avoid an overstatement of this case for staying in forest areas, we will consider the total number of days of stay in camping grounds in all regions of Continental Portugal, except Algarve, since here, being close to the beach is certainly, the overwhelming motivation for camping. This makes a total of 4 608 078 day.visit for the other regions.

According to the same source, the number of nights spent by guests in rural tourist facilities in 2001 was 384098.

These numbers don't include a large and increasing number of urban people who visit forest areas on weekends and holidays without camping or staying in rural cottages. A very rough estimate of this type of demand can be made as follows:

a) we assume that this type of demand comes mostly from the residents in the two metropolitan areas of Porto and Lisbon, where lived 1179004 households, in 2001 (INE, 2003d);

b) assuming that half of these households go out of town once per year for a ride in a surrounding forest area, and counting just one day.visit per household, gives a total of 589502 day.visits.

Adding up these estimates, we get a total of 5 581 678 day.visits to forest lands. This number can be round up to 6 **millions days.visits** without risk of overestimation.

Willingness to pay per day.visit

The willingness to pay per day.visit is based on the only empirical study we could find for the recreational value of a Portuguese forest area. This study (Loureiro *et al.*, 1996) estimates the value the visitors were willing to pay to have access to a forest reserve in the Terceira Island of Azores, in 1995, in the hypothetical case where that space was fenced. Using a contingent valuation method, the authors found a mean value of 480 escudos per day.visit. Based on this study, we assume an willingness to pay for recreation in forest and other wooded lands in Continental Portugal as being equal to **2,75 €/day.visit** in 2001.

Total value of informal recreation

5000000 day.visits multiplied by 2, 5 €/day.visit makes a total of **12500000 €**.

Carbon storage

According to estimates presented in the Global Forest Resources Assessment 2000 for Portugal (UNECE & FAO, 2000), the net annual increment of carbon storage in woody biomass of Portuguese forests amounts to **1450000 ton C/year**. If we evaluate this flow at the mean social cost of carbon emissions of 20€/ton C estimated by Fankhauser (1995, p. 64) for the decade 1991-2000, we get a value of **29000000 €**.

Protection of agricultural soil

For the evaluation of the services provided by forests concerning soil protection we will consider here only the protection of agricultural land, starting with the regions where the risk of desertification is higher. These regions are Trás-os-Montes, Beira Interior and Alentejo. According to Poeira *et al.* (1990), in Alentejo the erosion of agricultural soil is somewhere between 5 and 10 tons/ha.year. Considering an apparent specific weight for sediments of 1,5 tons/m^3, this makes a total of 3,333-6,666 m^3/ha.year. Assuming a depth of 30 cm for agricultural soil, that amount of erosion represents an annual rate of soil loss between 0,111% and 0,222%. Here we will take the average of those two rates, that is, 0,165%. An assumption we will make is that this rate is also the corresponding rate of loss in agricultural production.

To proceed with this estimation we need another assumption about the contribution of forests to reduce agricultural soil erosion. Based on the work of Rocha *et al.* (1986), we will take as being equal to 2/3 in these regions the ratio of erosion with current forest to the erosion without forest cover.

Combining the previous assumptions, the value of crops preserved due to the protection of soil provided by the current forest cover is equal to $\frac{1-2/3}{2/3} \times 0{,}165\% \times$ gross value of crops.

Estimate of the value of crops preserved in the year 2000, due to the soil protection provided by forests (in 1000³ €)

	Gross value of crops in the year 2000	Gross value of crops preserved in the year 2000, due to the soil protection provided by forests
Trás os Montes	526260	434
Beira Interior	236470	195
Alentejo	531970	439
TOTAL	1294700	1068

Source of the gross value of crops in 2000: INE (2003a).

If the losses of crops due to erosion were irreversible, for a 2% discount rate, the value of 1068000€ in the table above would correspond to a capital loss avoided of 53400000€. If an amount of losses equal to v last for n years, the corresponding capital loss V_n is given by the following expression:

$$V_n = v\left[\frac{1-(1+r)^{-n}}{r}\right]$$

Considering a period of 50 years as being needed to recover from soil losses due to erosion and a 2% discount rate, we get a value of 33560000€ for the loss avoided every year in agricultural capital due to the existence of the current forest cover in the three regions more at risk of desertification.

We would need data on soil erosion in the other regions to extend there this kind of estimation. We simply know that the risk of desertification is lower in those regions. Let's assume that it is about one third of the rate of soil erosion in the three regions considered before, that is, 0,055% per year. Using the same kind of calculations for those regions, with a gross value of crops of 1812470000€ in the year 2000 (more recent year for which there is this kind of data at the regional level), we get a value of 15649000€ for the loss avoided every year in agricultural capital due to the existence of the current forest cover. This makes a total of 49209000 € for the whole Continental Portugal.

Protection of water resources

Concerning the protection of water resources by forests, the evaluation method we used is based on the **public costs of watershed management avoided by the existence of forests**. These costs should be viewed only as lower bound for the benefits that can be imputed to forests because of their role in the conservation of soil and water resources.

Total public costs of watershed management for the Portuguese international rivers planned for the period 2001-2020

Watershed	PO3 (1000^3 esc.)	PO4 (1000^3 esc.)	PO5 (1000^3 esc.)	PO6 (1000^3 esc.)	Total cost for 2001-2020 (1000^3 esc.)	Annual cost (1000^3 esc.)
Minho	980000	206000	857500	630000	2673500	133 675
Lima	391000	1021000	63000	2076000	4118000	205 900
Douro	1498000	763000	578000	10572000	18613000	930 650
Tejo	11739000	822000	450000	15910080	28921080	1 446 054
Guadiana	1459800	7840000	2914900	1250000	13464700	673 235

From the information contained in the Watershed Plans for the main watershed basins (INAG, 2000), we obtained the total public costs of the following operations, as planned for the period 2001-2020:

a) protection of ecosystems (PO3);

b) flood prevention (PO4);

c) fish and wildlife management (PO5);

d) water management(PO6).

Rates of forest cover and forest cover correction factors for soil erosion rates

Watershed	Total area (1)	Forest area (2)	(2)/(1) %	C	(1-C)/C
Minho	79 926	29 415	36,8%	1/3	2
Lima	117 219	34 686	29,6%	2/3	1/2
Douro	1 853 929	505 950	27,3%	2/3	1/2
Tejo	2 432 850	1 124 274	46,2%	1/3	2
Guadiana	1 146 011	344 198	30,0%	2/3	1/2
Rest of Continental Portugal	3 142 585	1 310 804	41,7%	1/3	2
CONTINENTAL PORTUGAL	8 772 520	3 349 327	38,2%		

The following step was the estimation of the value of those costs if the watershed had no forest. We assumed that the watershed management costs with current forest cover are in the same proportion of the watershed management costs without forest cover as the ratio of erosion with the current forest cover is to erosion without forest cover. The table above presents the values we used for this ratio (C) taking into account the rate of forest cover in each watershed calculated with data from the 1995 Forest Inventory as reported by the DGF software AreaStat, and data taken from the work of Rocha *et al.* (1986) on soil erosion. The last column in the table above is the coefficient by which we have to multiply the costs in the last column of the table before that one in order to get the amount of public costs annually avoided in watershed management due to existence of the current forest cover.

Estimate of the annual public watershed management costs avoided due to the existence of the current forest cover (1000[3] esc.)

Watershed	Annual costs with current forest cover for the period 2001-2020	Annual costs avoided for the period 2001-2020 due to the existence of the current forest cover	
		Total	Per ha
Minho	133 675	267 350	3,345
Lima	205 900	102 950	0,878
Douro	930 650	465 325	0,251
Tejo	1 446 054	2 892 108	1,189
Guadiana	673 235	336 618	0,294
Rest of Continental Portugal		3 736 534	1,189
CONTINENTAL PORTUGAL		5 800 885	0,661

The results of this estimation for each watershed are reported in the table above. Since the Watershed Management Plans on which we based this estimation are from 2000, we keep it as is, without correction for inflation. Converting into euros, we get a value of 28934000 €.

Forest landscape and biodiversity conservation

Forest landscape conservation in protected areas

The only study available in Portugal estimating the willingness to pay for forest landscape conservation is Santos's PhD dissertation (Santos, 1997). Using CVM, he estimated the willingness to pay of visitors to the Peneda-Gerês National Park for three different programmes of rural landscape conservation. One of the programmes deals specifically with forests, more precisely oak forest conservation. The best point estimate he got for the year 1996 was 6634 escudos per household and per year (Santos, 1997, p. 587). Based on the total number of households visiting the park between September 1995 and August 1996, he arrived to an aggregated willingness to pay of 397,377 millions of escudos per year (Santos, 1997, p. 590).

Unfortunately we have no studies of this kind for the other forests under a legal protection status or without this type of protection. Anyway, we will build up from this case to come up to an estimate for the whole Continental Portugal. The total area of forests under a special protection status, including the Peneda Gerês National Park, in the year 2000, is the one presented in chapter 2. Considering these forests only, we can get an aggregate benefit of forest conservation schemes based on Santos's case study for Peneda-Gerês if we convert his result into a willingness to pay per hectare and multiply it by that total area of forest under a special protection status. This is obviously based on a bold hypothesis since what we are assuming here

is that, for the protected forests outside the Peneda Gerês National Park, the characteristics of the visitors, the frequency of their visits and the characteristics of the areas are such that the benefit of forest landscape conservation schemes converted into a per hectare basis is the same as in that national park. To proceed in this manner, we need data on the area of forest and other wooded land in the Peneda-Gerês National Park which are not available. We estimate this area at about 60000 ha, natural pastureland included. Taking a conservative approach and dividing the aggregate willingness to pay by this whole area, we get 6623 escudos per hectare. Multiplying by the 594509 ha of forest and other wooded land existing in the Nature 2000 sites, the aggregate willingness to pay for their conservation is 3937,433 millions of escudos for 1996. Updating this value to 2001 prices, by using the consumer price index for recreation, leisure and cultural services, as of December 2001, base 100=1997, which is equal to 103,9, we get an aggregate willingness to pay of 3937 millions of escudos, that is about 20405000 €.

Public expenditures with forest landscape and biodiversity conservation

The official statistics on environment (INE, 2003g) report data on investment and operating expenditures with landscape and biodiversity conservation by the Public Administration (Central Administration, municipalities and public institutes), and the public non profit organisations. Even though the data published do not include an explicit breakdown of those two types of expenditures consolidated for these different kinds of institutions in Continental Portugal, based on what is published there, we estimate that, in 2001, the amount of public operating expenditures for this part of the country is about 145000000 €. Certainly not of all this refers to forest and other wooded land, even though most of it probably was aimed at this kind of areas. A conservative estimate of the amount of those expenditures concerning forests and other wooded land can be obtained considering the percentage of forests in the total area under some protection status which is 39,1%. Therefore we estimate the public expenditures with forest landscape and biodiversity conservation in 2001 as being about 56695000 €.

We will not estimate the contribution of public investment expenditures in landscape and biodiversity conservation for the increase in the capacity of forest areas to provide this kind of services. So what we get here is a lower bound for the cost based estimate of these services.

Adding up those 56695000 € with the 20405000 € estimated above for forest landscape conservation in protected areas would be double counting. So we will take the former value as our estimate for these services.

Forestry negative externalities

Costs of forest fires

In 2001, for a total of 866 forest fires for which it was possible to find out the cause of ignition, in 95,2% of the cases this cause was human:

a) negligent uses of fire (burning of grasslands, picnicking, rockets, cigarettes, etc.);

b) accidental ignition due to the operation in or near the forests of farm or forestry machinery, vehicles, trains, and electric lines;

c) conflicts about hunting;

d) criminal fire starts.

From this set of causes we can conclude that forest owners are seldom among the initiators of forest fires, even though they bear part of the costs of these events, together with other people in society (volunteer fire fighters, tax payers, etc.) who are also not responsible for fire starts. So the costs of most of the forest fires in Portugal may be considered negative externalities born by the forest owners and other people in society who share those costs with them. We are now going to estimate some of the components of these costs.

Costs of forest fire prevention

There are five main stakeholders in the forest fire prevention system:

- the non industrial private forest owners;

- the pulp and paper companies;

- the Ministry of Interior;

- the Ministry of Agriculture;

- the municipalities.

In recent years the pulp and paper companies spent more than 3000000 € per year in this kind of operations (CELPA, 2003). In 2001, the Ministry of Interior spent 8146877 €, most of it in transfers to forest owners' associations and municipalities for fire prevention actions (MAI, 2003). Out this funding by the Ministry of Interior, 3120309 € were allocated to the co-funding of brigades of fire sappers managed by forest owners associations. We estimate that this co-funding represents about 50% of the total operating costs of those brigades.

Through the EU-cofunded programmes of the Ministry of Agriculture there were 3083000 € transferred to public and private beneficiaries in the year 2000 to support forest fire prevention (MADRP, 2001b). We have no data for 2001, but we can assume the same amount as in the year 2000. We have no data on how much the Ministry of Agriculture spent from its own funding in running its network of forest fire detection.

Adding these four components we get a total of **17350000 €**, which is a lower bound for the social costs of forest fire prevention in 2001.

Social costs of forest fire fighting

There are three main stakeholders in terms of costs of forest fire fighting:

the Ministry of Interior from where comes most of the public funding for this purpose transferred to the local fire departments, or spent in the location of airplanes and helicopters;

the local fire departments, the large majority of which are based on volunteers;

the pulp and paper companies.

In 2001 the Ministry of Interior spent more than 21000000 € in forest fire prevention and fire fighting (MAI, 2002), through its special agency in charge of supervising the fire departments (SNB-*Serviço Nacional de Bombeiros*). This money was spent directly by SNB and spent indirectly through transfers to the local fire departments. The source of this information does not specify how much of this amount was allocated to fire prevention and to fire fighting. If we subtract from that amount the 8146877 € spent by the Ministry in fire prevention, we get around **12853000 €** for fire fighting. That source of information also does not provide data on how much of that funding by the Ministry of Interior goes to the local fire departments, and how much is the matching funding added by these departments.

As far as the pulp and paper companies are concerned, they spent more than **1500000 €** in fire fighting (CELPA, 2003).

To complete this estimation we need to calculate the opportunity cost of the time spent in this activity by volunteer fire fighters who have alternative productive occupations. In 2001 there were 26942 forest fires, according to DGF. A conservative assumption is that there were, on average, 20 fire fighters per fire, each of them loosing one of productive work per fire. This is equivalent to 2700 full time workers per year. In the Portuguese economy, in 2001, the value added per full time worker was 21236,3 € for the whole economy and 7955,33 € for the branches of agriculture and forestry. Assuming that the volunteer fire fighters with productive occupations with the same labour productivity as in the branches of agriculture and forestry, the value added lost because of the time they have spent in fire fighting, in 2001, amounts to about **21500000 €**.

Costs of losses in wood and non wood forest production

DGF estimates that the losses of wood production due to forest fires in 2001 amount to **38320000 €** (DGF-CNGF, 2003). DGF does not provide estimates for the losses in non wood forest products. One could think of using the estimates of the value of this production for 2001 as a basis for calculating these losses. The problem here is that the areas more affected by forest fires are not the ones from where come the more valuable non wood forest products. So if we followed that path there would be overestimation of these losses. Therefore, without further information on the incidence of fires on these products, no estimate of these losses will be made here.

Costs of the restoration of burnt forests

According to DGF, the area of forests burnt in 2001 was 45327 ha. Reforestation through installation of new plantations would cost about 2250 €/ha. Reforestation can also be done through management of natural regeneration (in the case of pine forests) and improvement of the stands resulting from that. In this case reforestation costs would be lower: 1000 €/ha, or less. Using this unit cost, we get a total of **45327000 €/ha**.

Other negative forest externalities

Other possible negative forest externalities which will not be estimated here are the following:

- erosion, floods, and landslides due to poor forest management;

- loss of landscape quality and recreational opportunities due to poor forest management;

- loss of biodiversity and landscape quality and other losses due to intensive forestry;

- damages due to pest infections.

By far, the main consequence of poor forest management in Continental Portugal is the increase in the risk of forest fires. So, some of the consequences of this kind of management are already covered by the estimation presented in the previous section.

Conclusions

Taken as an aggregate, the non wood forest products come out of this estimate as the main item in the total economic value of forest production in Continental Portugal (584771000 €), cork standing out as the main contributor to this value (390726000 €). Still in this group of the non wood forest products, acorns and grazing appear as the second major element (112377000 €) whose value is not imputed to forestry in national accounts as forest final production, since they are intermediate consumption in livestock production.

The estimation of forest indirect use value is incomplete, as well as the estimation of forest negative externalities. However, from what we could do here, the conclusion is that the costs of forest fires eat up the whole social value of forests in terms of carbon storage, and protection of agriculture soils, water resources and landscape quality.

Contribution to GDP

In Portugal, in 1998, the forest sector represented 2,93% of the GDP, which makes it **one of the top sectors in the economy in terms of value added.**

Gross value added of the forest sector (at current base prices, in 10^6 euros)

		1995	1996	1997	1998	1999	2000	2001
Forest Sector	Forestry	647	598	562	609	641	781	744
	Forest industries (except furniture)	1 652	1 388	1 490	1 591	1 611		
	(1) Total	2 299	1 986	2 052	2 200	2 252		
(2) All sectors		70 292	74 844	80 791	87 158	92 813	99 798	106 169
(1)/(2)		3,27 %	2,65 %	2,54 %	2,52 %	2,43 %		

Notes: forestry corresponds to branch 02; forest industries include branches 20 (wood and cork processing industries, except furniture) and 21 (pulp, paper, paperboard, and paper and paperboard products)
Sources:
a) 1995-99: INE (2003c);
b) Gross value added for all sector in 2000 and 2001: INE (2003c);
c) Gross value added of forestry in 2000 and 2001: INE (2003b).

Employment in the forest cluster

Underestimation of forest employment in official statistics

Official statistics underestimate the employment in forest sector. For this reason, we corrected and expanded those data for one year (1995) for Continental Portugal. The results show that the **forest cluster** (forestry, forest industries, other forest related industries, forestry and forest industries' related services) gave work to **227794** persons, which is **5, 13**% of the total employment. This number is broken down as follows:

- forestry, logging, hunting and related services: 34290 persons
  (8000 of which in hunting and game propagation)
- forest industries: 69337 persons
- other forest related industries: 80923 persons
- other forest related services: 43244 persons

To see how official data **underestimates** employment in the forest cluster here are the values for these variables according to a recent paper issued by major international organisations such as ILO, UNECE and FAO, based on EUROSTAT and UNIDO databases which, in turn, rely on national official statistics (Blombäck, Poschen & Lövgren, 2003):

- forestry, logging and related services: 13700 persons
- forest industries: 65067 persons

- other forest related industries: no data
- other forest related services: no data

The following table taken from a recent piece of national official statistics provides further evidence that official data underestimates employment in the forest sector.

Employment in forestry and forest industries
(number of employees in equivalent full time workers)

		1995	1996	1997	1998	1999
Forest Sector	Forestry	10 700	11 000	11 100	11 200	11 600
	Forest industries (except furniture)	72 000	70 400	71 200	73 400	71 500
	(1) Total	82 700	81 400	82 300	84 600	83 100
(2) All sectors		4 403 900	4 472 100	4 545 400	4 677 700	4 751 000
(1)/(2)		**1,87 %**	**1,82 %**	**1,81 %**	**1,81 %**	**1,75 %**

Notes:
a) forestry corresponds to branch 02;
b) forest industries include branches 20 (wood and cork processing industries, except furniture) and 21 (pulp, paper, paperboard, and paper and paperboard products)
Source: INE (2003c).

Relative position of the forest cluster in total employment

Now some data for comparison between employment in the forest cluster and employment in the other main clusters of the Portuguese economy, in 1995 (INE, 2003c):

a) agriculture and food industries: 698600
b) wholesaling and retailing: 596400
c) construction: 365500
d) non marketed services of Public Administration: 358800
e) textile and clothing industries: 287000
f) education and research: 257100
g) marketed services to private companies: 196600
h) equipment goods: 139900

As we can see, the forest cluster is one of the most important in terms in employment.

Estimation of employment in the forest cluster in 1995

We are now going to present in detail the results of our estimation, as well as the sources of data and the methods followed to fill in the data gaps[3].

1. ***Forestry and logging***: estimate made with contributions from Victor Louro of the Forest Institute, for an annual production of 14 300 000 m^3 of pine wood and eucalyptus wood (average for 1991/93), assuming that a worker can extract 6 m^3 per day and works 240 days per year.

2. ***Forest contractors***: estimate based on the following sources:

- number of firms: C. A. Loureiro (1995);

- number of workers per firm: estimate made with contributions from Rodrigo Corrêa de Sá, General Secretary of the National Association of Forest and Agricultural Contractors, based on the average number of permanent workers (administrative staff and machine operators) per firm, excluding seasonal workers.

[3] This is an expanded and updated version of our contribution for the CESE report (CESE, 1996, 1998).

3. *Cork oak related activities*

a) Permanent workers: AGRO.GES (1997);

b) Seasonal workers: full time equivalent of 10000 seasonal workers referred in the AGRO.GES report (1997), assuming each of them works 5 months per year.

The following activities are not included: transportation of cork from the farm to the factory, forest guards, and guards of hunting reserves, operation of forest nurseries, staff in the Forest Services in cork oak related activities and staff in the forest owners' associations in cork oak areas.

Employment in activities directly related to cork oak

ACTIVITIES		NUMBER OF JOBS
PERMANENT WORKERS	Cork harvesting and complementary activities	2 600
	Cork oak prunning and other regular silvicultural operations	500
	Transportation of cork from farm to factory	277
	Charcoal	100
	Livestock rearing	1 500
	Guards (forestry and gaming)	150
	Operation of nurseries, Forest Services, Forest owners' associations	200
	TOTAL	5 327
SEASONAL WORKERS		10 000

Source: AGRO.GES (1997)

4. ***Resin tapping***: estimate based on the number of seasonal workers referred in the article by Manuel Gil da Mata (1990), (8000 for 9 months, in 1988), taking into account the decline in resin tapping observed since 1988.

5. ***Haulage and transportation of timber and cork***: estimate made with contributions from João Soares (SOPORCEL) based on the number of round trips (from forest to factory and back to forest) assuming 60 km per trip for pine and eucalyptus wood and 200 km per trip for cork, one day of work per round trip and 240 days of work per year.

6. ***Game propagation***: number of workers in the game propagation firms supplying the associative hunting areas, according to FENCAÇA (*in* Público, 15/8/96, p.4).

7. ***Game gards***: estimate based on the number of areas under the special hunting regime in the hunting season of 1993/94 (1675).

8. ***Operation of forest tree nurseries***:

a) nurseries operated by the Forest Institute: data collected directly from the institute/

b) private nurseries (registered and not registered): estimate made by Victor Louro, from the Forest Institute.

9. ***Manufacture of wood and of products of wood and cork, including furniture and import and export of timber***: estimate of the employment in the firms affiliated to Associação das Indústrias da Madeira e do Mobiliário de Portugal (AIMMP, 1996) and to Associação de Industriais da Madeiras do Centro, based on data collected directly from these associations on the number of firms and their distribution by employment size.

This estimate is far above the official data for this industry, but is closer to the estimate made up Jakko Pöyry (1990) which amounts to 60000 workers.

10. ***Restoration of furniture***: estimate based on the number of firms listed in "Anuário de Antiguidades e Restauro 1996".

11. ***Manufacture of woodworking machinery***: GAPE (1992).

12. ***Wholesale and retail sale of furniture***: INE (1995d).

13. ***Manufacture of resinoids***: Ferreira (1995).

14. ***Cork industries***: estimate based on data collected from Associação dos Industriais e Exportadores de Cortiça do Norte on the distribution of the number of production units by size of employment in 1993, and assuming that 240 informal small units are all operating in cork manufacturing.

15. ***Manufacture of cork manufacturing machinery***: Ministério da Indústria e Energia-Direcção Geral da Indústria (1993)

16. ***Manufacture of pulp, paper and paperboard***: INE (1996b).

17. ***Manufacture of corrugated paper and paperboard, containers of paper and paperboard, household and sanitary goods and of toilet requisites, paper stationery, wallpaper and other articles of paper and paperboard n.e.c.***: estimate based on the list of firms affiliated to Associação Portuguesa das Indústrias Gráficas e Transformadoras do Papel, as report in their "Anuário 94/95".

18. ***Manufacture and repair of wooden boats***: direct employment data directly collected from Associação das Indústrias Marítimas, excluding sub-contractors for electrical, mechanical and other kinds of works.

19. ***Personnel of the Forest Institute***: total number of persons working in the Forest Institute according to "Plano de Actividades do Instituto Florestal para 1996", excluding 256 workers in the operation of forest nurseries belonging to the institute.

20. ***Personnel of the Nature Conservation Institute (ICN)***: data collected from ICN, including 568 persons with clear contractual status and 350 persons without a clear contractual status.

21. ***Personnel of CNEFF, EFN, CTIMM, CTCOR***:: data collected directly from these institutions.

22. ***Forest fire fighters (sappers)***: Baptista (1993).

23. ***Forest fire fighters (GEI's)***: estimate based on the number of "Special Intervention Groups" (GEI) reported by Loureiro (1995) assuming 5 fire fighters per group, working 3 months per year.

24. ***Other services***: own estimates.

25. ***Total employment in 1995***: INE, 2003c.

Employment in the forest cluster of Continental Portugal in 1995

Activities		Full-time equivalent workers
Forestry and logging	Forestry and logging (except planting and replanting, operation of forest tree nurseries and cork related activities)	10 000
	Activities related to cork and cork oak trees (cork extraction, pruning, grazing, etc.):	

	a) Permanent employment b) Seasonal employment (number of equivalent permanent workers)	4 700 4 200
	Resin tapping	2 000
	Forest contractors (planting and replanting)	3 750
	Operation of forest tree nurseries	1 000
Forestry service activities	Fire protection (CNEFF)	10
	Forest fire fighters	580
	Forest owners' associations	50
Hunting, trapping and game propagation, including service related activities	Game propagation	5 000
	Game guards	3 000
Manufacture of wood and of products of wood and cork, except furniture	Sawmilling and planning of wood; impregnation of wood	17 800
	Manufacture of builders' carpentry and joinery	14 576
	Manufacture of veneer sheets; manufacture of plywood, blame board, particle board, fibre board and other panels and boards	2 000
	Wood and cork handcrafting	1 000
	Natural cork processing (cork planks)	1 000
	Manufacture of articles of natural or agglomerated cork (cork manufacturing industry)	14 000
	Manufacture of articles of natural or agglomerated cork (fabrication of cork granulates and agglomerates)	3 400
Manufacture of pulp, paper and paper products	Manufacture of pulp	5 224
	Manufacture of paper and paperboard	4 897
	Manufacture of corrugated paper and paperboard, containers of paper and paperboard, household and sanitary goods and of toilet requisites, paper stationery, wallpaper and other articles of paper and paperboard n.e.c.	5 440
Other forest related industries	Manufacture of resinoids	2 000
	Manufacture of furniture	75 116
	Restoration of furniture	1 000
	Construction and repair of wooden boats	300
	Manufacture of woodworking machinery	2 349
	Fabrication of painting, gluing, preservation and other chemical products for wood and furniture industries	n. d.
	Manufacture of cork manufacturing machinery	158
Other forest related services	Haulage and transportation of timber and cork (from forest to factory)	2 300
	Wood import and export	770
	Wholesale of furniture	3 692
	Retail sale of furniture	31 834
	Forest Institute[4]	2 775
	Nature Conservation Institute	918
	National Forest Research Station	100
	Forest high education institutions	150
	Forest professional training	600
	Technological Centres for the wood and cork industries (CTIMM & CTCOR)	55
	Business associations of forest industries	50
TOTAL EMPLOYMENT IN THE FOREST CLUSTER	**FORESTRY, LOGGING, HUNTING AND RELATED SERVICES**	**34 290**
	FOREST INDUSTRIES	**69 337**
	OTHER FOREST RELATED INDUSTRIES	**80 923**
	OTHER FOREST RELATED SERVICES	**43 244**
	TOTAL	**227 794**
TOTAL EMPLOYMENT IN THE COUNTRY		**4 437 000**
FOREST EMPLOYMENT IN % OF TOTAL EMPLOYMENT		**5,13 %**

[4] This is the English translation of the official denomination of the public Forest Services, in 1995.

Contribution to foreign trade

Exports, and not domestic consumption, have been the major drivers of forest production in Portugal for the last century:

- exports explain almost entirely the growth in cork oak production and eucalyptus for pulpwood;

- they also explain a good deal of the growth in pine wood production.

One result of this is that, since the XIXth century, forest products have contributed positively for the balance of trade in Portugal. Nowadays these products are **the fourth major group** in the Portuguese exports, generating 11% of the total exports in value. They were the second group until a few years ago, before a big project in car making industry took off. It is important to point out that the forest products have risen to a percentage of this magnitude around 1880.

Even though the global forest trade balance is positive, the forestry trade balance is negative, being compensated by a positive balance for manufactured forest products. This is due mostly to the following situations:

- imports of tropical timber for the furniture industry;

- some imports of pulpwood;

- imports of cork.

Exports of goods and services, forest products and cork (current prices)

Years	Total exports of goods	Total exports of forest products		Exports of cork and cork products		
	Thousand of escudos	Thousand of escudos	2/1 (%)	Thousand of escudos	4/1 (%)	4/2 (%)
	1	2	3	4	5	6
1870	19396,2	864,1	4,5	653,3	3,4	75,60468
1871	19900,5	961,0	4,8	746,4	3,8	77,66909
1872	21173,8	1350,6	6,4	1064,4	5,0	78,80942
1873	21896,6	1488,5	6,8	1161,8	5,3	78,05173
1874	21035,1	1617,8	7,7	1264,4	6,0	78,15552
1875	22489,7	1369,0	6,1	1128,7	5,0	82,44704
1876	19578,5	1186,2	6,1	968,9	4,9	81,681
1877	21681,3	1395,6	6,4	1166,9	5,4	83,61278
1878	17379,9	1483,3	8,5	1230,1	7,1	82,92995
1879	16941,0	1413,2	8,3	1239,1	7,3	87,68044
1880	23288,1	3164,6	13,6	2758,9	11,8	87,18005
1881	20644,4	2318,4	11,2	2068,0	10,0	89,19945
1882	22555,9	2798,1	12,4	2532,5	11,2	90,50784
1883	22789,0	2633,8	11,6	2363,0	10,4	89,71828
1884	21569,3	2777,9	12,9	2537,6	11,8	91,34958
1885	22647,1	2853,645	12,6	2656,945	11,7	93,10706
1886	26108,2	2844,604	10,9	2612,104	10,0	91,82663
1887	21239,3	2745,76	12,9	2609,560	12,3	95,03962
1888	23443,0	2737,772	11,7	2621,572	11,2	95,75567
1889	23343,7	3142,94	13,5	3005,040	12,9	95,61239
1890	21538,6	3275,49	15,2	3114,090	14,5	95,07249
1891	21379,0	3137,671	14,7	2951,071	13,8	94,05291
1892	24631,2	3166,744	12,9	2939,144	11,9	92,81281
1893	23407,9	3219,852	13,8	2992,952	12,8	92,95309
1894	23923,7	3472,326	14,5	3065,826	12,8	88,29315
1895	26961,0	3979,273	14,8	3668,873	13,6	92,19958
1896	26139,0	3909,371	15,0	3650,071	14,0	93,36722
1897	27311,0	3970,73	14,5	3710,230	13,6	93,43949
1898	31124,0	3597,676	11,6	3303,276	10,6	91,81694
1899	28804,0	3327,279	11,6	3042,379	10,6	91,43745
1900	30931,0	3820,168	12,4	3325,968	10,8	87,0634
1901	28281,0	4185,521	14,8	3491,921	12,3	83,42859
1902	28435,0	4212,214	14,8	3448,014	12,1	81,85752

1903	30603,0	4717,028	15,4	3740,628	12,2	79,30053
1904	30712,0	4822,455	15,7	3948,093	12,9	81,86894
1905	28969,0	4328,858	14,9	3664,273	12,6	84,64757

Exports of goods and services, forest products and cork (current prices)

Years	Total exports of goods	Total exports of forest products		Exports of cork and cork products		
	Thousand of escudos	Thousand of escudos	2/1 (%)	Thousand of escudos	4/1 (%)	4/2 (%)
	1	2	3	4	5	6
1906	30593,0	5063,563	16,6	4217,217	13,8	83,28556
1907	30410,0	5227,07	17,2	4378,992	14,4	83,77527
1908	28377,0	4865,941	17,1	3881,195	13,7	79,76248
1909	30880,0	5147,806	16,7	4050,998	13,1	78,69368
1910	35724,0	5597,673	15,7	4518,913	12,6	80,72842
1911	34065,0	5458,148	16,0	4377,979	12,9	80,20997
1912	34317,0	5779,139	16,8	4721,259	13,8	81,69485
1913	35287,0	6399,992	18,1	5107,444	14,5	79,80391
1914	271148,0	5170,665	1,9	4145,377	1,5	80,17106
1915	34000	4773,24	14,0	3370,325	9,9	70,60875
1916	56000	5568,816	9,9	3675,579	6,6	66,00288
1917	55000	4362,476	7,9	3283,625	6,0	75,26976
1918	83000	5138,152	6,2	3485,045	4,2	67,82682
1919	107000	7077,617	6,6	4688,548	4,4	66,24473
1920	222000	21673,99	9,8	15699,245	7,1	72,43357
1921	225000	20343,93	9,0	13199,909	5,9	64,88377
1922	444000	51684,74	11,6	34904,169	7,9	67,53283
1923	684000	86696,19	12,7	68323,389	10,0	78,80783
1924	949000	104233,5	11,0	80220,764	8,5	76,96255
1925	862000	90199,29	10,5	73660,438	8,5	81,6641
1926	736000	99513,16	13,5	82685,608	11,2	83,09012
1975	49449000	8738000	17,7	2971190	6,0	34,00309
1976	55122000	11668000	21,2	3741300	6,8	32,06462
1977	77927000	14931000	19,2	5717320	7,3	38,29161
1978	106762000	18648000	17,5	7249380	6,8	38,87484
1979	176833000	28712000	16,2	10230320	5,8	35,63082
1980	233141000	42544000	18,2	14235890	6,1	33,46157
1981	257550000	46079000	17,9	14155630	5,5	30,72035
1982	333878000	53677000	16,1	16670400	5,0	31,05688
1983	513988000	72627000	14,1	22336000	4,3	30,7544
1984	767932000	115447000	15,0	30582480	4,0	26,49049
1985	977746000	139708000	14,3	33827570	3,5	24,21305
1986	1085796000	154795000	14,3	37799050	3,5	24,41878
1987	1313719000	202180000	15,4	47111250	3,6	23,30164
1988	1585997000	245821000	15,5	58510170	3,7	23,80194
1989	2021592000	296459000	14,7	76604390	3,8	25,83979
1990	2340480000	300208000	12,8	80433000	3,4	26,79242
1991	2361525000	287120000	12,2	80293387	3,4	27,9651
1992	2482563000	284792000	11,5	81651247	3,3	28,67048
1993	2557314000	293171000	11,5	87082374	3,4	29,70361
1994	3083930000	368021000	11,9	96501608	3,1	26,22177
1995	3629407000	438897000	12,1	102247232	2,8	23,29641
1996	3897800000	404295000	10,4	110542771	2,8	27,34211
1997	4319264400	460561000	10,7	128689062	3,0	27,94181
1998	4608840600	486506000	10,6	141285642	3,1	29,04088
1999	4784863700	489247000	10,2	148339923	3,1	30,32005
2000	5379272800	551009362	10,2	176334960	3,3	32,00217

Sources and methodology: Mendes (2002b)

Exports by groups of products

Groups of products	1999		2000	
	1000 euros	%	1000 euros	%
Machinery	4381271	19	4965972	20
Clothing and shoes	4653784	20	4372782	17
Vehicles	3531240	15	3778105	15
Forest products	2240899	**10**	2747878	**11**
Chemical products	1555436	7	1956360	8
Textile	1792710	8	1876119	7
Food products	1934573	8	1818019	7
Finished products (miscellaneous)	1522286	7	1593470	6
Minerals and metals	1361090	6	1578426	6

Energy	422582	2	673791	3
TOTAL	23395871	100	25360920	100

Source: INE

Trade balance in forest products

		1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Forestry	Imports	27312	25014	26598	22411	30659	41523	33203	42744	59281	45998
	Exports	5989	6292	7591	6440	6579	11043	7847	9365	9601	10061
	Balance	-21323	-18722	-19007	-15971	-24080	-30480	-25356	-33379	-49680	-35937
Forest Industries	Imports	108220	131459	152244	157108	172771	212745	226551	256027	301548	316160
	Exports	294219	280828	277201	286731	361442	427854	396448	451196	476905	479186
	Balance	185999	149369	124957	129623	188671	215109	169898	195169	175357	163026
Forest Sector	Imports	135532	156473	178842	179519	203430	254268	259754	298771	360829	362158
	Exports	300208	287120	284792	293171	368021	438897	404295	460561	486506	489247
	Balance	164676	130647	105950	113652	164591	184629	144542	161790	125677	127089
Economy	Imports	3589570	3811076	4087577	3982457	4595294	5150145	5558201	6287988	7081777	7436917
	Exports	2335798	2354083	2475202	2546037	3074273	3618737	3922604	4335113	4609978	4647800
	Balance	-1253772	-1456993	-1612375	-1436420	-1521021	-1531408	-1635597	-1952875	-2471799	-2789117
Forest export/Forest imp.		**225,2**	**186,7**	**161,6**	**165,0**	**180,8**	**172,7**	**155,7**	**153,6**	**134,9**	**135,3**
Forest import./Total imp.		**3,8**	**4,1**	**4,4**	**4,5**	**4,4**	**4,9**	**4,7**	**4,8**	**5,1**	**4,9**
Forest export./Total export		**12,9**	**12,2**	**11,5**	**11,5**	**12,0**	**12,1**	**10,3**	**10,6**	**10,6**	**10,5**

Source: MADRP (2000b).

Chapter

3

Forest resources

Natural conditions

Climate and relief

Climate shaped by the relief is the primary factor affecting the structure and functioning of the forest ecosystems. So it is going to be the starting point for this description of the natural factors. The first thing to mention is that, even though Portugal is a very small country, it has several combinations of two types of climates, Atlantic and Mediterranean, but there are also elements of Continental, Alpine and Subtropical climates in some parts of the country. The Atlantic influence is stronger in the North and along the coastal regions. It is especially important in winter being responsible for relatively high precipitation and for the attenuation of the effects of dry and cold winds coming from Spain. The Mediterranean influence is stronger in the South and during the summer which are relatively hot and dry.

The coastal region in Northern and Central Portugal with altitudes up to 400 m has a dominantly Atlantic climate with a Mediterranean influence. The annual precipitation is around 1300 mm and the temperature between 13 and 17º on average.

Going from the coast to the east in Northern and Central the altitudes average between 400 and 700 m, with small mountain ranges and depressions usually drained by rivers, and a few mountains passing the cap of 1000 m. The annual precipitation can be relatively high in the northernmost mountain ranges (>2500 mm), but in the other parts of these regions the precipitation and the temperature are not much different from those along the coast.

In the Northeast, in parts of the Central region close to Spain and in the Southern province of Alentejo there are areas of depressed plateau which are relatively extensive in the south, ranging up to 400 m. These are the regions where the Mediterranean climate is dominant. Annual precipitation is around 800 mm in the interior North and Central Regions and between 600 and 700 mm in the Alentejo. Summers are very dry and hot and winter is cold, with some snowfall every year in the Northern and Central regions.

The Mediterranean climate is also the dominant feature of Algarve in the southernmost part of the country with an average annual precipitation of 600 mm.

The coastal areas from the Central Region down to Algarve range up to 500 m of altitude like the ones further north, but differ from those because of a stronger Mediterranean influence with lower precipitation and higher temperatures.

Evapotranspiration calculated by the Thornwaite method is the following:

- between 730 and 750 mm in the Northwest and the Central western region;

- between 680 and 740 mm in the Northeast;

- between 800 and 840 in the South.

The major factors influencing the climate of Continental Portugal are the following (Macedo & Sardinha, 1993):

latitude;

proximity of the Atlantic Ocean, the Mediterranean sea and Northern Africa;

orography;

continentality of the Iberian Peninsula.

Climatic regions in Continental Portugal

Regions	Average annual rainfall (mm)	Average temperature (°C)	Temperature range (°C)	Average annual insolation (hours per year)	Average number of days with rainfall	Frost
Atlantic (NW)	1000-2500	10-14	n.a.	Up to 2600	100-150	Frequent
Atlantic with Mediterranean influence (coastal part of the Central region)	600-1000	15	15-21	2500	80-130	Not frequent
Mediterranean with Atlantic influence (intermediate part of the Central region and western half of Alentejo)	450-800	16	n.a.	n.a.	n.a.	n.a.
Continental (NE, except the Douro valley)	500-1200	10-13	23-28	2300-2800	70-150	Very frequent
Mediterranean with continental influence (interior regions, from the western part of the Douro Valley included, to South)	500-800	14-17	25-30	2900-3050	80-100	Frequent
Mediterranean (eastern part of the Douro Valley and Algarve)	400-600	15-18	20-25	2800-3150	60-90	Rare

Source: Macedo & Sardinha (1993)

Because of its latitude, Continental Portugal is under the artic influence of the masses of air coming down from Iceland and tropical influence of the masses of air flowing up from the Saharian region. The result is a great seasonal variation, with two very distinct seasons, winter and summer, and two transitional seasons, spring and fall.

Because of the proximity of the Atlantic Ocean and the Mediterranean Sea, the temperature is moderate, especially in the coastal regions.

The orography allows these maritime influences go beyond the coastal regions, but not up to the central part of the Iberian Peninsula (the Iberian *Meseta*). Because of these mountain chains in Portugal, Galicia and the Cantabric regions, the *Meseta* has a relatively high degree of continentality which has an important influence in the interior regions of the country.

The combined result of all these factors is a climate with significant regional variations, as shown in the previous table.

With variations according to the regions presented above, an important characteristic of the climate in Continental Portugal is the fact that summer tends to be hot and dry, and winter tends to be humid. Combing this with the fact that most of the vegetal species in forests and scrub lands have a relatively high degree of inflammability, we have a situation where forest resources are under a high natural risk of damage by fire in summertime.

Soils

In terms of lithology there are three main regions to be distinguished:

- the old granites and slates belonging to the Iberian Meseta which cover the North, most of the Central region and most of the Alentejo province in the South;

- the post-paleozoic calcareous areas along the coast in the Central region down to Lisbon and in Algarve;

- the fertile antropozoic plains of the rivers Tejo and Sado.

A growing forest resource base

Trends in forest land

Forestland has been growing at least since the first estimation available for this resource, which refers to the year 1867. Until the 50s there was simultaneous growth of forest and agricultural land. This was possible because of the large amount of uncultivated land fit for cultivation existing in the XIXth century, due to a multi-secular process of deforestation. With the intense rural emigration in the 1960s and 1970s farmland started to fall, while forestland continued to expand. However, since the 1970s the growth in forestland has not taken all the abandoned farmland, the result being an increase in uncultivated land in recent years.

According to the most recent forest inventory (DGF, 2001), agricultural land represents 33,5 % of the area of Continental Portugal, while forest and other wooded land[5] represents 37,7 % corresponding to an area of 3349327 ha.

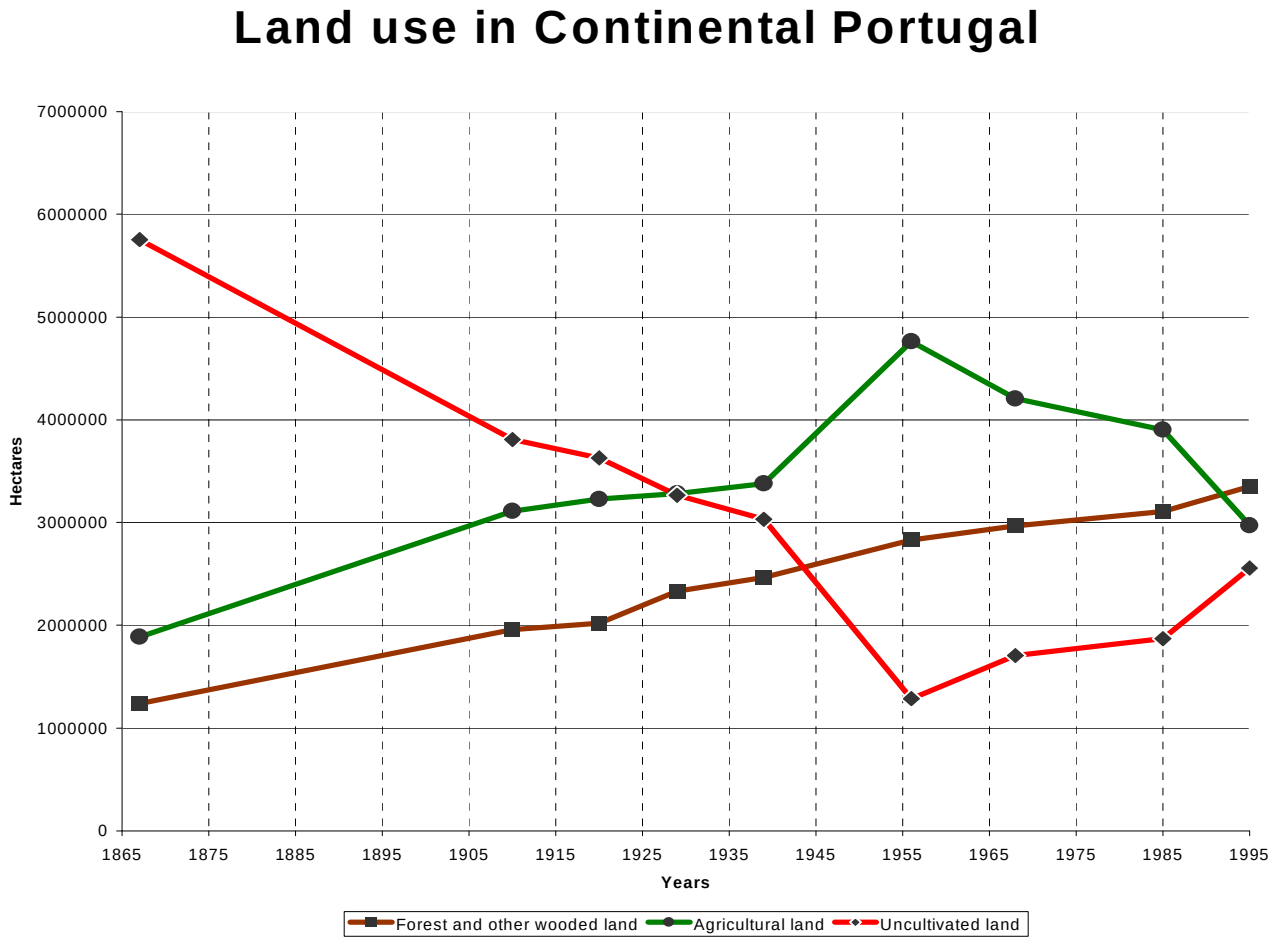
Land use in Continental Portugal since 1867

SPECIES	1867	1902	1910	1920	1929	1939	1950/56	1963/66	1968/78	1980/85	1995/98
1. FOREST AND OTHER WOODED LAND	**1240000**	**1736938**	**1956500**	**2022491**	**2332000**	**2467000**	**2832268**	**2825700**	**2969120**	**3108200**	**3349327**
A) Forest land by tree-species dominance											*3201131*
a) Conifers	210000	250000	430194	913689	1132000	1161000	1189524				
- Maritime pine								1287600	1293040	1252300	976069
- Other conifers											
b) *"Montados"*:	370000	712986	782653	868850	940000	1050000	1274490	1215400	1192480	1128700	1174390
- Cork oak	121000	325493	365995	413713	560000	690000	651406	636800	656580	664000	712813
- Holm oak	249000	387492	416658	455137	380000	360000	623084	578600	535900	464700	461577
c) Other oaks and chestnut	60000	173952	130986	173952	193000	188000	170000		99840	143200	171478
- Other oaks	n.a.	78165	47006	78165	108000	108000	94000		70550	112100	130899
- Chestnut	n.a.	95787	83980	95787	85000	80000	75000		29290	31100	40579
d) Eucalyptus	0	-----	-----	-----	8000	n.a.	113288	98900	213720	385800	672149
e) Other	600000	600000	612667	66000	59000	68000	84966		170040	198200	207045
B) Other wooded land	n. a.	n. a.	n. a.	n. a.	n. a.	n. a.	n. a.	n. a.	n. a.	n. a.	*148196*
2. AGRICULTURAL LAND	**1886000**		**3111882**	**3229000**	**3282000**	**3380000**	**4762000**		**4205882**	**3902362**	**2972883**
UNCULTIVATED LAND	**5462862**	**n. a.**	**3426618**	**3245671**	**2883162**	**2648000**	**885594**		**1279860**	**1419300**	**2054571**

[5] "Other wooded land" is defined here as being burnt forests, areas of clear cut and land with trees below the density needed to be classified as "forests".

FIT FOR CULTIVATION Productive, but uncultivated land (fallow, grazing, etc.)	2116000		1926000	1639000	1565000	1484000	395594	n. a.	n. a.	n. a.	n. a.
Other uncultivated land fit for cultivation	3346862		1503780	1606671	1318162	1164862	490000	n. a.	n. a.	n. a.	n. a.
3. LAND UNFIT FOR CULTIVATION	**291000**	**374000**	**381700**	**382700**	**382700**	**384000**	**400000**	**n. a.**	**425000**	**450000**	**503081**
4. TOTAL LAND AREA	**8772520**	**8772520**	**8772520**	**8772520**	**8772520**	**8772520**	**8772520**	**8772520**	**8772520**	**8772520**	**8772520**
5. INLAND WATERS	**107342**	**107342**	**107342**	**107342**	**107342**	**107342**	**107342**	**107342**	**107342**	**107342**	**107342**
6. TOTAL AREA	**8879862**	**8879862**	**8879862**	**8879862**	**8879862**	**8879862**	**8879862**	**8879862**	**8879862**	**8879862**	**8879862**
Forest coverage (1./4.)	**14,1%**	**19,8%**	**22,3%**	**23,1%**	**26,6%**	**28,1%**	**32,3%**	**32,2%**	**33,8%**	**35,4%**	**38,2%**

Sources and methodology: Mendes (2002b)



Trees species origin and distribution

According to the 1995 Forest Inventory (DGF, 2001), the major forest species in Continental Portugal are maritime pine (29, 1%), cork oak (21,3%) and eucalyptus (20,1%).

The major pine species is *Pinus pinaster*, which may have been introduced by man's hands, but long time ago, because there are traces of it since the Neolithic period. This species expanded since the XVIth century by plantation, by natural and artificial dissemination and by natural regeneration. Concerning natural and artificial dissemination and natural regeneration, it is almost impossible to specify the relative roles they have played in the expansion of pine forests. For some time, the Forest Services distributed seeds to the local populations who spread

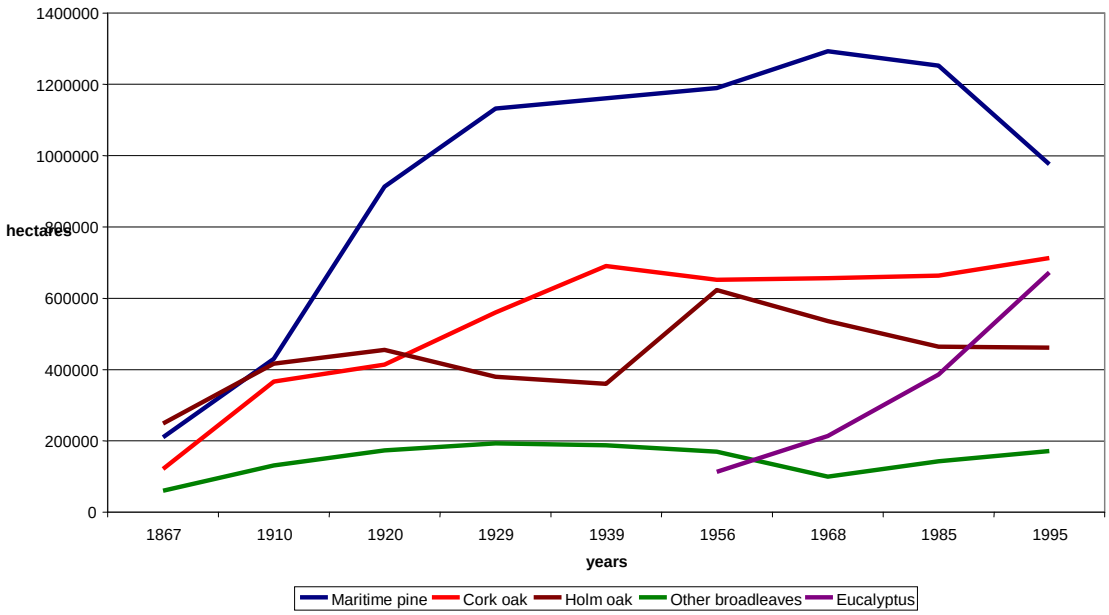
them in the fields they were abandoning from agriculture. In other cases, the dissemination of pine forests in abandoned farmland happened simply by natural dissemination. Especially in the Central region, after a forest fire it is possible to see, in many places, the terraces and other infrastructures of the farmland existing there before pine came in.

The major species of eucalyptus existing in the country is *Eucalyptus globulus* originated in Tasmania. In the 1960s the eucalyptus plantations took off to supply wood for the pulp mills recently installed in the country. This species has been replacing part of the pine forests damaged by forest fires, especially in the Northern and Central regions. In the take off of this species, the Forest Services played an important role by distributing plants free of charge to the forest owners.

The Alentejo is the region of the most important agro-forestry systems in the country (*"montados"*) based on cork and holm oak trees. Holm oak lost most of its economic value in the 1960s due to the swine fever, which decimated the stock of Iberian pigs, fed on the acorns from these trees. Cork oak has kept its economic value because of the continuing demand from the cork manufacturing industries where Portugal is the leader in the world since the Spanish Civil War, in 1936. More recently, the EU funds for the afforestation of farmland (Reg. 2080/92) have been used at great profit by the landowners to renovate and expand the cork oak forests. In the 50s, due to the initiative of the grand father of research on cork and cork oak, J. Vieira Natividade, there was a programme including the distribution to the forest owners, free of charge, of seeds collected from the best trees.

Still far from the importance they had in the past, other oaks and chestnut forests have been growing since the 1960s, especially in the Northern and Central regions. Part of this is, especially in the case of other oaks, is due to natural regeneration, namely in unmanaged forestlands and abandoned farmland. In the case of chestnut, there has been a regain in interest for this tree, namely for fruit production of good quality due to an increasing demand in domestic urban markets and in foreign markets.

Trees species composition of forests in Continental Portugal



Main explanatory factors of pine and eucalyptus trends

The expansion in the area of maritime pine until the end of the 1970s was due to the following factors:

dissemination of pine seeds in uncultivated lands, or in agricultural lands recently abandoned, either by natural processes, or by voluntary action of farmers, sometimes using seeds distributed free of charge by the Forest Services;

artificial plantations (25600 ha, most of which with pine trees) carried out by Forest Services, mostly during the first quarter of the XXth century, in the sandy lands of the coastal areas to prevent erosion;

artificial plantations (328521 ha, most of which with pine trees) also carried out by the Forest Services, mostly from 1938 to the 1960s, sometimes in a authoritarian way, in the communal lands of the mountains in Northern and Central regions.

Since the 1970s, the area of pine forests is declining. This is due to the damages caused by forest fires for which contributed the following factors:

rural outmigration and changes in the household and agricultural technologies of the remaining rural people leading to decreasing demand and increasing costs of removals of shrubs, thinnings and waste wood from pine forests;

sharp decline in resin tapping since the beginning of the 1980s due to foreign competition.

Some available forest inventory data show that this crisis in pine forests is not only in terms of a declining area, but also in terms of declining increments.

Maritime pine inventory data for 1982, 1987 and 1992

Types of stands	Inventory data	1982	1987	1992	1995
Pure and Mixed dominant stands[6]	Area (ha)	1306400	1247900	1047100	976069
	Growing stock (1000 m3)	100925,6	96848,7	87837,2	89417
	Mean growing stock (m3/ha)	77,255	77,609	83,886	91,609
	Annual increment (1000 m3)	6989,1	6295,6	4932,6	n.a.
	Mean annual increment (m3/ha)	5,350	5,045	4,711	n.a.
All stands	Growing stock (1000 m3)	103388,3	101324,1	93315,2	98804
	Annual increment (1000 m3)	7164,4	6557,2	5236,5	n.a.

Source: Instituto Florestal (1993) for 1982, 1987 and 1992; DGF (2001) for 1995.

Eucalyptus inventory data for 1986, 1992 and 1995[7]

Types of stands	Inventory data	1986	1992	1995
Pure and Mixed stands (dominant and dominated)	Area (ha)	434700	529100	805546
	Growing stock (1000 m3)	26955,2	21808,6	34897
	Mean growing stock (m3/ha)	62,0	41,2	43,3
	Annual increment (1000 m3)	n.a.	n.a.	n.a.
	Mean annual increment (m3/ha)	(1)	(1)	(1)

Source: Instituto Florestal (1994) for 1986 and 1992; DGF (2001) for 1995.
(1): From forest inventory data reported in several publications by DGF (1992, 1998e, 1998f), the mean annual increment for eucalyptus in this period was around 10-11 m3/ha.

Eucalyptus started to expand in the 1960s when the pulp and paper industry took off. To be viable, this industry had to work very hard to create its own resource base since in the

[6] Stands where maritime pine is the only or the dominant species.
[7] The criteria used in each inventory are not the same. For 1986 and 1992 the data refer to the area available for wood supply. The data for 1986 does not include some southern counties.

middle of the 1960s there were about 100000 ha of eucalyptus, not all of them with the proper characteristics for pulpwood. Pine which was abundant was also used as raw material for the industry, but eucalyptus already appeared to be a better and more competitive material. Pulp and paper companies and Forest Services worked intensively in the research and dissemination among forest owners of appropriate techniques for eucalyptus silviculture. Forest Services also installed nurseries and distributed to forest owners, free of charge, large quantities of seedlings. From 1981 to 1988 a programme financed by the World Bank provided credit to the public pulp and paper company and to the Forest Services to carry on afforestation with pine and eucalyptus mostly in private lands (60000 ha by the pulp and paper company, almost all with eucalyptus and 71908 ha by the Forest Services, 8429 of which with eucalyptus). Some incentives for eucalyptus existed after this programme, but they were drastically reduced in the end of the 1980s. So the more recent growth in the area of eucalyptus is almost totally funded by pulp and paper companies and private forest owners. This growth in eucalyptus stands is taking over some of the burnt pine forests, but not all, and some agricultural lands which are abandoned or which were actively farmed before, but where this fast growing species is becoming economically more attractive than alternative agricultural uses.

Potential natural forest types and current forest cover[8]

Aguiar & Capelo (2004) identify six types of potential natural forests in Continental Portugal:

a) Deciduous oak forests;
b) Birch forests;
c) Oak forests adapted to calcareous soils;
d) Evergreen oak forests;
e) Other evergreen forests and other forests adapted to calcareous soils;
f) Hygrophilic forests.

Deciduous oak forests

Potential natural forests of deciduous oak trees are of two main sub-types according to the dominant species: *Quercus robur* or *Quercus pyrenaica*. Potential natural forests dominated by *Quercus robur* (single or mixed with *Quercus pyrenaica*) correspond to the NW part of Continental Portugal with Atlantic climate (1A1 and 4A1)[9]. Potential natural forests dominated by *Quercus pyrenaica* are typical of the highlands of the Northeastern and Central eastern regions (2A, 2B and 2C), where the Atlantic climate is subject to Continental and Mediterranean influences.

Since the Neolithic, these forests regressed due to agricultural and pastoral land uses. This regression process was concluded by the end of the Middle Ages. Nowadays, they are residual. So what we find instead are agricultural lands, in the lower altitudes; single or mixed stands of maritime pine (*Pinus pinaster*) and *Eucalyptus globulus* in the lower or intermediate altitudes; and shrub lands of *Cytisus* sp. pl., *Genista florida* subsp. *Polygalaephylla*, *Ulex* sp. pl., or *Erica* sp. pl. in higher altitudes.

[8] This section is our own summary of the contribution prepared by Aguiar & Capelo (2004) for the book chapter by Mendes (2005a). This contribution is based on their earlier joint work about the biogeography of Continental Portugal (Costa *et al.*, 1998). We take full responsibility for all the possible shortcomings and errors in preparing this summary of their work.

[9] Here and in the rest of the section this kind of notation refers to the biogeographic regions shown in the map.

Birch forests

The typical species of potential natural birch forests in Continental Portugal is *Betula celtiberica*. This species can co-exist with the deciduous oak forests where hydric conditions are appropriate, as is the case of the mountains of Gerês (1B) and Estrela (2D).

Oak forests adapted to calcareous soils

Potential natural forests of *Quercus faginea subsp. broteroi (class Quercetea ilicis)* are typical of the calcareous soils of Extremadura and Arrábida regions (4A2 and 4B3), where there is a mixture of Atlantic and Mediterranean climatic influences. These forests are now very residual, after a long period of regression due to fires and pastoral land uses. In the sandy lands along the coast near by nowadays there are forests of maritime pine installed by the Forest Services in the beginning of the XXth century to prevent erosion.

Evergreen oak forests

The two major species of potential natural evergreen oak forests in Continental Portugal are cork oak (*Quercus suber*) and holm oak (*Quercus rotundifolia*, class *Quercetea ilicis*). Cork oak is present in the provinces of Trás-os-Montes (2C3), Beira Baixa (3A11 and 3 A12), and Estremadura (4A23, 4B1), and in the western part of Alentejo and Algarve (4B2, 4B3, 4C1, 4C3, 3B21). Holm oak is typical of some of the more arid and interior areas, in the provinces of Beira Alta (2B) and Alentejo (3B11, 3B12, 3B13, 3B22) and in the eastern part of Algarve (4C3).

Especially in the case of cork oak, most of the stands existing today are man made and managed for the production of cork.

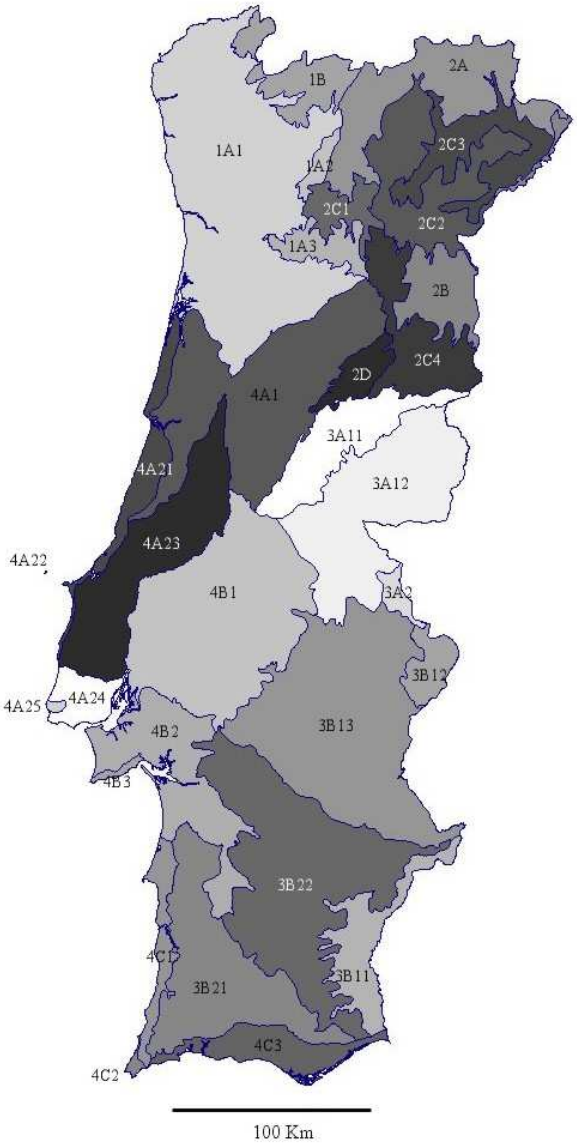
Other evergreen forests and other forests adapted to calcareous soils

Other potential natural forests of evergreen species and of species adapted to calcareous soils are typical of the surrounding region of Lisbon (4A24) and the eastern part of Algarve (4C3). The main species here is *Olea europeia* subsp. *sylvestris*. In the case of the calcareous soils of Algarve there is also the presence *Quercus faginea* subsp. *alpestris* and carob (*Ceratonia siliqua*). In the latter case, nowadays, the trees are managed for fruit production.

Hygrophilic forests

As far as riparian forests are concerned, the main species existing in Portugal are alders (*Alnus glutinosa*) and willows (*Salix atrocinerea* and *Salix neotricha*). In the other wetlands, swamps excluded, the main tree species is ash (*Fraxinus angustifolia*).

Map of potential and actual forest vegetation[6] in Continental Portugal



Legend:

- 1A1 and 4A1: potential natural forests of deciduous oak trees with *Quercus robur* as the dominant species, currently substituted by agricultural land uses, maritime pine and eucalyptus
- 2A, 2B and 2C: potential natural forests of deciduous oak trees with *Quercus pyrenaica* as the dominant species, partially substituted nowadays by agricultural land uses and maritime pine
- 1B and 2D: potential natural forests of birch (*Betula celtiberica*)
- 4A21, 4A22, 4A23, 4A24, 4A25 and 4B3: potential natural forests of oak forests adapted to calcareous soils (*Quercus faginea*) which, nowadays, are residual after destruction by fires and pastoral land uses, or substituted by maritime pine in the sandy lands along the coast
- 2C3, 3A11, 3A12, 4A23, 4B1, 4B2, 4B3, 4C1, 4C3, 3B21: potential natural evergreen forests of cork oak, currently man made, in most cases, and managed for cork harvesting
- 2B, 3B11, 3B12, 3B13, 3B22: potential natural evergreen forests of holm oak, currently legally protected by conservation laws
- 4A24 and 4C3: potential natural forests of *Olea europeia* adapted to calcareous soils
- 4C3: other potential natural forests adapted to calcareous soils composed by *Quercus faginea* and carob.

Forest functions

In 1995, the main function of 51, 8% of the forest area was for wood supply. The second main function corresponding to 48, 2% of the forest area was for non-wood forest products, essentially cork oak, in the Southern regions. In the Natura 2000 areas there are 594509 ha of forests, which represent 17, 8% of the total forestland.

Forest according to main functions

Functions	1985		1995	
	1000 ha		1000 ha	%
Wood supply	**1846**	**57,6**	**1698**	**51,8**
predominantly conifers			735	22,4
predominantly broadleaves			584	17,8
Mixed stands			379	11,6
Non-wood forest products	**1357**	**42,4**	**1577**	**48,2**
predominately coniferous			52	1,6
predominately broadleaves			1161	35,5
Mixed stands			364	11,1
TOTAL	**3203**	**100,0**	**3275**	**100,0**

Source: DGF- Inventário Florestal Nacional (In Leite & Martins, 2000a, 2000b)

Forests for wood supply

The 11 200 000 m^3 o.b. of annual fellings for wood supply are almost of the same amount as the 12900000 m^3 o.b. of net annual increment in the forests with the same main function. So the **derived demand by forest industries is in tight tandem with wood supply**.

Net annual increment per hectare in forests for wood supply (4,6 m^3/ha/year for *Pinus pinaster* and 9,0 m^3/ha/year for *Eucalyptus globulus*) is relatively small due to poor forest management. With better management, these increments could be increased by 20% or more.

Area, growing stock, increment, fellings and removals in 1995

	Area	Growing stock volume	Annual net increment	Fellings	Annual removals	
	(1000 ha)	(1000 m^3 o.b.)	(1000 m^3 o.b.)	(1000 m^3 o.b.)	(1000 m^3 o.b.)	(1000 m^3 u.b.)
Trees in forest, total	**3 383**	**275 760**	**14 312**	**11 500**	**11 300**	**9 400**
Coniferous	1 179	147 782	8 323	6 200	6 100	4 900
Broadleaved	2 204	127 978	5 989	5 300	5 200	4 500
Trees in forest for wood supply[10]	**1 897**	**188 020**	**12 900**	**11 200**	**11 000**	**9 100**
Coniferous	1 021	140 871	7 890	6 200	6 100	4 900
Broadleaved	876	47 149	5 010	5 000	4 900	4 200
Trees in forest with other purposes		**87 740**	**1 412**	**300**	**0**	
Trees in other wooded land		**16 246**	**213**	**0**	**0**	
Trees outside forest and other wooded land			**670**	**0**	**0**	
TOTAL		**292 006**	**15 195**	**11 500**	**11 300**	

Source: DGF (1999)

Net growth of the standing timber stock in 1995 (1000 m^3 o.b.)

	Annual net increment	Annual removals	Net growth of the standing timber stock
Trees in forest, in other wooded land and outside forest	**15 195**	**11 300**	
Coniferous	8 323	6 100	2 223
Broadleaved	6 872	5 200	1 672

[10] We evenly split the 344000 ha of mixed stands between conifers and broadleaved species.

Biodiversity

Almost three fourths (73, 7%) of the Portuguese forests are considered to be "semi-natural", meaning that they were developed through natural regeneration. Most of the rest (24,7%) is made of "plantations" (MCPFE, 1998, p. 58).

About 1520000 ha (17, 1% of the total land area of Continental Portugal) are land under some special protection status. In the Natura 2000 sites there are 594509 ha of forests and in the National Network of Protected Areas there are 162613 ha, which represents respectively 18, 6% and 5, 1% of the total forest land. As expected, the species of main commercial interest such as maritime pine, cork oak and eucalyptus have a lower incidence in these areas.

Total area under special protection status in year 2000 (ha)

Protection status			Total protected area	Forest land in protected areas
Natura 2000		Directive Birds	744 844	
		Directive Habitats	1 094 340	
		Total (without double counting)	Not available	594 509
National Network of Protected Areas (NNPA)	Areas of national protection status	National parks	70 290	
		Natural parks	527 069	
		Natural reserves	63 218	
		Botanic reserves	24	
	Areas of regional protection status	Protected landscapes	12 835	
		Classified sites	2 301	
	TOTAL (without double counting)		638 311	162 613
TOTAL (without double counting)			**1 520 000**	**Not available**

Sources: DGF (2001) and data collected from the DGF Internet site, on 19 November 2000.

Tree species by protection status in year 2000

Species	Natura 2000		NNPA	
	ha	% of the total area of the species	Ha	% of the total area of the species
Maritime pine	135474	13,9	59061	6,1
Cork oak	145481	20,4	13906	2,0
Eucalyptus	86300	12,8	18315	2,7
Holm oak	109932	23,8	22791	4,9
Other oaks	42021	32,1	17221	13,2
Pinus pinea	24371	31,4	5563	7,2
Chestnut	10220	25,2	4806	11,8
Other broadleaves	26244	25,7	10922	10,7
Other conifers	14466	52,9	10028	36,7
TOTAL	**594509**	**18,6**	**162613**	**5,1**

Source: DGF (2001)

The following table presents data about the number of vegetal and animal species present in Portuguese forests compared to the total number of species present in the country. A special mention is made to the number of endangered species. As expected, the data show that all tree species existing in the country, including all the endangered ones, are associated with forest ecosystems. These ecosystems are also important for animal species, especially mammals, birds and butterflies. As far as animal endangered species are concerned, 64% of the mammals and 30% of the birds in this situation are associated with forests.

Number of species existing in Portuguese forests, in 1995

Species	All species		Species existing in forests			
	Total	Endangered	Total		Endangered	
			Number	% of all	Number	% of all
Trees	63	5	63	100,0	5	100,0
Other vascular plants	4600	299	490	10,7	16	6,4
Fern	114	7	34	29,8	3	42,9
Moss	451	211	92	20,4	11	5,2
Mammals	70	25	35	50,0	16	64,0

Birds	350	10	122	34,9	3	30,0
Other vertebrates	46	5	12	26,1	0	0
Butterflies	151	1	74	49,0	0	0

Source: DGF (1999)

The output gaps: a resource base with further potential for growth

The secular growth in the forest resource base has substantial potential to go on much further. This growth can happen in three non mutually exclusive ways:

a) **extensive growth**: **growth in the forestland** through afforestation of uncultivated land and substitution of farming by forest in abandoned farmland or in agricultural lands more suitable for forestry;

b) **intensive growth**:

- **growth in increments** through improved forest management and genetically improved varieties;

- **reduction in damages caused by forest fires** through improved prevention, detection and fire fighting.

Potential for growth in forestland

Natural potential

Available estimates about the potential area suitable for forestry, taking into consideration natural conditions, range from 5280000 ha (BPI *et al.*, 1996) to 5524631 ha (GCPF, 1986).

If these estimates are good, they indicate that, by the end of the 90s, eucalyptus plantations may have reached its natural potential for **extensive** growth. The main margin for growth left for this species in the coming years is **intensive** growth through relocation to sites of higher productivity and genetic improvements to increase increments.

For almost all the other species, there are substantial natural potential for **extensive** growth.

Natural potential for forestland in Continental Portugal and suitable tree species distribution

Tree species	Area of forest in 1980/85	Area of forest in 1995/98	Potential area of forest	Potential growth			
				With respect to 1980/85		With respect to 1995/98	
				ha	%	Ha	%
Maritime pine	1252300	976069	2253990	1001690	80,0	1277921	130,9
Eucalyptus	385800	672149	530780	144980	37,6	-141369	-21,0
Cork oak	664000	712813	916676	252676	38,1	203863	28,6
Holm oak	464700	461577	640885	176185	37,9	179308	38,8
Chestnut	31100	40579	84288	53188	171,0	43709	107,7
Stone pine	56250	77650	209824	153574	273,0	132174	170,2
Other oaks	112100	130899	67841	-44259	-39,5	-63058	-48,2
Other conifers	50250	27358	453925	403675	803,3	426567	1559,2
Other broadleaves	91700	102037	366422	274722	299,6	264385	259,1
TOTAL	3108200	3201131	5524631	2416431	77,7	2323500	72,6

Sources:
a) Area of forest in 1980/85: Second revision of the National Forest Inventory (data collected on 24 March 1998, from the DGF site: http://www.dg-florestas.pt/divinven.html)

b) Area of forest in 1995/98: DGF (2001)
c) Potential area of forest: GCPF (1986)

Economic potential

The estimates made by GCPF presented in the previous section don't take into the account economic constraints, namely the fact that forestry may not be an economic viable land use, namely in comparison to agricultural land use. The study by BPI *et al.* (1996) tried to take car of these constraints. The results of their estimates are the following:

a) natural potential forestlands:
5280000 ha

b) forestland in 1996: 3108000 ha

c) natural potential growth: 2172000 ha

- area currently farmed where conversion to forestry is economically viable: 1068000 ha

- other areas: 1104000 ha

According to this study it should be in these 1068000 ha of land currently farmed where conversion to forestry is economically viable that the main efforts of afforestation should be focused.

Potential for growth in increments

Silvicultural research available in Portugal indicates that, with better forest management, it is possible to increase current increments of maritime pine and eucalyptus stands **about 20%** (BPI *et al.*, 1996):

a) maritime pine: from 4,6 m3/ha/year to 5,5 m3/ha/year (+19,6%)

b) eucalyptus: from 9 m3/ha/year to 11 m3/ha/year.

Chapter 4

Risks to forest resources

Distribution of damaged forest land by types of damages

Forest fires are publicly perceived as the major threat to forest resources in Portugal and actually cause very severe and irreversible damages every year. Besides this risk, there are others also important, namely the damage caused by insects and diseases. Even though it is not perceived as such, this type of damage has an incidence in terms of forest area wider than forest fires, as shown in the following table.

Degree of forest damage by types of damages in 1995

	Area (ha)	% of the total forest area
Degraded forest and other wooded land	**641000**	**18,5**
- primarily damaged by insects and diseases	391000	11,3
- primarily damaged by wildlife and grazing	23000	0,7
- primarily damaged by fire	88000	2,5
- primarily damaged by known local pollution	0	0
- primarily damaged by storms, snow or other identifiable abiotic factors	101000	2,9
- area with damage by unidentified causes	38000	1,1

Source: UNECE/FAO, 2000

Forest fires

Forests damaged by fires versus afforestation and reforestation

Fire is a major threat to Portuguese forests, especially to the pine forests in the Northwest and Central West regions, which were reduced respectively by 41 and 21% between 1982 and 1995. This problem definitely emerged in the 1960s when the emigration from the rural areas was more intense. So the abandonment of traditional uses of forests, which until then helped keeping some minimum management standards, has certainly been an amplifying factor of the natural conditions (wet winters and hot and dry summers) favourable to the ignition of forest fires.

Since 1968, when data started to become available on the number and area of forest fires, the annual and cumulated areas of afforestation and reforestation have tended to be below the annual and cumulated area of forests burnt. More precisely, the cumulated forest area burnt from 1968 to 1999 is about the double of the area afforested or reforested during the same period.

The 283063 ha of forests burnt in 2003 are the worst forest fires since there is quantitative data on this type of damage. They represent 8,5% of the total area of forests and other wooded land existing in Continental Portugal, according the 1995 Forest Inventory.

Forest fires, afforestation and reforestation in Continental Portugal since 1968 (ha)

Year	Burnt areas				Afforestation & reforestation	
	Forests		Shrubs	TOTAL	Annual	Cumulated
	Annual	Cumulated				
Annual average 1942/51	5000					
1966/80					**181272**	**181272**
1968	**11680**	11680	11760	23440	**10799**	10799
1969	**5384**	17064	4570	9954	**11367**	22166
1970	**11335**	28399	11722	23057	**6078**	28244
1971	**3343**	31742	915	4258	**14561**	42805
1972	**19670**	51412	2238	21908	**14896**	57701
1973	**10618**	62030	4834	15452	**15991**	73692
1974	**31777**	93807	23297	55074	**8331**	82023
1975	**82086**	175893	8601	90687	**7376**	89399
1976	**20790**	196683	29800	50590	**6825**	96224
1977	**12360**	209043	6568	18928	**13903**	110127
1978	**68165**	277208	4368	72533	**14812**	124939
1979	**48060**	325268	29179	77239	**12120**	137059
1980	**29219**	354487	15041	44260	**8230**	145289
1981	**63649**	418136	26148	89797	**17920**	163209
1982	**27436**	445572	12121	39557	**19785**	182994
1983	**32427**	477999	16953	49380	**18742**	201736
1984	**26580**	504579	26133	52713	**20829**	222565
1985	**79440**	584019	66815	146255	**18278**	240843
1986	**58612**	642631	40910	99522	**24882**	265725
1987	**49848**	692479	26420	76268	**14890**	280615
1988	**8628**	701107	13807	22435	**29229**	309844
1989	**62165**	763272	64070	126235	**17410**	327254
1990	**79549**	842821	57703	137252	**20892**	348146
1991	**125488**	968309	56998	182486	**17574**	365720
1992	**39701**	1008010	17311	57012	**21803**	387523
1993	**23839**	1031849	26124	49963	**17194**	404717
1994	**13487**	1045336	63836	77323	**34714**	439431
1995	**87554**	1132890	82058	169612	**70286**	509717
1996	**30542**	1163432	58325	88867	**24947**	534664
1997	**11466**	1174898	19068	30534	**40715**	575379
1998	**57393**	1232291	100975	158368	**36234**	611613
1999	**31052**	**1263343**	**39561**	**70613**	**33743**	**645356**
2000	**68646**	1331989	90958	159604		
2001	**44983**	1376972	65945	110928		
2002	**65160**	1442132	59251	124411		
2003	**286040**	1728172	139661	425701		
2004	**54663**	1782835	65867	120530		

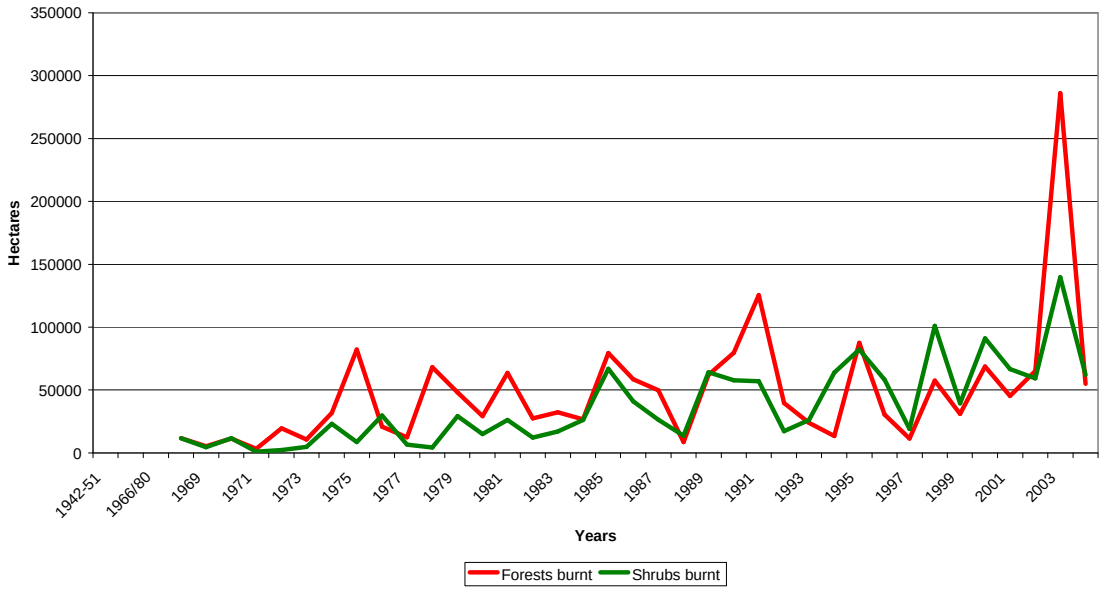
Sources:
a) Average annual area of forests burnt in 1941-52: Soares (1993)
b) Burnt areas since 1968 (data collected from the Forest Services)
c) Afforestation and reforestation (see chapter 9)

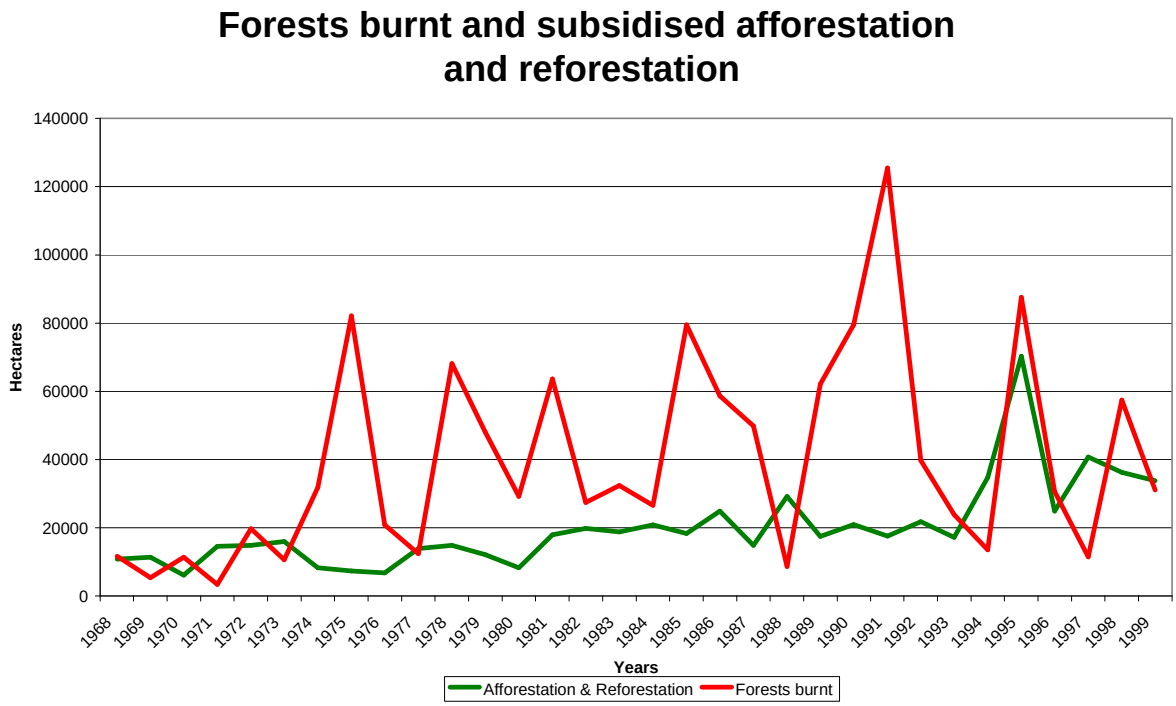
Number and size of forest fires

Years	Total	< 1ha	≥ 1ha				
			Total	[1 ha; 10 ha[	[10ha; 100ha[	[100ha; 500ha[	≥ 500ha
1980	**2349**						
1981	**6730**						
1982	**3626**						
1983	**4539**						
1984	**7356**						
1985	**8441**						
1986	**5036**						
1987	**7705**						
1988	**6131**						
1989	**21896**						
1990	**10745**	5399	5346				
1991	**14327**	9530	4797				
1992	**14954**	11311	3643				
1993	**16101**	12338	3763				
1994	**19983**	13360	6623				
1995	**34116**	23917	10199				
1996	**28626**	21063	7563				
1997	**23497**	17860	5637	5231	369	**35**	2
1998	**34676**	25842	8834	7687	906	**167**	74
1999	**25477**	19695	5782	5248	420	**86**	**28**
2000	**34109**	25307	8802	7621	898	233	50
2001	**27188**	20203	6985				
2002	**26488**	19996	6492	5549	730	168	45
2003	**26180**	20872	5308				
2004	**19917**	15751	4517				

Source: data collected from the Forest Services

Forest fires in Continental Portugal





Factors of vulnerability to forest fires

Natural conditions

As mentioned in a previous section, a dominant characteristic of the climate in Continental Portugal is the fact that summer tends to be hot and dry, and winter tends to be humid. Combing this with the fact that most of the vegetal species in forests and scrub lands have a relatively high degree of inflammability, we have a situation where forest resources are under a high natural risk of damage by fire in summertime.

Tree species composition of forests

The kind of afforestation directly and indirectly promoted by the public policies for the last one hundred years as relied a lot on maritime pine, installed in stands which often have a high risk of inflammability because of the characteristics of this species and the monospecific composition of those stands.

For this frequent appeal to maritime pine contributed the following reasons:

a) it is a pioneer species, that is, a species fitting sites which were poor and non afforested before;

b) it is a species with a higher survival rate than the others.

Because of this second characteristic the Forest Services and private contractors tended to use it when they did not have enough knowledge about which species would fit better the sites they were afforesting.

Rural depopulation and increasing labour costs of forest management

The rural depopulation started in mid 50s and that is still going on is having the following negative impacts on forest management:

a) decreasing local demand for inflammable forest sub-products (fuelwood, forest litter, shrubs, etc.), which tend to accumulate in the forests without removal;

b) increasing labour costs for forest owners who have to hire workers if they want to reduce the accumulation of those inflammable materials in their forests.

The first of these two impacts is reinforced by technological changes in agricultural and household production. Nowadays, the forest sub-products mentioned above are not as demanded as before by rural households (most of them tend to use gas or electricity for cooking and heating) and by farmers (fertilization of farmland appeals more to chemical fertilizers than to manure).

Expansion of scrublands

In a previous section we mentioned the fact that, since mid 50s, the decline in agricultural land has not been fully compensated by an increase in forest land. What this means is that scrublands are now occupying areas which were farmed before. These scrublands are often very vulnerable to fire. So if a fire starts in one of them it may quickly spread to neighbouring forests.

Crisis of resin tapping

The rapid decline in resin tapping since mid 80s deprived the forests most vulnerable to forest fires (pine forests) from the regular presence of resin tappers. Their contribution to prevent forest fires was very important. Since they were obvious not interest in such kind of damage they were active in overseeing the forests against the risk of fire and they also worked in reducing the amount the inflammable materials in the forests.

Chapter 5

Forest ownership and management

Distribution of forest ownership: the high salience of private forestry

Portugal is one of the countries in Europe where non-industrial private forestry is more important. In spite of this situation coming from long time ago, public policies and forest research have not taken it into consideration with the priority that it deserves. For more than one century forest polices have given priority to the management of public and communal forests. Promotion of the collective organisation of private forest owners was left out until the late 90s. Public incentives to private forest investment came in the 80s, with the opportunity of access to cheap foreign funds.

93, 4% of the area of forests and other wooded land are under private management, the rest being almost entirely communal forests managed by the Forest Services. Behind each of the three major species existing in the country (pine, eucalyptus and cork oak) can be found the four major stakeholders concerned with forestry in Continental Portugal:

- the **non-industrial private forest owners (NIPFO)**, managing more than 4/5 of the **pine** forests (typically with small holdings, in the northern and central regions), and almost all of the cork oak forests (often with large holdings, in the southern regions);

- the **Forest Services,** managing the public forests and most of communal forests which are often dominated by maritime pine;

- the **pulp and paper industry,** managing 28% of the **eucalyptus** forests, the rest being almost entirely with **non-industrial private forest owners**.

Distribution of the area of forests and other wooded land by types of ownership

Types of owners	1928		1959		1974/82		1995	
	Area	%	Area	%	Area	%	Area	%
State forests	53662	2,3	58000	2,0	78000	2,6	40000	1,2
Communal forests	55954	2,4	145000	5,0	380000	12,4	180000	5,4
Private forests	2221824	95,3	2697000	93,0	2598000	85,0	3129000	93,4
TOTAL	2331400	100,0	2900000	100,0	3056000	100,0	3349000	100,0

Sources:
1928: Ministério da Agricultura (1940, p. 131)
1959: Mendonça (1961, p. 31)
1974/82: DGF (1988, p. 9)
1995: see next table.

Distribution of the area of forests and other wooded land by types of ownership and tree species in 1995 (1000 ha)

Types of owners	Total		Maritime pine		Eucalyptus		Cork oak		Other forests and wooded land	
	Area	%	Area	%	Area	%	Area	%	Area	%
State forests	40	1,2	27	2,8	0	0,0	2	0,3	11	1,1
Communal forests	180	5,4	116	11,9	14	2,1	1	0,1	49	5,0
NIPF	2910	86,9	822	84,2	470	69,9	690	96,8	928	93,9
Forest industries	219	6,5	11	1,1	188	28,0	20	2,8	0	0,0
TOTAL	**3349**	**100,0**	**976**	**100,0**	**672**	**100,0**	**713**	**100,0**	**988**	**100,0**

Sources:
a) Total forest area and its distribution by species (year 1995): DGF (2001);
b) Total forest area of state forests (year 1992): own calculation from data published in the DGF booklet (DGF, 1992);
c) Total area of communal forests (year 1995): own estimate made by subtracting the total area of state forests from the total area of state and communal forests as reported by National Forest Inventory (DGF, 2001).
d) Distribution of the total area of state and communal forests by species: own estimates based on the sources mentioned in b) and c);
e) Total forest area of forest industries and its distribution by species (year 2001: data extracted from table 2 of the 2001 CELPA Statistical Report (CELPA, 2002, p. 39), excluded non forest uses and assuming that the "other species" which are neither maritime pine and eucalyptus correspond essentially to cork oak.
f) Areas of maritime in state forests and in communal forests (year 1992): areas inferred from data on growing stocks included in the tables in page 8 of the DGF publication (DGF, 1992)
g) Areas of eucalyptus in state forests and in communal forests (year 1992): areas inferred from data on growing stocks included in the tables in page 8 of the DGF publication (DGF, 1992)
h) Forest area of the non-industrial private forest owners and its distribution by species: obtained by subtraction from the total the areas for the other types of owners.

There is no census or survey of the forest owners. The only information available about the distribution of forest holdings by size comes from agricultural censuses and surveys and is not of very good quality. It is this kind of data that is reported in the following table.

Forest holdings size distribution in 1995 (%)

Regions		Forest holdings class sizes (ha)						
		0-4	5-9	10-19	20-49	50-99	100 and more	Total
Northwest	N.º holdings	89,7	6,4	2,2	1,2	0,2	0,3	100,0
	Forest area	34,4	13,6	9,0	10,2	4,1	28,7	100,0
Northeast	N.º holdings	90,6	6,6	2,2	0,4	0,1	0,1	100,0
	Forest area	53,7	19,9	13,2	5,4	3,4	4,4	100,0
Central West	N.º holdings	91,5	5,8	1,7	0,8	0,1	0,1	100,0
	Forest area	53,1	18,4	10,7	10,8	2,4	4,6	100,0
Central East	N.º holdings	73,1	14,3	7,3	3,9	0,7	0,7	100,0
	Forest area	18,1	13,8	14,1	15,3	5,9	32,8	100,0
Ribatejo Oeste	N.º holdings	84,8	6,5	3,6	2,5	1,1	1,5	100,0
	Forest area	8,3	3,8	4,1	6,6	6,7	70,5	100,0
Alentejo	N.º holdings	23,8	12,0	15,6	14,9	11,3	22,4	100,0
	Forest area	0,5	0,9	2,5	5,4	9,2	81,5	100,0
Algarve	N.º holdings	58,9	14,2	11,6	9,5	3,5	2,3	100,0
	Forest area	7,5	7,5	12,5	23,2	17,9	31,4	100,0
Continental Portugal	N.º holdings	**85**	**8**	**3**	**2**	**1**	**1**	**100,0**
	Forest area	**15**	**7**	**7**	**9**	**7**	**55**	**100,0**

Source: INE (1997b)

The table shows the **contrasting forest landownership structures between the North and South**: small-scale forestry (mostly below 10 ha) in the Northern and Central regions, and much larger holdings (mostly above 100 ha) in the South. The communal forests are located mostly in the Northern and Central regions.

For the same year of 1995, the yearbook of the Forest Services reports an estimation of the distribution of forest and other wooded land by type of ownership and by holding size. This estimation is presented in the following table. These data hide the dualistic distribution of forest ownership in Portugal with predominately small-scale forestry in Northern and Central regions and large-scale forestry in most of the southern regions. At the aggregated level what the data show is an **ownership distribution, which is more concentrated than it is often believed to be**. This concentration, however, should be interpreted taking into consideration that we are dealing with data aggregated at the national level merging the two very contrasting situations of small-scale forestry in the Northern and Central regions and large holdings in the South.

Considering private forests the situation is the following:

- forest holdings in the range up to 3 ha (1,08 ha on average) represent 84,80% of the number of holdings, but only 12% of the area of forests and other wooded land;

- forest holdings above 100 ha represent 1,09 % of the number of holdings and 55,41 % of the area of forests and other wooded land.

Distribution of forest and other wooded land by ownership and holding size in 1995

Type of ownership	Holding class Sizes	Area of forests and Other wooded land		Number of forest holdings		Average holding size per class
		ha	%	Number	%	
State and Communal Forests	Less than 3 ha	0	0	0	0	
	3-10 ha	0	0	0	0	
	11-50 ha	16000	6,45	951	83,42	16,82
	51-100 ha	4000	1,61	81	7,11	49,38
	101-500 ha	5000	2,02	39	3,42	128,21
	501-10000 ha	223000	89,92	69	6,05	3231,88
	Total	**248000**	**100**	**1140**	**100**	**217,54**
Private Forests	Less than 3 ha	376000	11,99	347277	84,80	1,08
	3-10 ha	344000	10,97	34596	8,45	9,94
	11-50 ha	453000	14,45	20178	4,93	22,45
	51-100 ha	225000	7,18	2989	0,73	75,27
	101-500 ha	953000	30,40	3737	0,91	255,02
	501-10000 ha	784000	25,01	747	0,18	1049,53
	Total	**3135000**	**100**	**409524**	**100**	**7,66**
Total	Less than 3 ha	376000	11,11	347277	84,56	1,08
	3-10 ha	344000	10,17	34596	8,42	9,94
	11-50 ha	469000	13,86	21129	5,15	22,20
	51-100 ha	229000	6,77	3070	0,75	74,59
	101-500 ha	958000	28,32	3776	0,92	253,71
	501-10000 ha	1007000	29,77	816	0,20	1234,07
	Total	**3383000**	**100**	**410664**	**100**	**8,24**

Source: DGF (1999)

Forest management behaviours

Non-industrial private forest owners

Northern and Central Portugal

Non-industrial private forest owners in Northern and Central Portugal are mostly of the following types:

- small private owners who, in many cases, are small part-time or aged farmers still living near their forests;

- larger private owners usually living in the city with their lands leased out to tenants or left under-utilised.

In the past, forestlands were a necessary complement to agriculture because they provided pasture to feed the livestock and brushwood, which after being used as bedding for animals was turned into manure to fertilise the land. The forests were also a free source of fuel wood and non-wood products indispensable for the subsistence of the local communities. Therefore forestlands were actively used and were managed free of charge for their owners.

Currently things are different. Modern farming uses industrial fertilisers and foodstuffs, the rural households no longer use fuel wood or the non-timber products from the forests. Therefore, the forest owners don't have local people going around their forests to collect the combustible materials free of charge for the owners. Nowadays, if they want these materials cut and removed, they have to hire workers for that. Often it is very difficult to find workers who can do this job, under appropriate technical supervision and at an acceptable price. These costs are also aggravated by the difficult topography of many forestlands in the Northern and Central Portugal. We should also take into account another aggravating factor of the risk of forest fires in the pine woods of these regions already mentioned which is the fact that resin tapping almost vanished from these forests.

Comparing three alternative options to reduce the accumulation of combustible materials in the forest, the costs are the following:

- mechanised cutting and removal from the forest: 500 euros/ha;

- mechanised cutting without removal from the forest: 125 euros/ha;

- prescribed burning: 7,5 euros/ha.

The first two options fall outside the range of the willingness to pay of most forest owners. The third one is affordable, but it has many restrictions in order to be implemented correctly. Also, it is still very much within the circles of forest research, lacking qualified personnel in the field to use it properly.

So because the forest maintenance costs are rising beyond the willingness to pay of private owners, because the benefits are uncertain and do not occur in the short run, and also because part of these benefits are externalities for which the private owner is not compensated, the result is that the large majority of private owners spend very little money in the maintenance of their forests. Also they do not spend money in afforestation unless it is financed by others (pulp and paper industry for the eucalyptus, and generous public grants for the other species). So the growth and decay of the forests is left to natural regeneration and wildfires.

When the owner decides to cut, it is not because he is following some forest management plan guided by optimal rotation principles, but because he needs cash to make ends meet. This leads to the following management practices:

- clear-cut after a forest fire;

- commercial thinning removing the best trees and leaving behind the worse ones causing negative selection and lowering the productivity of the forests.

Since the beginning of the 90s there has been a growing movement to promote forest owners' associations. The main types of services provided by these associations are the following:

- information about the public incentive schemes for forest investment;

- preparation of forest plans to apply for funds from those programmes;

- monitoring of forest plans and afforestation works carried out by private contractors;

- technical information about forest management operations;

- training courses for forest owners.

These associations are recent and still far from representing the majority of the forest owners in their territories even though their membership has been growing. This growth is the combined result of the following driving forces:

- private owners in the upper class sizes usually living in the city with their lands leased out to tenants or under-utilised, but willing to put them in a less labour intensive productive use like forestry;

- decentralised bodies of the Public Administration willing to support regional development initiatives like this one;

- new generations of foresters who have to open up more to private forestry than the older generations of foresters who made most of their careers in the Forest Services;

- forest contractors stimulated by the recent generations of afforestation programmes appealing to the initiative of the private sector.

To finance their activities, the associations have relied mostly on grants from national and regional programmes financed by the European Union, the annual membership fees making up a small part of their income. Those that are more dynamic are providing an increasing quantity and diversity of private services to their members, partially subsidized by public programmes (ex. preventive silvicultural works) or not. With few exceptions, the large majority of them have not yet clearly stepped into the business of harvesting and selling forest products on behalf of their members. Some provide technical and commercial advice on this matter, but without fully taking in charge these activities on behalf of their members.

Southern Portugal

In Southern Portugal the most important forest owners are the ones who have cork oak forests. Compared with the owners in Northern and Central Portugal, they have the following advantages:

- large forest holdings;

- a forest product like cork which, for that kind of holdings, may generate income almost every year;

- a topography less hilly than in Northern and Central Portugal leading to relatively lower harvesting and maintenance costs, in forestry.

After these forest owners got back their lands occupied by the farm workers after the 1974 Revolution, some associations were born, especially in the good cork oak areas of the Tejo and Sado basins. In addition to the services mentioned in reference to the associations in the North, some in the South have made further steps into the commercial and industrial arena. Inspired by what was done in Spain by IPROCOR, some of them established a system for surveying the quality of the cork before extraction. This system has the following benefits:

- it helps the forest owner to negotiate a price for his cork based on better knowledge of the quality of his products;

- it helps the industry to anticipate the properties of the cork to be harvested;

- the system also allows the selection of trees and seeds with good quality.

One forest owners' association in this region promoted the first project of vertical integration going from forest production towards forest production manufacturing. The project was firm called EQUIPAR located in Coruche, for the production of cork planks, whose initial stockholders were forest owners' having lands in that area.

Industrial private forests

The industrial forests in the country belong almost entirely to the pulp industry. These forests where eucalyptus is, by far, the major species, are certainly among the most carefully managed in the country, each pulp company having set up its own forest management firm to take care of these operations. These groups have also invested regularly in the prevention and fight of forest fires as well as in research and development to improve the productivity of the plantations.

About 25 % of the eucalyptus forests are reaching the fourth rotation and have to be replaced within the next ten years. The industry will probably take this opportunity to use the results of that R&D and improve the productivity of the new plantations.

The industry is also bound to take these actions because it has to face severe constraints to the expansion of eucalyptus plantations. These constraints come mostly from a package of decrees approved in 1988 and 1989 and are maintained in the current orientations of forest policy.

A major structural change promoted by the Public Administration might occur here in terms of forest management operators. In fact, the Ministry of the Economy is steering a merger of the two Portuguese paper groups (PORTUCEL and SOPORCEL) which is likely to result in the consolidation of their two forest management companies.

Communal forests

Communal forests are an example of "common property": the resource has physical and social bounds and it is managed according to formal and informal rules by a well-defined group of users who are all the members of the local community which owns the communal forest. To make decisions about the use of the commons (*"baldios"*), they meet in assembly, called the Assembly of Commoners (*"Assembleia de Compartes"*). The decisions are taken by majority rule and are implemented by a Directive Council elected by the commoners.

The legislation regulating the communal lands is the Law 68/93 of September 4, 1993, which replaced previous legislation, essentially the Decree 39/76 of January 19, 1976. Two major features of this law are the following:

- the village councils *("Juntas de Freguesia")*[11] can take up the management of communal forests if this is decided by the Assembly of the Commoners;

- it becomes legally possible to sell communal lands if it is for reasons of public interest, especially those related to urban and industrial development (expansion of urban areas, creation of industrial zones, etc.).

This law facilitates a greater intervention of the local governments in the commons either by taking up the responsibility of forest management on behalf of the Assembly of Commoners, or by alienating these lands for non-forestry uses.

Forest management operations can be conducted directly by the Directive Council representing the commoners, or by the village council. The alternative regime, which is used much more frequently, is to delegate this responsibility to the Forest Services. In this case, the Forest Services have the right to keep 40 % of the revenues of the plantations they have installed, and 20 % of the revenues of the forests existing when they took up the management.

If the Assembly of Commoners manages the forests, they can still appeal to the Forest Services to take charge of afforestation and reforestation projects in which case the Forest Services will keep 20 % of the forest revenues.

The rural abandonment, the type of afforestation done by the Forest Services incompatible with the traditional sylvo-pastoral systems and the transfer of management responsibilities from the local communities to the village councils and the Forest Services eroded the secular bonds involving the local communities in the active agro-forestry use of their communal lands.

After a strong posture in the first decades of afforestation of the commons, the capacity of the Forest Services, in terms of financial and human resources began to decline. This process culminated recently with the integration of the regional Forest Services in the regional agricultural services, loosing the autonomy they had managed to preserve for a long time. With this integration, the regional Forest Services are loosing not only a great deal of their autonomy, but also the management of the state and the communal forests which has been their major task for the last five decades.

To take over the management of these forests, the Ministry of Agriculture is going to create a public company specialised in forest management, without some of the constraints of the old Forest Services (less personnel, human resource management rules similar to the ones in the private sector, financing less dependent on transfers from the State Budget, possibilities to appeal to the financial markets and to do outsourcing to forest contractors, etc.).

Public forests

In Portugal, Forest Laws (see Forest Policy Law of 1996) apply similarly to public and private (also communal) forests, since there is in general no differentiation between the general objectives for private and public forests. All types of forest ownership should serve the economic, social (recreational, educational, scientific) and ecological functions of forests, combined in a sustainable management way. However, it is implicit that, at least, in sate owned forests, social functions should have more weight than in privately owned forests and revenues from timber sales and other market goods and services should be utilized to the benefit of society.

[11] This is the lowest geographical level of elected local governments in Portugal.

Forest owners' organisations in Portugal: a recent phenomenon[12]

National organisations

For the last twelve years, in Northern and Central Portugal there has been a continuous movement to promote forest owners' associations led by a non profit organisation called *FORESTIS-Associação Florestal de Portugal* [Forest Association of Portugal], formerly *FORESTIS-Associação Florestal do Norte e Centro de Portugal*, established in 1992. The main task of this association is to promote the creation of local forest owners' associations, provide some technical services of common interest (diffusion of information about forest policy and forest technologies, publication of a periodical bulletin, organisation of training courses for the staff and the directors of the associations, forest mapping, etc.), and represent its members in the forest policy making arenas, as well as in the negotiations with other stakeholders in the forest sector. Initially, since there were no local forest owners' associations in the region where it started, FORESTS accepted different kinds of members (forest owners and other individuals with an interest in the forest sector, as well as the new forest owners' associations created by FORESTIS, etc.) interested in contributing to the establishment of this new form of organisation of forest owners. As the network of associations promoted by FORESTIS and some that already existed in other regions showed an interest in joining this movement, the statutory rules were changed to make it closer to a federation of local forest owners' associations, while keeping a space for the individual founding members. Another change in the statutory rules was to broaden the geographical coverage to the entire country, since it was initially limited to the Northern and Central regions. So nowadays FORESTIS includes some associations in the southern regions, but its stronghold continues to be the small-scale forestry of Northern and Central Portugal where it is clearly the leading organisation in this matter. A final note is that FORESTIS developed in a way totally independent from the three national organisations disputing the representation of the agricultural sector and, by extension, the forest sector:

CAP-Confederação dos Agricultores de Portugal;

CNA-Confederação Nacional da Agricultura;

CONFAGRI (Confederation of the Farm Cooperatives).

Besides FORESTIS there are two other organisations of national scope federating local forest owners' organisations. One difference with respect to FORESTIS is that emanate from agricultural organisations:

one is *FPFP-Federação dos Produtores Florestais de Portugal* affiliated to CAP;

the other is FENAFLORESTAS affiliated to CONFAGRI.

FPFP is older than FORESTIS and FENAFLORESTAS is younger. The stronghold of FPFP is in the regions more towards the south of the country. Another difference is that the types of organisations affiliated to FPFP are more diverse in terms of size and activities than in the case of FORESTIS. One result of this is that FPFP has a history of internal balances of power and relations with its mother institution (CAP) more agitated than FORESTIS. This has not prevented this organisation from having stronger lobbying power due to its closer

[12] Section based, for the most part, on the paper by Mendes (2002a).

connections to the politicians that have successively been in charge of forest policy in the country.

FENAFLORESTAS is a latecomer to this movement. With very few exceptions, farm cooperatives did not showed a strong and effective interest in organizing and providing technical support to their members as far as their forestry activities were concerned. Some cooperatives set up forestry sections, and some specialized forestry cooperatives were created with the support of the Forest Services, but they didn't step up in this domain up to a point of having the salience of FORESTIS and FPFP. Some of these cooperatives are even affiliated to one of these two federations. The definitive interest of the farm cooperative movement in this area appeared in the follow up of the Forest Policy Law of 1996, where the Ministry of Agriculture got into the process of setting up a Forest Advisory Council established by that law and it was necessary to choose the representatives of the different stakeholders. It was around that time that the leaders of the farm cooperative movement set up FENAFLORESTAS.

Regional and local organisations

In spite of the fact that, for many years, there has been a high percentage of forestland under private ownership, which is also very fragmented in a large part of the country, the collective organisation of private forest owners is a very recent phenomenon. The national organisations presented in the previous sections played a role in federating and establishing new organisations of forest owners at the local level, taking advantage of public incentive schemes, but without a major involvement of the Forest Services in directly promoting this kind of institutions. The state played an important catalysing role, but in an indirect way, through the series of grant driven afforestation programmes and other incentive existing since the accession of the country to the EU which, not only helped to support the set up and operating costs of these organisations, but also stimulated among forest owners' a demand for the technical advice services they are aimed to provide.

The following tables clearly show that the emergence of forest owners' organisations in Portugal is a fact dating mostly from the late 90s, and very much irradiating from the small scale regions of Northern and Central Portugal (Entre-Douro-e-Minho, Trás-os-Montes, Beira Litoral and Beira Interior).

Number of forest owners' organisations by regions, in January 2002

Regions	Number
Entre-Douro-e-Minho	22
Trás-os-Montes	25
Beira Litoral	28
Beira Interior	28
Ribatejo e Oeste	13
Alentejo	8
Algarve	6
TOTAL	130

Source: DGF

Number of forest owners' organisations by regions and by years

Region / Year	EDM	TM	BL	BI	RO	AL	ALG	TOTAL
1977	1	1	9	1	4	3	0	19
1998	13	6	13	14	9	6	6	67
1999	14	40	15	20	11	4	6	110
2002	22	25	28	28	13	8	6	130

Source: DGF

The next table presents the distribution of the forest owners' organisations by type of legal status. The organisations with statutes under the Civil Code ("associations" not for profit) predominate by far. Cooperatives were only 31 out of 130, in January 2002. Since some of these cooperatives are affiliated to FORESTIS or FPFP, and the same happens to almost all those having the status of association, this situation illustrates the point made before about the late arrival to this arena of the farm cooperative movement.

Forest owners' organisations by type of activities and legal status

Activities	Forestry		Agriculture and forestry		
Legal status	Associations	Cooperatives	Associations	Cooperatives	TOTAL
2000	73	3	22	10	110
2002	71	5	28	26	130

Source: DGF

For this salience of the associative type of status might also have contributed the following facts:

a) the name “cooperative”, in some areas, has a “bad” connotation (many cases of farm cooperatives with bad management and in a bad financial situation, and a “leftist” connotation sometimes attached to this term and unsympathetical to large forest owners in Southern Portugal);

b) an association has lower costs to set up and can be more easily shut down, in case things go wrong, than a cooperative;

c) since at this initial stage of their lives, these organisations are not expected to provide a lot of marketable services, the tax exemptions existing for cooperatives are not enough to compensate for the type of advantages mentioned above.

About the cooperatives, two groups can be differentiated:

- one is part of the first generation of forest owners' organisations and consists of cooperatives specialised in forest management, which were established with the assistance of the Forest Services in the Central regions (Beira Litoral and Beira Interior);

- another group developed in more recent years, originating from agricultural cooperatives.

Some of the cooperatives in the first group are inactive. The data presented in the following table illustrates the developments in that second group and the locations of those in the first group.

Forest owners’ organisations by type of legal status

Regions	2000			2002		
	Associations	Cooperatives	TOTAL	Associations	Cooperatives	TOTAL
Entre-Douro-e-Minho	13 + 1*	1 + 1*	14	16	6	22
Trás-os-Montes	39	1	40	23	2	25
Beira Litoral	10	5 + 4*	15	16	12	28
Beira Interior	16	4 + 4*	20	18	10	28
Ribatejo e Oeste	11	-	11	12	1	13
Alentejo	4	2*	4	8		8
Algarve	5	1	6	6		6
TOTAL	98	12	110	99	31	130

Source: DGF; Note: (*) Inactive

Non industrial private forest owners' motives[13]

Types of motives

The conservation motive

What Campos Palacin *et al.* (2001) call the "conservation value" of agro-forestry systems can be considered what forest owners are willing to pay to maintain the use value of their forests, that is, their capacity to produce the goods and services (especially amenities) they want for their self consumption. In the typical natural conditions of Portugal, one piece of possible evidence of this type of motive may be the interest of forest owners who, even without willingness to invest on their forests for commercial purposes, at least want them to be treated in a way that can reduce the risk of forest fires. Other pieces of possible evidence of this type of behaviour is the fact that there are people without very much commercial interest in forest production who want to keep their property or want to buy forested land in order to use or to build country houses for themselves.

The commercial motive

What is called here the "commercial motive" corresponds to the motivation of forest owners who are willing to invest in their forests with the purpose of promoting the production of marketable forest goods and services.

The asset motive

Each of the two motivations mentioned before can be combined with an asset motive. Even if forest owners don't invest in the improvement of their forests because of a commercial motive, in order to get a better monetary income out of them, they remain as an asset which can be converted into exchange value in case they have unexpected needs for cash. Given the imperfections in financial markets, which many forest owners have to face, forest may be a quicker and easier source of funds than established financial institutions.

Some bits of empirical evidence for an hypothesis about the motives of Portuguese forest owners'

Private profitability of forestry

Calculations made about the private internal rates of return for investments in the three main species existing in Portugal show the following (BPI & Agro.Ges, 1997):

a) only for eucalyptus, it is possible for those rates to be higher than the best alternative financial investments, taking into account a specific premium for the risk of forest fire;

b) maritime pine and cork oak are not profitable, even if we take into account the opportunity cost of holding the land in forestry.

[13] Section based, for the most part, on the paper by Mendes (2002a).

A piece of evidence that these profitabilities may be ranked in this way is the fact that the area of eucalyptus has been growing in recent years without public incentives, often substituting burnt pine stands, whereas afforestation with pine and cork only happens where there are generous public incentives. For this reason, with the exception of eucalyptus, commercial motives are very much weakened in the other species for this private unprofitability, except if the forest owners have the means to apply for existing public incentives.

Pulpwood supply

In his Master Thesis, Dias (2001) estimated an econometric model of the eucalyptus pulpwood market in Portugal for 1970-99. The results for the supply function are reported in the following table. They can be interpreted in the following way:

a) the supply of eucalyptus pulpwood is positively influenced by its price;

b) the positive sign for the coefficient of the interest rate says that forest owners increase timber supply when the cost of borrowing money goes up which may be evidence that net growth in the owner's timber stock is a substitute for credit from financial institutions;

c) one possible meaning of the positive sign for the coefficient of the variation in household disposable income can be that forest income is not needed to finance regular consumption needs of the forest owners by covering up for decline in disposable income, but instead may be positively related to **financing owner's investments** made possible when disposable income is rising, which is consistent with the interpretation of the sign of the interest rate coefficient;

d) as expected, area and wood supply are positively correlated.

Supply function of eucalyptus pulpwood in Portugal in 1970-99

Variables	Coefficient	t statistics	p-value
Constant	-2112238	-3,5520	0,0007
$PMEUC_t$	121102,0	3,2341	0,0018
$TXJACT_{t-1}$	71149,90	7,6740	0,0000
ΔRNFL	0,000345	2,6099	0,0109
$AREUC_t$	5,380483	11,2448	0,0000
R^2	0,9318		
$\overline{R}^2$	0,9205		
DW statistics	1,7344		
White test	14,3104		
Chow test	1,3714		

$PMEUC_t$: price of eucalyptus pulpwood, off bark, at factory gate at the end of year t
$TXJACT_{t-1}$: nominal interest rate (lending rate by financial institutions) in year t-1
ΔRNFL: variation in household disposable income; $AREUC_t$: area of eucalyptus plantations in year y

If these interpretations are correct, they imply that an "**asset motive**" may be part of the driving forces behind the supply of eucalyptus pulpwood.

Forest owners' participation in public incentive schemes

Taking the members of the biggest forest owners' association in Portugal in terms of membership (Forest Owners' Association of the Sousa Valley), Mendes (1999c) and Tavares

(2004) estimated a series of **multinomial logit models** whose purpose is to investigate how some of the forest owners' characteristics influenced their probability of applying for the public incentive schemes to forest investment in the following types of projects:

a) individual afforestation projects only;

b) grouped afforestation projects only;

c) individual and grouped afforestation projects.

From these models we concluded that individual characteristics of the forest owners, in particular the **size** of their forest lands and the **proximity** to their forest holdings, proved to be statistically significant variables to predict their probability to implement afforestation projects. Concerning the size effect, we concluded grouped projects are more like to be carried out by small owners, than by larger owners.

Concerning the distance effect, we concluded that proximity of residence to the forest holdings increases the probability of the forest owner to apply for financial incentives to an individual or a grouped project.

Another interesting result concerning distance effects is that the more a forest owner lives away from his forest the less he is likely to join in grouped projects. This means that **local community ties** play a positive role in get grouped projects going.

Finally one more result of this work worth to be mentioned is the relation between the fact that a forest owner invest in his forest with the support of these programmes and his level of **commitment to the forest owners' association**. A proxy for this commitment was whether or not he pays all his membership fees and in due time. The results here show a positive correlation between this level of commitment and investing in forestry.

General conclusion

A tentative hypothesis that can be drawn from these studies for the Portuguese case is the following:

- the main driving motives of forest owners' behaviours are the conservation and the asset motives;

- the commercial motive is weak and concentrated in a very small number of owners;

- even though they are predominant, the conservation and the asset motives may generate some willingness to pay from the forest owners for **preventive silvicultural services** capable of preserving the productive capacity of their forests and reduce the risk of forest fires;

- this willingness to pay may not be enough to pay those services at their market prices.

Forestry services activities[14]

Loggers and timber intermediaries

Number and size of the logging enterprises

[14] This section is based on our contributions for the CESE report (CESE, 1996, 1998).

In 1995, there were in Continental Portugal 750 logging enterprises, with a total turnover of 120 million euros, and an unknown number of independent and unregistered loggers.

In the past, their relations with the forest industries were controlled by a small number of intermediaries who subcontracted logging to small logging firms, acting independently from each other. During the 80's there was an interesting movement of cooperation between some of these logging and intermediary firms which led to the establishment of a cooperative called UNIMADEIRAS-União de Comerciantes de Madeiras, S.A. (Albergaria-a-Velha). This organisation concentrates the supply and the negotiations of their members with the pulp and paper companies which are their main buyer. The following tables present some data we collected in 1996 from the managers of the cooperative about the characteristics of their members. This data is interesting because there is very few quantitative information available about this kind of forest service providers.

Besides UNIMADEIRAS there are other kinds of companies concentranting wood supply to the forest industries. The names of the main ones are the following:

-ABASTEMA-Sociedade Abastecedora de Madeiras, L.da (Coimbra);

-MADITORRES-Sociedade de Comércio e Exportação, L.da (Torres Vedras);

-FICAP.

Distribution of the number of enterprises and family workers by size of the family labour force, for the logging enterprises members of UNIMADEIRAS in 1996[15]

Number of family workers in the enterprise	Enterprises		Workers	
	No.	%	No.	%
0	95	27,5	0	0,0
1	95	27,5	95	20,4
2	87	25,0	174	37,3
3	43	12,5	129	27,7
4	17	5,0	68	14,6
Did not answer	9	2,5	--	--
TOTAL	**346**	**100,0**	**466**	**100,0**

Distribution of the number of enterprises and hired workers by size of the hired labour force, for the logging enterprises members of UNIMADEIRAS in 1996[16]

No. of hired workers in the enterprise	Enterprises		Workers	
	No.	%	No. of workers	%
0	43	12,5	0	0,0
1	9	2,5	9	0,7
2	61	17,5	122	9,0
3	52	15,0	156	11,5
4	43	12,5	172	12,7
5	26	7,5	130	9,6
6	26	7,5	156	11,5
7	26	7,5	182	13,5
8	17	5,0	136	10,1
9	9	2,5	81	6,0
10 or more	17	5,0	208	15,4

[15] This data does not include the owner of the enterprise in the number of workers.
[16] This data does not include the owner of the enterprise in the number of workers.

Did not answer	17	5,0	--	--
TOTAL	346	100,0	1352	100,0

From this data we can draw the following conclusions:

- almost three quarters of the enterprises (72, 5%) have family workers besides the owner himself;
- most of the employment is in enterprises with 10 workers or less.

So, this is an activity of **very small family enterprises**.

The type of activities performed by logging enterprises

The data provided by UNIMADEIRAS also includes information about the degree of vertical integration of their members. This data is presented in the following table. We can see that about half of the enterprises contract out some of their activities more or less frequently. Also the large majority of these enterprises have their own means of timber transportation to the factory gate.

The 40% of enterprises which frequently contract out the logging operations are simply timber intermediaries between loggers and forest industries. The other 60% of enterprises combine two aspects in their activities:

- one is the **commercial aspect** when they act as intermediary merchants between the forest owners and the forest industries;
- the other is the **forest services provider' aspect** when they supply timber harvesting services to the forest owners using their family labour or hired labour.

Indicators about the degree of vertical integration among the members of UNIMADEIRAS in 1996

	% of enterprises
1. Do you frequently contract out some of your logging operations?	
- No	47,5
- Yes	40,0
- More or less	12,5
2. Do you have your own means of timber transportation?	
- Yes	90,0
- No	10,0

In its commercial aspect timber-merchants do the "*matching*" between the forest owners and the forest industries by searching for owners willing to sell timber and for industrial firms willing to buy it. So, in this case, the main production factor is the **detailed knowledge about the local forest resources and forest owners** which these entrepreneurs normally have. The local nature of this knowledge favours the organisation of this activity as a **spatial oligopsony**, where each logging company or timber intermediary colludes with his neighbours in order to divide the forest territory according to the local knowledge each ones has.

Timber prices are negotiated directly between individual forest owners and these loggers or timber intermediaries. Since, when forest owners sell wood often they do it because they are under some form of financial stress, this situation together with what we said before about market imperfections, shifts the balance of power in favour of the loggers and timber intermediaries.

The market power these entrepreneurs often have with respect to the forest owners does not happen in the same way when they deal with the forest industries. Here many times

they have to face companies which are bigger than they are and more concentrated, especially in the case of the pulp and paper industries. Here there is another problem which has to do with the fact that the wood demand from these industries is subject to wide conjunctural variations.

The commercial role of these enterprises which is often the object of deserving or undeserving negative remarks by forest owners is still going to remain for many years to come, in spite of the recent progresses in the collective organisation of forest owners. These organisations normally are unable to operate throughout a territory as wide as the one on which these enterprises work. Also they have not yet acquired the commercial expertise these entrepreneurs have during their lifetime and from their parents, when the two generations are in the same business which is often the case, as we have seen before.

Concerning the provision of logging and timber transportation services, this is another are where these private enterprises will probably remain for many years to come, without substantial progress of vertical integration upstream from the forest owners' associations. In fact, this activity is subject to wide fluctuations in demand, but requires some relatively high fixed costs (trucks, harvesting equipment, etc.) which is something for what most existing forest owners' associations are not prepared. Also, the fragmentation of forest ownership combined with the difficult topography of most of the Portuguese forests contributes to relatively high logging costs. Because of this, these enterprises manage to survive due to the following factors:

- when they can, they use some market power with respect to private forest owners;
- they have a very light structure in terms of personnel;
- they often rely on unpaid and intensively family labour.

Forest owners' associations with a geographically limited area of intervention, and without possibility of relying on the same type of labour as these enterprises will have a hard time to be competitive in this business.

Forest consultants

One of the effects of the afforestation programmes supported by the EU structural funds since 1986 has been the establishment of universe of forestry consulting companies and individual forestry consultants. Their main job has been to assist the private forest owners in the preparation of the forest management plans and the investment projects needed to apply for the public financial incentives provided by those programmes. Usually they also take care of the contacts with the public agencies in charge of managing these programmes. Finally some of them continue to assist the forest owner after they get their applications approved, by supervising the afforestation works.

The following table presents data on the number of these professionals in 1995, the middle point of the period covered by the EFFE project, according to the following qualifications:

a) Bachelor's degree in forest sciences;

b) Bachelor's degree in agronomic sciences and good skills in forestry;

c) Other academic degrees in agronomic areas and professional experience in the preparation, analysis and supervision of forest projects.

Number of forest consultants and number of forest projects they prepared and got approved for public funding during the 1st campaign of the Forest Development Plan (PDF)

Regional delegations of the Forest Services	Number of forest consultants				Number of forest projects prepared by the consultants and approved for public fundin			
	a)	b)	c)	Total	a)	b)	c)	Total
Entre-Douro-e-Minho	22	2	7	31	74	7	59	140
Trás-os-Montes	17	1	3	21	43	3	4	50
Beira Interior	33	7	10	50	125	19	53	197
Beira Litoral	18	2	12	32	115	9	40	164
Ribatejo Oeste	13	12	13	38	40	76	40	156
Alentejo	11	17	17	45	23	59	96	178
Algarve	8	8	5	21	49	62	16	127
TOTAL	**122**	**49**	**67**	**238**	**469**	**235**	**308**	**1 012**

Source: Instituto Florestal-Divisão de Planeamento (1995).

Chapter

6

Production, manufacturing and trade of wood products

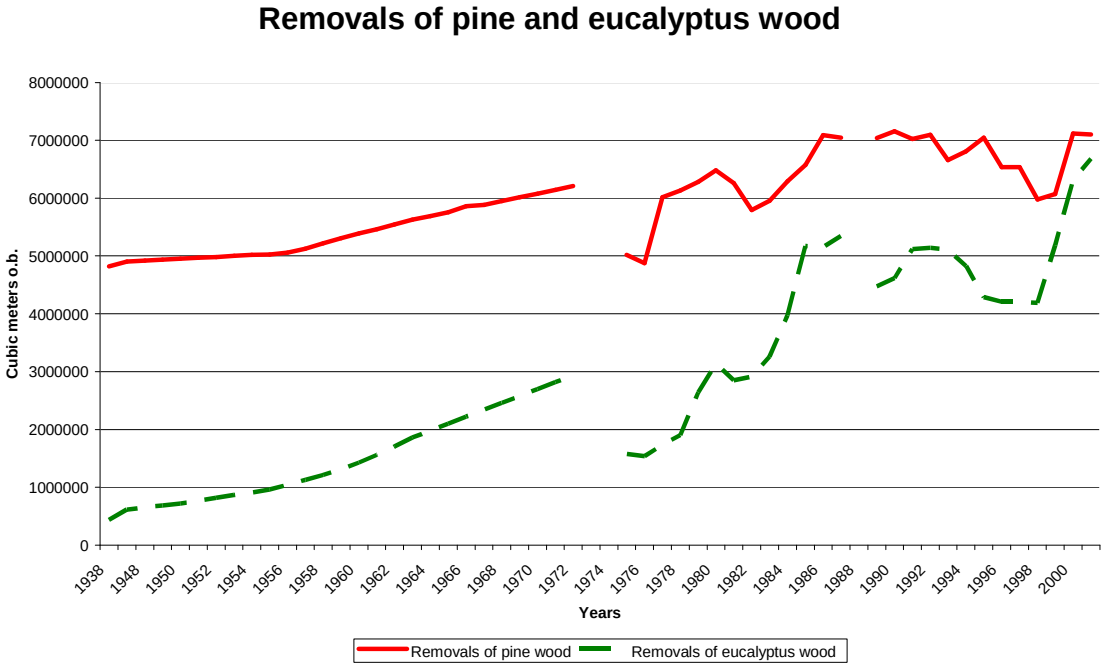
Removals of pine and eucalyptus wood

Removals of pine wood increased from mid 70s to the beginning of the 90s, declined during the 90s and gave signs of restart growing since the year 2000. The rise and fall of these removals is probably explained mostly by the rise and fall of the exports of sawnwood for pallets.

In spite of some difficulties during the 90s, the removals of eucalyptus wood for pulp show a clear positive trend, at higher growth rates than for pine. This is due to the derived demand from a growing pulp and paper industry, more competitive than the pine based sawmilling.

The 11200000 m^3 o.b. of annual feelings for wood supply are almost of the same amount as the 12900000 m^3 o.b. of net annual increment in the forests with the same main function. So the **derived demand by forest industries is in tight tandem with wood supply**.

Net annual increment per hectare in forests for wood supply (4,6 m^3/ha/year for *Pinus pinaster* and 9,0 m^3/ha/year for *Eucalyptus globulus*) is relatively small due to poor forest management. With better management these increments could be increased by 20% or more.



Removals of pine and eucalyptus wood (m^3 o.b.)

Year	Pine	Eucalyptus	Year	Pine	Eucalyptus
1938	4820000	432000	1974		
1947	4904000	612000	1975	5017800	1577900
1948	4920000	648000	1976	4877800	1535700
1949	4937000	684000	1977	6014100	1734400
1950	4954000	720000	1978	6135400	1900300
1951	4970000	768000	1979	6279100	2639900
1952	4983000	816000	1980	6480700	3139600
1953	5000000	864000	1981	6259900	2850700
1954	5017000	912000	1982	5793700	2911300
1955	5026000	960000	1983	5954100	3259400
1956	5055000	1044000	1984	6290900	3975200
1957	5124000	1128000	1985	6574400	5170800
1958	5221000	1212000	1986	7088000	5152000
1959	5306000	1308000	1987	7048000	5346800
1960	5387000	1428000	1988		
1961	5464000	1560000	1989	7038000	4474000
1962	5545000	1704000	1990	7153000	4617000
1963	5626000	1860000	1991	7021000	5119000
1964	5687000	1980000	1992	7094000	5139000
1965	5752000	2100000	1993	6657000	5107000
1966	5858000	2220000	1994	6809000	4827000
1967	5883000	2340000	*1995	7046000	4286585
1968	5948000	2460000	1996	6536000	4207317
1969	6013000	2580000	1997	6536000	4207317
1970	6078000	2700000	1998	5977000	4187805
1971	6144000	2820000	1999	6073000	5181707
1972	6209000	2940000	2000	7117000	6313415
1973			2001	7100000	6684146

Sources and methodology:
a) pine and eucalyptus removals from 1938 to 1972: INE, Estatísticas Agrícolas (several years)
b) pine and eucalyptus wood removals from 1975 to 1987: DGF (1991)
c) pine wood removals from 1989 to 1992: total removals of coniferous (roundwood and pulpwood, fuelwood excluded) obtained from INE (1996a)

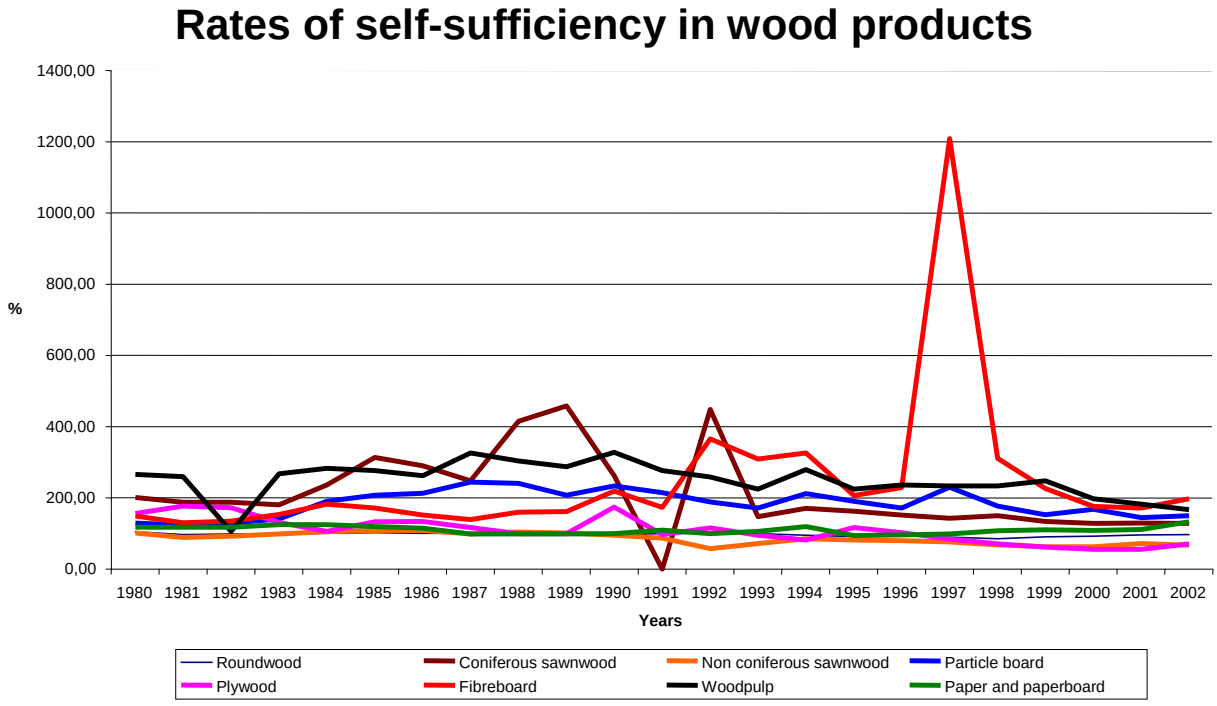
d) pine wood removals for 1993 and 1994: total removals of coniferous (roundwood and pulpwood, fuelwood excluded) obtained from INE (1998)
e) pine wood removals from 1995 to 1998: total removals of coniferous (roundwood and pulpwood, fuelwood excluded) obtained from INE (2001) converted from cubic meters u.b. to cubic meters o.b. using the conversion factor 1 m^3 o.b. = 0,7 m^3 u.b.
f) pine wood removals from 1995 to 1998: total removals of coniferous (roundwood and pulpwood, fuelwood excluded) obtained from INE (2003e) converted from cubic meters u.b. to cubic meters o.b. using the conversion factor 1 m^3 o.b. = 0,7 m^3 u.b.
g) eucalyptus wood removals from 1989 to 1992: total removals of pulpwood from broadleaved obtained from INE (1996a)
h) eucalyptus wood removals for 1993 and 1994: total removals of pulpwood from broadleaved obtained from INE (1998)
i) eucalyptus wood removals from 1995 to 1998: total removals of pulpwood from broadleaved obtained from INE (2001a) converted from cubic meters u.b. to cubic meters o.b. using the conversion factor 1 m^3 o.b. = 0,82 m^3 u.b.
j) eucalyptus wood removals from 1995 to 1998: total removals of pulpwood broadleaved obtained from INE (2003e) converted from cubic meters u.b. to cubic meters o.b. using the conversion factor 1 m^3 o.b. = 0,82 m^3 u.b.

Domestic consumption and foreign trade

The trends in production, apparent domestic consumption and foreign trade based on the UNECE/FAO TIMBER database for 80s and 90s were the following:

- Portugal had an exporting position in all wood products categories throughout the entire period;
- The rate of self-sufficiency increased during the 80s and declined during the 90s.

Since these trends are common to all product categories, and given the date in the trend reversal, there are good reasons to advance the hypothesis that it is mainly due to changes in the macroeconomic policies and in the macroeconomic environment. The major change in this matter was the process of joining the Economic and Monetary Union, which left the exporting activities without the protection they had until then through variations in the exchange rate.



Brief overview of the forest industries

Value added and employment

The following tables present some data about the relative importance of wood processing industries in terms of value added and employment. Even though it is decline, the share of the forest industries is still relatively important in terms of the value added and employment of the Portuguese industry.

Relative importance of the wood processing industries in terms of value added (10^6 esc.)

Year	Sawmills, carpentry and wood panels	Cork products	Wood pulp	Paper and paperboard	Wood furniture	Total forest industries	Total manufacturing industries	Forest industries/ Manufacturing industries (%)
1984	12630	10283	25450	17643	4966	70972	597129	11,89
1985	14755	10775	27356	19622	5122	77630	708721	10,95
1986	19315	11027	34689	25073	6652	96756	859083	11,26
1987	24256	12396	54653	27920	8912	128137	1033523	12,40
1988	27256	13692	62689	33354	10979	147970	1204546	12,28
1989	31454	17385	75713	35997	12386	172935	1313685	13,16
1990	51027	24825	55743	26466	33162	191223	1855310	10,31
1991	55927	32945	44675	29423	46317	209287	2013473	10,39
1992	55416	28927	42663	28799	50236	206041	2098473	9,82
1993	51640	38294	20449	30761	46838	187982	2214102	8,49
1994								
1995	331196							
1996	278269							
1997	298718							
1998	318967							
1999	322977							

Sources: INE – 1984-85 – Estatísticas Industriais; 1990-93 – Estatísticas das Empresas

Relative importance of the wood processing industries in terms of employment (number of workers)

Year	Sawmills, carpentry and wood panels	Wood furniture	Cork products	Wood pulp	Paper and paperboard	Total forest industries	Total manufacturing industries	Forest industries/ Manufacturing industries (%)
1984	26169	12000	14361	5043	13370	70943	654069	10,85
1985	24910	11700	12590	4521	13159	66880	630216	10,61
1986	24784	11435	12192	4451	12913	65775	629680	10,45
1987	24174	12142	12227	4060	12717	65320	628876	10,39
1988	23511	12171	11280	4028	12541	63531	618639	10,27
1989	22771	11870	10544	4052	12649	61886	615429	10,06
1990	40143	38095	17747	6583	11925	114493	1011339	11,32
1991	39205	49301	18903	6191	10860	124460	1042593	11,94
1992	34854	51374	16867	5900	10931	119926	994107	12,06
1993	34000	40146	17330	6270	10541	108287	970353	11,16
2001	30641	52865	18016	5652	8094	115268	909921	12,67

Sources: INE – 1984-85 – Estatísticas Industriais; 1990, 1993, 2001 – Estatísticas das Empresas

Modes of entrepreneurial organisation

In wood and cork processing industries, there are, at least, three types of entrepreneurial organisation to be distinguished:

a) the pulp and paper and the wood panel industries which are dominated by large firms of international scope;

b) cork manufacturing and furniture industries where we can find situations close to the **marshallian district** concept;

c) sawmilling and carpentry which are more dispersed in both geographic and entrepreneurial levels.

The case of the cork manufacturing industries (at the second level of transformation, that is from the manufacturing of cork planks onwards) is close to the marshallian district level if we define this type of organisation by the combination of high levels of inter-firm specialization and spatial integration. The case of the furniture industry is less close to the marshallian district concept because the level of spatial integration is high, but the level of inter-firm specialization is lower. This difference is probably due to the fact that cork industries have been export oriented for a long time, whereas the furniture industry has been oriented primarily towards the domestic market.

Chapter

7

Production, manufacturing and trade of cork products[17]

The long run series of cork removals and exports

Cork is the major non-timber forest product in Portugal, the country being the main producer of raw cork in the world (more than 50% of the world production). Since the Spanish Civil War, in 1936, Portugal also became the main manufacturer of this material in world.

In a previous paper (Mendes, 2002) I provided the long series of cork removals and exports represented in the graph for the period since 1865[18]. These series show the following facts:

- a strong correlation between the amounts of cork removals and exports;

- three different periods in the dynamics of these two variables:

a) **from 1865 until the second half the 30s**:

- positive trends in cork removals and exports (total, unprocessed and processed cork), only interrupted during World War I and the crisis of 1929;
- exports of unprocessed cork being more important (in quantity terms) than processed cork until World War I, staying close to each other until the end of this period;
- the last decade of the XIXth century as the moment of take off for the cork industries;

b) **from the second half of the 30s until mid 60s**:

- positive trend in cork removals and exports of processed cork;
- negative trend in exports of unprocessed cork

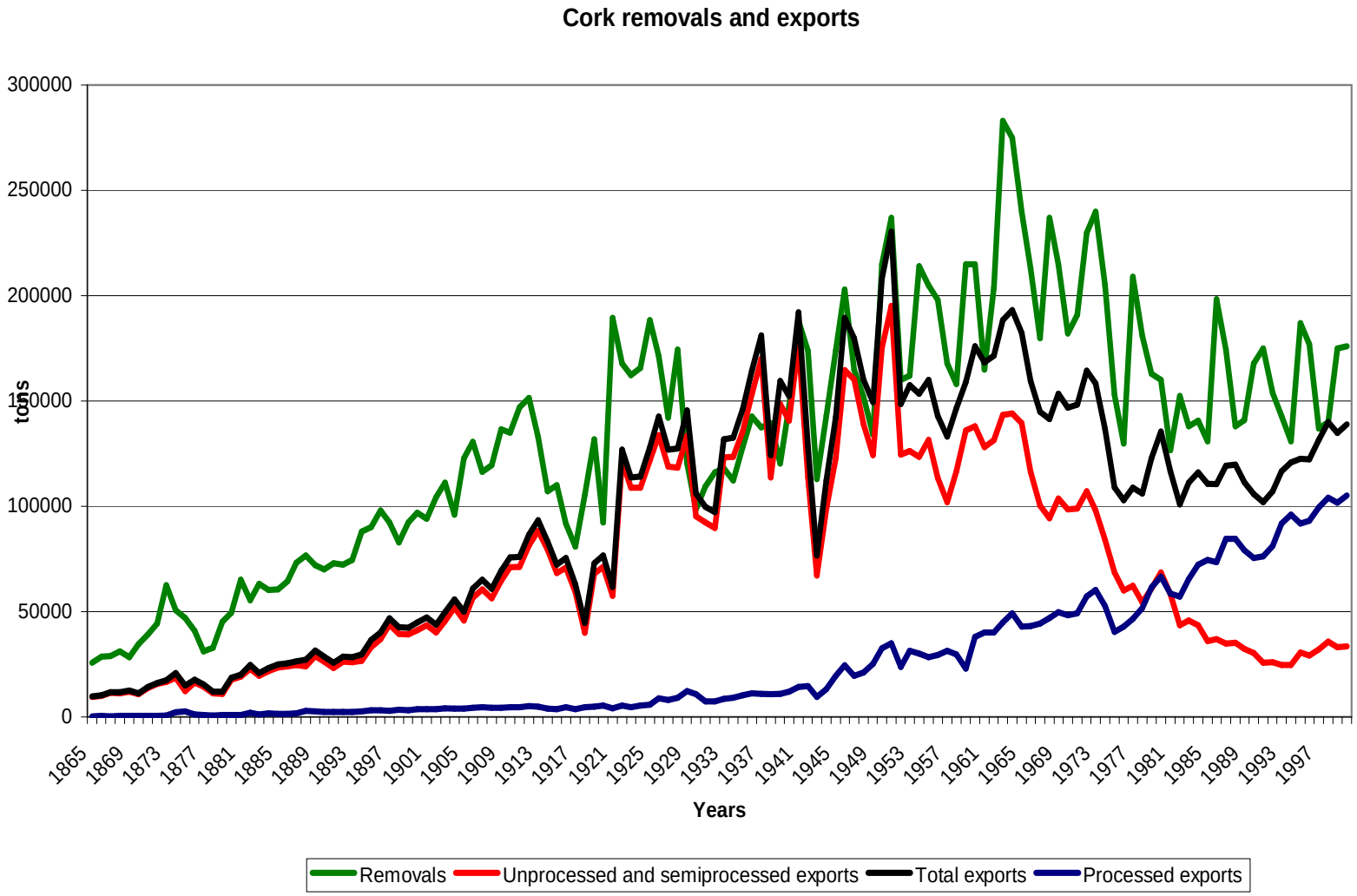
c) **from mid 60s until mid 80s**:

- sharp decline in cork removals;
- continuing decline in exports of unprocessed cork;
- decline in exports of processed cork;

d) **since mid 80s**:

[17] This chapter is the full version of the paper by Mendes (2005b).
[18] The graph is based on the series presented in Mendes (2002b), completed and updated with data from the officila foreign trade and agricultural statistics.

- positive trend in cork removals recovering the level of the end of the 30s;
- positive trend in exports of processed cork recovering the levels (in quantity terms) of before the Revolution of 1974.


Cork removals and exports
300000
250000
200000
150000
100000
50000
0
tons
1865
1869
1873
1877
1881
1885
1889
1893
1897
1901
1905
1909
1913
1917
1921
1925
1929
1933
1937
1941
1945
1949
1953
1957
1961
1965
1969
1973
1977
1981
1985
1989
1993
1997
Years
Removals
Unprocessed and semiprocessed exports
Total exports
Processed exports

From 1865 until the second half of the 1930s

Drivers of cork removals and exports

Foreign demand factors

During this period cork products were not yet facing the competition of what was going to be a powerful substitute later on, namely plastic materials. So economic growth in the USA and in Europe led to an increasing demand for cork products which was not weakened by that kind of competition.

At the beginning of this period, the cork industries in Portugal were still very weak. So the industrial demand for unprocessed cork was coming mostly from abroad:

- from Spain, and more precisely, from Cataluña where the second half of the XIXth was the "golden age" of the cork stopper;

- from importing countries (USA, Germany, France, Russia, United Kingdom, etc.) which had installed their own cork industries.

The existence of taxes and other barriers to exports of unprocessed cork from Cataluña and other Spanish regions during most of this period deviated some of the demand for unprocessed cork towards Portugal.

Reductions in the costs of international transports also contributed to increase foreign demand.

Even though cork industries are weight loosing activities, the continuing demand for unprocessed cork from importing countries was sustained by the invention of cork agglomerated products in the end of the XIXth century. This technological change opened up the possibility of using for profit almost all the raw material, but reserved this opportunity only to those with means to invest in this new cork industry which was capital intensive, contrarily to the existing ones which were labour intensive.

Macroeconomic factors

During the 1860s, 1890s and 1880s the Portuguese economy went through a period of economic growth, with active policies of public investments in infra-structures, namely roads and railroads, accompanied by a gold standard for the national currency from 1854 until 1890 to attract foreign capitals capable of financing the public debt. Some of these foreign capitals came to the businesses of cork plank exports and cork manufacturing.

The new public infra-structures gave the cork producing regions relatively easy access to the Lisbon harbour from where cork could be shipped abroad.

A series of internal and external events affected the inflow of foreign capital in the end of the 1880s leading to a serious crisis in the public finances, the result being the end of the gold standard in 1890. The monetary regime that came after benefited those who exported goods paid in strong currencies and did not have to face protectionism by importing countries. This situation favoured exporters of unprocessed cork, but not exporters of processed cork, for two reasons:

- importing countries having their own cork industries were very protective of these activities (since the early 1870s), but needed to import unprocessed cork;

- exporters of unprocessed cork tended to pay higher prices to cork producers, than the domestic cork industries.

Real prices

Real prices for unprocessed cork followed a positive trend until the mid 1880s which, together with a rising demand, was a supporting factor for the growth of the cork oak area. That rise in prices was steep between 1875 and 1885. Since 1885 until the beginning of the 1930s this trend in real prices turned negative, but cork removals could increase as the trend in demand remained positive, the new cork areas coming from the previous period reached the age of production and new areas of cork oak were installed.

Interdependencies between cork and wheat production

In Portugal the main cork and wheat growing regions largely coincide. In the economic crisis of the end of the 1880s, the landowners from those regions were strongly in favour of protectionism at home for their wheat production, and were not on the side of the workers and entrepreneurs of the cork industries against protectionism in cork importing countries because they were better paid by foreign cork industries, than by domestic ones. One outcome of this economic crisis was the institution of a protectionist regime on wheat in 1889 followed, in 1899, by a mechanism of guaranteed price to producers. With some modifications along the way, this favourable regime for wheat lasted almost one century, until the accession of Portugal to the EEC in 1986.

Cork and wheat production during this period were interdependent in several ways related to the socioeconomic structure of cork and wheat production. Until the institution of the protectionist regime on wheat in 1889, the price of cork tended to rise relative to the price of wheat. This price increase and the rising demand for cork motivated landowners to expand the cork producing area. This was carried out by clearing the scrublands where small cork plants popped up, managing their natural regeneration and substituting cork for wheat where this activity was abandoned due to the competition from lower priced imported wheat. For that expansion in cork area landowners needed to appeal to a relatively stable population of farm workers. In a lowly populated region as was the one where cork is produced, one way to attract and settle those workers was to engage them in the complementary production of wheat and other crops. In those days cork and wheat could coexist in the same cleared scrublands and, if not, they were grown in territories close enough to each other to provide sufficient food and work to settle the necessary population of farm workers.

When the relation between the prices of cork and wheat was reversed, after the institution of the protectionist regime in 1890, the complementarity between the two activities remained: natural regeneration of cork oaks could be managed in existing or newly cleared lands now intended, at first, for wheat production, and this expansion of cork oak areas could continue to count on a positive trend in demand for cork.

Drivers of cork industries

Impeding factors of cork industry development in Portugal

Considering what was presented in the previous section, we can draw the following list of impeding factors of cork industry development in Portugal during this period:

a) the existence of competitive industries in Cataluña and in the major importing countries, which were superior to the Portuguese industry in terms of technology, marketing capacities, quality and price of the final products;

b) the better prices paid to unprocessed cork by these foreign industries than by the cork industries installed in Portugal;

c) the barriers to exports of unprocessed cork from Spain deviating some of the demand for this product towards Portugal;

d) protectionist policies in the main importing countries (France, Germany, Russia, USA) for their cork industries against which Portugal had a very weak negotiating power.

For this weakness contributed not only the different dimension of Portugal compared to these big countries, but also an internal factor. This factor was the divergence between the interests of cork producers and cork manufacturers which was an impeding factor for the construction of a strong coalition able to press the government for negotiating concessions from protectionist countries.

Supporting factors of cork industry development in Portugal

In spite of the impeding factors mentioned above, the average export price for processed cork followed a positive trend until 1885, both in real terms, and in relative terms compared to the export price for unprocessed cork.

Also the public policies of the 1860s, 1870s and 1880s concerning the improvement in transportation and communication infrastructures facilitated the development of industries such as cork manufacturing dependent on the frequent transfer of relatively large volumes of raw materials and products.

These two factors might have contributed to the first significative rise in Portuguese cork industries during the second half of the XIXth century, the total employment in these activities having gone up from a little more than 70 workers around 1845 to 3616 in 1890. Companies oriented towards the British market, some of which owned by British businessmen such as G. Robinson and T. Reynolds, played an important role in this period. This was, by far, the major market both for unprocessed and for processed cork exported by Portugal during the second half of the XIXth century. In the British market, Portuguese processed cork products benefited from lower protectionist barriers than in other importing countries. Because the transportation infrastructures were still undervelopped, the tendency during the earlier part of this period in terms of location was for the cork companies (preparation of cork planks and manufacturing of stoppers) to be installed in the cork producing regions, that is mainly in Alentejo.

The economic problems in the United Kingdom in the end of the XIXth century did not favour the firms strongly dependent on the British market. So the next surge of the cork industries which took place in the early years of the XXth century was driven mostly by companies oriented towards an alternative and expanding market, more precisely the USA. That was the case of Mundet, installed in Seixal, in 1905, which was going to become the largest cork company in the world, integrating vertically the different stages of cork processing (cork planks, cork stoppers, agglomerates) together with a commercial network spread throughout the main importing countries, including a good basis in the USA market.

The developments in the transportation infrastructures (especially the railways which were being completed during the first decade of the XXth century connecting the regions of

Alentejo and Algarve to the Montijo/Seixal/Barreiro area) facilitated the installation of plants for cork stoppers and agglomerates near the Lisbon harbour where there was also more supply of wage labour, leaving the preparation of cork planks in the cork producing areas. This is where Mundet and other relatively large cork companies were located in this period. In the development strategy of this industrial group an important component was the vertical integration of cork manufacturing with the preparation of cork planks and the production of agglomerates.

In the north, in the cities of Porto and Gaia, with later displacements to the area of Feira, there was a pocket of very small family firms devoted to the manufacturing of cork stoppers for the wine production shipped abroad from the Douro harbour or exported as such for wine importing countries, namely the United Kingdom. In their beginnings these small companies took advantage of the connections to these kinds of markets and from the access to the cork production coming from some regions in the North such as Trás-os-Montes or the Valley of Arouca. These sources of cork production were not as favourable in quantity and quality as the ones in the southern regions. So this industry in the North had a handicap in terms of access to cork supply compared to the industry in the south. However, as transportation infrastructures were developing and, especially after the appearance of road transportation, the tendency was for that handicap to become less important. What remained as major difference was the higher reliance on family labour in the firms in the North compared to the firms in the South. In the North many firms were small and cork workers lived in rural areas with a high population density and possibilities for part time farming. In the South, especially in the surroundings of Lisbon (Montijo/Seixal/Barreiro) cork workers were simply wage workers, living in urban areas without that kind of complementarity with agriculture.

Besides the development in the railway system connecting the regions of Alentejo and Algarve to the Montijo/Seixal/Barreiro area, another supporting factor for the development of the cork industries since 1910 was the legislation approved in that year constraining the exports of unprocessed cork. This was an old claim of cork industry workers which was finally taken up by the government after a long series of strikes of cork workers culminating in a general strike in September 1910.

By the end of the period under analysis, Portugal had a cork industry dominated by the companies located in the Montijo/Seixal/Barreiro area, some of them of large size, vertically integrated, with a diversified set of products and relatively well implanted in foreign markets. In the Feira area there was already an active pocket of small family firms in the manufacturing of cork stoppers. The preparation of cork planks remained spread throughout the cork producing areas. Pushed by the foreign demand and by this growth in the demand by the domestic industry, Portugal was the leader in the world in terms of production of unprocessed cork, but this was not enough yet to reach a leading position in cork manufacturing. Here the Catalonian industry was still holding the first position. The Civil War, in Spain, by destroying the industrial capacity in that region, brought about an irreversible change in the relative position of the two countries, in terms of cork manufacturing.

From the second half of the 1930s to the mid of the 1960s

Drivers of cork industries

During this period there were four relevant facts for the development of cork industries in Portugal:

a) The Civil War in Spain which severely damaged cork industries in that country, especially in Cataluña;

b) the development of plastic materials competing with cork agglomerates;

c) the development of railways and road transportation;

d) the instauration of the corporative regime of Salazar with policies of legal barriers to entry in industrial activities (*"condicionamento industrial"*) and public regulation of the regional segmentation in cork labour markets.

The effect of the destruction of cork industries in Spain is that the Portuguese industry took over the Spanish position, becoming, since then, the leading country not only in cork production, but also in cork manufacturing.

The main effect of the emergence of plastic materials was the crisis in the large firms of the Montijo/Seixal/Barreiro area, especially Mundet, which had based a lot of their strategy on the production of agglomerates and other materials now competed by plastics. Another effect was to make less competitive the cork firms installed in importing countries which had based part of their competitiveness in the full valorisation of cork through production of stoppers and utilisation of residues for agglomerates.

The development of railways and road transportation was to diminish the advantage of the industry in the Montijo/Seixal/Barreiro area over the industry in the Feira district in terms of access to the cork production areas.

The main effects of the industrial and labour market policies of the Salazar regime were to favour the development of the small family firms in the Feira district:

a) they were totally or almost totally free from the requirements imposed by the "industrial conditioning" system which was not the case of the larger firms;

b) the public regulation of the cork labour markets consecrated the wage differentials between the Feira district and the industry in the South, with salaries lower in the former compared to the latter.

In the development of the Feira district during this period the Amorim group rose to a position of dominance over the small family firms in the area:

a) some of these firms were run by former employees of the Amorim companies;

b) the Amorim group supplied cork planks and credit to the small firms and exported most of their products (cork stoppers).

Overall, the main changes during this period were the rise of Portugal to the leading position in terms of cork manufacturing and the reversal of the relative positions between the industry in the North (Feira) and the industry of in the South (mainly in the Montijo/Seixal/Barreiro area):

a) in 1930 there were 24 cork industrial units in the Aveiro district, 111 in the Setúbal district and 297 in the rest of the country, while, in 1980, there were respectively 377, 139 and 103 (in Mendes, 2002b);

b) in 1939 there were 2677 cork industry workers in the Aveiro district, 9469 in the Setúbal district and 5276 in the rest of the country, while, in 1975, there were respectively 7319, 5703 and 2683 (in Mendes, 2002b).

Drivers of cork removals and exports

Because of the destruction in the Spanish cork industry and the crisis of cork industry in some importing countries together with the development of cork industries in Portugal, the exports of unprocessed cork followed a negative trend, whereas exports of processed cork followed a positive trend interrupted by World War II and the Korean War.

Since exports were rising cork removals were also on the rise. This was possible because the new cork areas installed in the previous period were reaching the age of production. Also, during the early part of this period, there was an expansion in the area of cork oak. This expansion happened in some of the scrublands cleared for wheat production during the campaign for the expansion of this activity organized by the government between 1928 and 1938 (*"Campanha do Trigo"*). When the growing of wheat was not profitable due to the reduction in public support and the overexploitation of the land some of these lands turned into cork oak areas only. In those which remained in wheat production there were cases where cork oak plants were left growing in the middle of the wheat fields.

In the 40s, 50s and 60s the cork oak area declined due to the following factors:

a) increase in the demand for charcoal during World War II;

b) the hurricane of February 15, 1941;

c) mechanization of agriculture;

d) expansion of irrigated areas in some cork producing zones;

e) substitution of cork oak by eucalyptus.

The three last factors in this list mean that during this period cork production had to meet the competition of innovations in farming activities, in processes, such as mechanization and in products, such as irrigated crops, as well as the competition of a new forest species (eucalyptus). Throughout the whole period wheat benefited from the price support policy initiated in 1899.

The reduction in cork oak area happened in spite of the legislation protecting this species which was approved in the 1920s. During this period there were also some efforts to develop the research on the silviculture of cork oak and to renovate the cork oak areas through distribution to the forest owners, free of charge, of plants with good quality, accompanied by some technical assistance by the Forest Services. Most of these activities owed a lot to the work of Vieira Natividade, but did not survive very long after his death.

From mid 1960s to mid 1980s

Drivers of cork removals and exports

The insufficient investment on cork oak areas in the previous period and the fact that many of the areas where cork production was first developed were getting too old contributed to the reversal in the positive trend of cork removals which had been happening at least since the 1860s.

The 1960s were also a period of rural abandonment which continued throughout the 1970s and 1980s. This phenomenon probably contributed to some degradation in the management of cork oak areas.

The occupation of the large farms in the cork oak areas of Alentejo after the Revolution of 1974 did not improve the management of this resource. Instead it appears that it contributed to the negative trend started in mid 60s.

One result of this decline in cork removals was a positive trend in real prices.

For this decline in cork production may also have contributed the decline in exports. To this decline in exports may have contributed the fact that the industry in the Montijo/Seixal/Barreiro was in crisis. They had products such as agglomerates which did not compete well with plastics. They were also based on labour relations leading to higher wage costs and more conflicts than for the industry in the North. These problems got much worse after the Revolution of 1974.

Drivers of cork industry

The rise in real prices for cork and in real wages together with conflicting labour relations were fatal blows for major cork companies in the Montijo/Seixal/Barreiro area. The Feira district had much less labour conflicts before and after the Revolution of 1974. Because many of the firms there relied on family labour they also resisted more to the positive trend in real wages. The result was that the Feira district reinforced its relative position in the Portuguese cork industry.

This result also owes a lot to the type of inter-firm network build up during the previous period, more precisely the structure with a large group (Amorim) dominating the small family firms engaged in the manufacturing of cork stoppers.

By developing a powerful network of cork purchasing agents, the Amorim group was able to mitigate the positive trend in real prices for cork. Since the group was also the supplier of cork to many small firms in the Feira district they also benefited somehow from this commercial organisation.

In terms of exports, the Amorim group managed to penetrate in new markets such as the Eastern European countries and Russia through trading business contracts. The group also continued to expand its marketing channels in other parts of the world.

Another important development in the Feira district during this period is that the Amorim group picked up on the crisis of the firms in the south as far as the production of agglomerates is concerned and started its owned production of agglomerates on new technological and commercial basis, more able to cope with competing materials. With this production the group controlled the local market of residues from the production of cork stoppers, tying up even more its connections with the small firms in this business.

Since mid 1980s

Drivers of cork removals and exports

During this period cork removals and exports returned to a positive trend. Since 1986 the country was member of the EEC which may have favoured some exports. However, here again firms' strategies may also have played an important role. Amorim and other large groups in the cork industry were active in developing their own marketing channels in the importing countries either by setting up companies there, or by purchasing existing ones which, in some cases, were their competitors. These investments were not confined to the European countries. Instead they aimed at the main countries in wine production and consumption not only within, but also outside Europe.

Pushed by exports, cork removals restarted to rise, now in a more stable social setting, after the land was returned to their former owners in the cork producing areas. This was also

the time when the cork oak areas installed in the 20s and 30s with the "Wheat Campaign" reached the age of production.

After the decline observed in the previous period, the cork oak area started to increase largely due to the favourable financial incentives provided by the EU co-funded programmes initiated in mid 80s: the Forest Action Programme, followed by the Forest Development Plan and Reg. (EEC) 2080/92.

A threat to this increase in cork oak area is something already referred as a possible cause of the decline observed in the previous period: rural abandonment. With less and less people living in rural areas farmland turns into scrubland and the proper management of cork oaks and other forests becomes more and more difficult to do at affordable costs. The end result may be something that was not frequent before in cork oak areas, but is becoming more and more frequent in recent years: forest fires.

Drivers of cork industry

As was said in the previous section, the major industrial groups were engaged in investments abroad to improve their marketing channels in importing countries. This was necessary in order to cope with a negative trend in exports in the previous period. Also this was the time when the industry faced a serious threat of competition in its core product, the cork stopper. This threat is coming from synthetic and other materials considered to be more able for preserving the quality of the wine, than cork stoppers because of the substances can produce when it is in contact with wine.

Under the pressure of a rising real price for cork during most of the 90s, and under this high pressure for quality control in its core product, the major cork companies made substantial investments in the modernization of their plants, in quality control, in research and development of new products and in personnel training. Some of these investments benefited from support by EU co-funded programmes.

Still because of the need to improve quality throughout the whole production chain, some of them, including those mainly based in the Feira district, made large investments in vertical integration upstream, towards cork plank preparation. The productive capacity installed in these new plants located in the cork producing region of Alentejo is close to one half of the total average production of cork. So this is a big step in terms of concentration of the cork plank preparation industry.

Chapter

8

Forest policy until the EU accession

Situation until the XIXth century

When Portugal was established as an independent country in the beginning of the XIIth century there were forests in the valleys of difficult access and on the hillsides, but the top of the mountains, more exposed to wind and erosion, had poor forest coverage. These were mostly the remains of old natural forests (*Quercus robur, Quercus pyrenaica, Quercus faginea, Quercus suber, Quercus ilex* and chestnuts). The demographic growth of the Middle Ages and the corresponding need for farmland, grazing, wood and coal lead to deforestation, even though some complementarity was kept between farming and forestry. During the first dynasty, which lasted until the end of the XIVth century, most of the forests were in Crown lands, or belonged to noblemen or religious orders. They were used by the royal family and the aristocracy mostly for hunting. These rights were often in conflict with the uses of the forests by the local communities for fuel wood and grazing. The second big push for deforestation after the Middle Ages came with the navigations and the expansion of the Portuguese empire in the early XVth century. The demand of wood for shipbuilding became very strong since this was the most important industry in the country at that time. The species most demanded were oak (namely cork oak) and pine (*Pinus pinaster* and *Pinus pinea*). This demand was already emerging at the beginning of the XIVth century when King Denis ordered the plantation of pines in the coastlands of Leiria. This is still today one of the best-managed pine forests in the country. As the gap between supply and demand was widening, the imports of wood for shipbuilding started to grow in the XVth century, the major supplier being the Hanseatic League. The interest groups involved in this import business probably contributed for the lack of a strong and comprehensive policy to stop the depletion of forest resources. So with a few exceptions like the "Law of Trees" of 1565, forest resources continued to shrink until the XVIIIth century, without any breakthrough in public policy towards reforestation. At that time, the forest cover rate might have reached its lowest level, at about 7% of the country land area.

Creation of the Forest Services

We had to wait until the beginning of the XIXth century to see an active and scientifically based forest policy reversing the secular trend towards forest resources depletion. This policy was strongly influenced by a group of foresters trained in Germany. This group advocated the need for reforestation, improved protection and management of existing forests, reorganisation of the administration of the royal forests, and scientifically based silviculture. These recommendations lead to the creation of the Forest Services, in 1824, whose initial

mission was to manage the public forests. In the beginning, the Forest Services were part of the Ministry of Navy, a legacy from the time when wood supply to the shipbuilding industry was very important. In 1835, public forests expanded substantially, with the nationalization of the lands belonging to the religious orders expelled from the country by the liberal revolution. Four years later a group of experts was commissioned to prepare a Forest Code in order to consolidate and reform the forest legislation. In 1864, a degree in Forestry was established, in the General Institute of Agriculture, in Lisbon, this being the start of forest higher education in the country. In 1886, the Forest Services were incorporated in the Directorate General of Agriculture. This integration of the Forest Services in the public administration for agriculture, with more or less autonomy, has been the rule in Portugal since then.

Afforestation: the main stated priority of forest policy since its beginning

The large amount of uncultivated land fit for cultivation and without a productive use existing in the middle of the XIXth century (38,2 % of the total land area) explains why afforestation was, by far, a major priority of the Forest Services, which were making their beginnings by that time. This purpose is clear in the Decrees of December 24, 1901 and December 24, 1903 establishing the so called **"Forest Regime"** which remained as the fundamental forest laws of the country for almost one hundred years (Germano, 2000).

However, since those days, there has been a wide gap between the wishes of forest policy makers and foresters and the actual implementation of forest policy. If we look at where the Forest Services started their activities what we see is that they were devoted almost entirely to the management of some state owned forests representing a very small part of the total forest land in the country.

By the end of the XIXth century and in the beginning of the XXth century forest policy and Forest Services priorities moved to another front also in the public domain, more precisely the afforestation of the 25600 ha of dunes along the coast which remains until today one of the most socially valuable projects carried out by those services.

The next front to which forest policy and Forest Services moved their priorities was the afforestation of the communal lands in Northern and Central Portugal. After some preparatory work, this afforestation finally started in the 1930s, after the political regime had taken a dictatorial turn. These political conditions have to be mentioned because this afforestation was often implemented in a authoritative way, against the traditional uses of those lands by the local communities (Brouwer, 1995). The major output of this programme (*"Plano de Povoamento Florestal"* - PPF) was the afforestation of 318000 ha from 1935 until 1972, mostly with maritime pine. The management of these forests on behalf of the local communities made up the essential of the Forest Services activities from the 1930s until the present days (Rego, 2001). The Forest Services had to give part of the proceeds from the communal forests to the local communities, but they were allowed to keep the rest, making these services a potentially self-funded public agency.

There is another intervention of the Forest Services during the 30s and 40s which deserves to be mentioned. It is the technical support provided to people working on resin tapping. This activity had several interesting features:

a) it responded to a growing industrial demand in the country and abroad;

b) with proper technical support, the labour costs in Portugal were such as to make it competitive in the world market;

c) it provided alternative employments in rural areas which were strongly dependent on agriculture and some other forestry related activities;

d) it provided a regular source of income to forest owners without damaging timber production if the activity was properly ran;

e) it also protected forest resources against the risk of forest fires because resin tappers were a regular presence in the forest watching out even each tree against this and other potential damages.

The gap we mentioned before between the stated priorities of forest policy and Forest Services and their actual practice has to do with the fact that their three major fronts of intervention (public forests, afforestation of the dunes, and communal forests) are certainly a valuable part of the total forest land in the country, but are far from being the main one. Also they are certainly not the domains where took place most of the afforestation observed since the middle of the XIXth century. To see that, let us look in more detail to the trends in forestland use since then:

- conifers (basically maritime pine) rose from 210000 ha in 1867 to 1293040 ha in 1968/78 which cannot be driven essentially by the afforestation of 25600 ha of dunes and 318000 ha of communal lands, even if these 343600 ha were entirely made up of pine forests which is not true;

- cork oak and holm oak forests rose from 370000 ha in 1867 to 1174390 ha in 1995/98, which again, cannot be imputed essentially to the action of the Forest Services because these forests are mostly in the South, so far from the main domains of intervention of this agency;

- eucalyptus rose from a situation of almost non-existence in the middle of the XIXth century to 672149 ha in 1995/98, which was due essentially to the direct investment of the pulp and paper companies and to the investment of non-industrial private forest owners stimulated by the demand from those companies.

As we will see later on, most of this investment in eucalyptus plantations has not benefited from public incentives. So what are today the main three segments of Portuguese forests owe most of their growth since the middle of the XIXth century, not so much to public interventions, but to other factors and actors. Among these factors certainly processes of natural regeneration might have played an important role, but we should not forget the actions of non-industrial private forest owners' (NIPFOs). In fact, according to data referring to 1995, this type of owners are responsible for 76,6% of the forest land, pulp and paper companies manage 7,7 %, and only the 2,2% of state owned forests and part of the 13,4% of communal forests are left for the direct intervention of the Forest Services.

Whatever might have been the relative roles of forest policy and private initiative in the triplication of forest land since the middle of the XIXth century, afforestation remains today, as it was at that time, the main stated priority of forest policy, both for public policy makers and for private stakeholders. Several reasons contribute to these attitudes:

a) forest land and forest production are still far from having reached the maximum of their economic and ecologic potential:

- further growth in forest area up to 5280000 hectares (60,2 % of the land area) is possible through afforestation of 1068000 ha of marginal agricultural lands non suitable for farming and about 863000 ha of other lands with forest potential (BPI *et al.* 1996);

- substantial productivity gains (around 20 % more in annual increments of *Pinus pinaster* and *Eucalyptus globulus*) resulting from improved forest management and use of better plants (BPI *et al.*, 1996);

b) afforestation and reforestation through the 1970s, 80s and 90s supported by public incentives lagged far behind the area of deforestation due to forest fires (the former was only 54 % of the latter) and have not taken up most of the land released from agriculture due to farm out migration (agricultural land fell by 1233000 ha during this period while forest and other wooded land increased only by 380207 ha);

c) timber and cork production are lagging behind the demand from the forest industries leading to increases in the real prices paid for these products by the industries, since mid 1995.

Afforestation, reforestation and stand improvement financed by public funds since 1923(ha)

Years	TOTAL		PPF		FFF	PFP		PAF		797		2080		PDF	
	Affor. & Reaffor.	Stand impr.	Dunes	Commons	DGFF	Forest Services	PORTUCEL	Affor.	Stand impr.	Affor.	Stand impr.	Affor.	Stand impr.	Affor. and reffor.	Stand impr.
1923	**937**		446	491											
1924	**732**		276	456											
1925	**722**		299	423											
1926	**955**		516	439											
1927	**880**		471	409											
1928	**1338**		635	703											
1929	**1978**		1065	913											
1930	**2047**		1007	1040											
1931	**1631**		763	868											
1932	**1147**		496	651											
1933	**1566**		703	863											
1934	**2313**		1559	754											
1935	**4537**		3368	1169											
1936	**3222**		2402	820											
1937	**3911**		3179	732											
1938	**3600**		3001	599											
1939	**5098**		2477	2621											
1940	**4463**		2069	2394											
1941	**3558**		1187	2371											
1942	**5421**		1491	3930											
1943	**3942**		1146	2796											
1944	**4066**		140	3926											
1945	**3176**		308	2868											
1946	**1642**		0	1642											
1947	**2935**		0	2935											
1948	**7127**		210	6917											
1949	**6109**		32	6077											
1950	**6988**		111	6877											
1951	**7399**		100	7299											
1952	**7532**		32	7500											
1953	**8182**		142	8040											
1954	**8450**		67	8383											
1955	**8045**		42	8003											
1956	**12282**		133	12149											
1957	**16136**		101	16035											
1958	**18904**		0	18904											
1959	**16743**		473	16270											
1960	**13770**		461	13309											
1961	**14469**		540	13929											
1962	**15226**		391	14835											
1963	**10974**		439	10535											
1964	**14555**		289	14266											
1965	**8528**		901	7627											

1966	**16151**		840	8174	7137											
1967	**13664**		820	8470	4374											
1968	**10799**		456	8015	2328											
1969	**11367**		505	7175	3687											
1970	**6078**		326	5434	318											
1971	**14561**		263	4794	9504											
1972	**14896**		172	4236	10488											
1973	**15991**			4506	11485											
1974	**8331**			2606	5725											
1975	**7376**			1448	5928											
1976	**6825**			1274	5551											
1977	**13903**			773	13130											
1978	**14812**				14812											
1979	**12120**				12120											
1980	**8230**				8230											

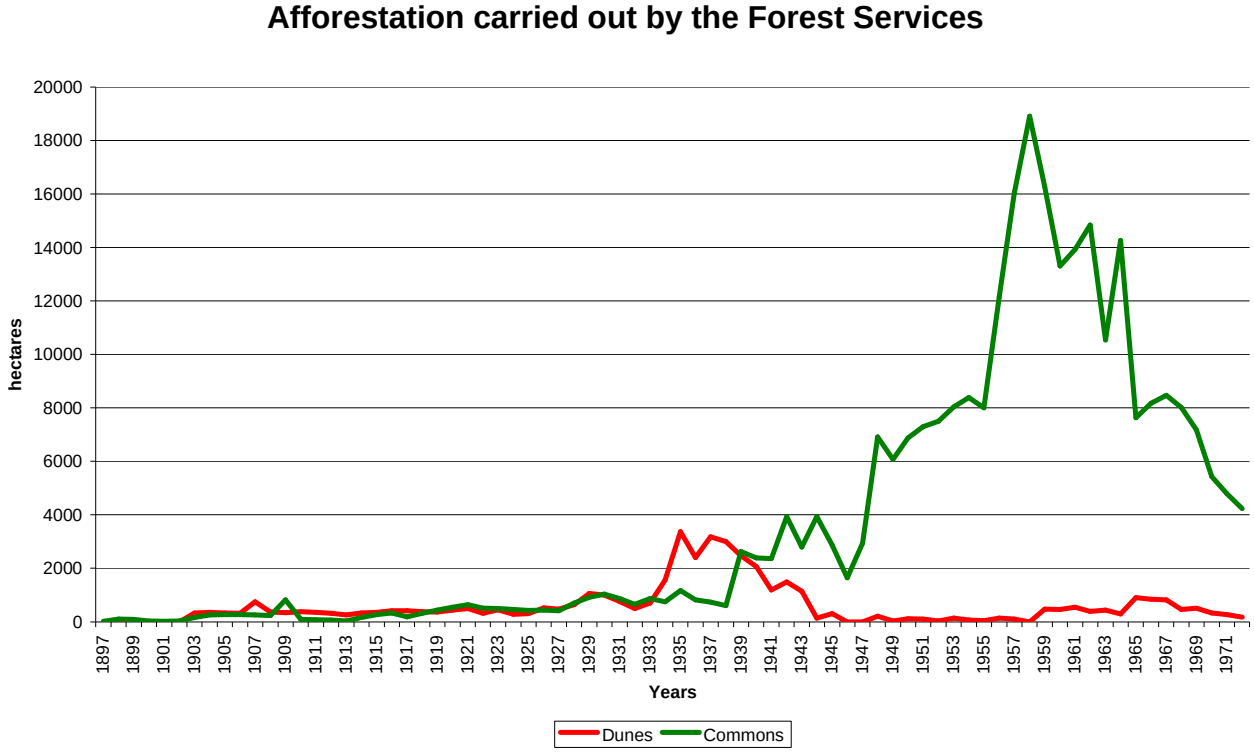
Afforestation, reforestation and stand improvement financed by public funds since 1923(ha)

Years					FFF	PFP		PAF		Reg. 797/85		PDF		Reg 2080/92	
	Affor. & Reaffor.	Stand impr.	Dunes	Commons	DGFF	Forest Services	PORTUCEL	Affor.	Stand impr.	Affor.	Stand impr.	Affor.	Stand impr.	Affor. and reffor.	Stand impr.
1981	**17920**	**0**			8979	1441	7500*								
1982	**19785**	**0**			2837	9448	7500*								
1983	**18742**	**0**			301	10941	7500*								
1984	**20829**	**0**				13329	7500*								
1985	**18278**	**0**				10778	7500*								
1986	**24882**	**0**				17382	7500*								
1987	**14890**	**0**				7390	7500*								
1988	**29229**	**44154**				1199	7500*	20530	44154						
1989	**17410**	**52156**						17410	52156						
1990	**20892**	**41511**						20892	41511						
1991	**17574**	**20254**						15319	19644	2255	610				
1992	**21803**	**24197**						16906	21948	4897	2249				
1993	**17194**	**12307**						11313	9996	5881	2311				
1994	**34714**	**38251**						6054	11480			20495	1995	8165	24776
1995	**70286**	**63673**						5141	10196			41055	2291	24090	51186
1996	**24947**	**13450**						564	164			19892	643	4491	12643
1997	**40715**	**29888**						0	0			31214	699	9501	29189
1998	**36234**	**31161**						0	0			26405	269	9829	30892
1999	**33743**	**14768**						0	0			26049	963	7694	13805
TOTAL	**942407**	**385770**	**36850**	**290673**	**126934**	**71908**	**60000**	**114130**	**211249**	**13033**	**5170**	**165109**	**6860**	**63770**	**162492**

Sources:
FFF & PFP (Forest Services): Carvalho & Morais (1996)
PFP (PORTUCEL): the information about the total (60000 ha) comes from the Forest Services, and the amount per year is the annual average
PPF:

a) until 1972: Rego (2001);
b) 1973-77: INE, Estatísticas Agrícolas (this data refers to afforestation in all forest land under the Forest Services management)

Reg. (CEE) 797/85: IFADAP
PAF, PDF and Reg. 2080/92: see next chapter



Source: graph built with data collected from Rego (2001)

Attempts to support private forestry

Law 2069, of 1954

The Law 2069, approved in 1954, was part of the "First Development Plan" (1.º Plano de Fomento). Its main objective was to promote afforestation in private lands, through three types of measures:

a) afforestation carried out by private forest owners, according to forest management plans drawn by the Forest Services;

b) afforestation of private lands shared by the forest owners and the Forest Services;

c) afforestation of private lands carried out by the Forest Services, remaining under public management for up to 20 years.

These measures were to be implemented according to "regional afforestation plans" to be prepared for the parts of the country considered to be o higher priority for this purpose, namely the South and the interior Northern and Central regions.

This Law established the rights and duties of the private forest owners and the State according to each of the three types of measures mentioned above. However, the regulation of specific financial incentives adapted to private forest owners was left for future implementation decrees which never came up.

The outcomes of this law were very poor:

a) creation, within the structure of the Forest Services, of a special agency in charge of the implementation of this law called "Serviço de Melhoramentos Florestais";

b) the afforestation of 40000 ha;

c) the preparation and official approval, without implementation, of regional afforestation plans for the following watershed basins: rivers Vascão, Carreiros and Oeiras (1958); rivers Terges and Cobres (1959); rivers Chanças and Limas; river Mira.

The reason for these poor outcomes are probably the fact that the financial incentives were not specified and implemented and the fact that the Forest Services were not prepared to provide appropriate technical assistance to private forest owners. Their capacities were essentially oriented towards intervention in public and communal forest lands. On the positive side, the main outcome of this law is that, for the first time, within the structure of the Forest Services, a special agency was created to deal specifically with the promotion of private forestry. One of the major activities of this agency with long lasting effects in the future was the installation of nurseries which, later on, where one of the main suppliers of eucalyptus plants for the plantations of this species which started to develop in the sixties.

The Cork Oak Development Plan, of 1956

Due to the action of Joaquim Vieira Natividade, the great pioneer of cork oak research in Portugal, the Government established (Ministerial Order N.º 15551, of September 30, 1955) a Commission for the Development of Cork Oak (*Comissão de Fomento Suberícola*) with the following missions:

a) identification of the areas without forest which are suitable for cork oak;

b) study of the vegetative conditions of the existing cork oak stands;

c) study of measures to be taken in order to prevent soil degradation in the areas of cork oak production;

d) study of the conditions of natural regeneration of cork oak trees;

e) study of economic measures to promote cork oak production.

An important point of this initiative is that it was a combination of the following types of actions:

a) research through the work of the research station directed by Natividade;

b) technical assistance on the field to private forest owners through the following agencies: *Brigadas de Fiscalização da Junta Nacional da Cortiça* and Brigadas do *Sector de Protecção de Arvoredos dos Serviços Florestais*.

The main outcome of this initiative was not an expansion of the area of cork oak which remained without major changes until the 80s. The main outcomes were of a different nature:

a) a relocation of cork oak forests from areas where old stands were dying towards new areas with more capacities for this species;

b) the use of seeds of improved quality in the new plantations chosen from selected stands by the agencies in charge of this programme and supplied free of charge to the private forest owners.

The cork oak forests established with the support of this programme are now reaching the point of supplying the first harvests of cork.

The Forest Development Fund

The Forest Development Fund (*Fundo de Fomento Florestal*) is a public agency belonging the Forest Services with the special mission of providing technical assistance and assistance in kind to private forest owners. It was created with this mission, in 1901 (Decree of August 24, 1901), under the name of Fundo Especial dos Serviços Florestais. Its activity, however, was minimal. In 1945 (Decree 34394, of June 27) the name changed to Fundo de Fomento Florestal e Aquícola with the purpose of reactivating the mission of the agency, mainly by an increase in the assistance in kind, through the supply of seeds and seedlings to private forest owners grown in nurseries under the management of that agency.

The major reform of this agency happened in 1963 (Decree 45443 of December 16) and 1964 (Decree 45795, of July 6). From an action based essentially in assistance in kind, the agency moved to a broader set of interventions in private forestry:

a) management of financial incentives;

b) direct intervention in the afforestation of private lands, on behalf of the private forest owners, carried out by afforestation brigades (*Brigadas de Arborização*);

c) technical assistance to private forest owners in forest planning.

Again the sources of funds to finance these public interventions in private forests were the weakest point. The main author behind this legislation (António Manuel Azevedo Gomes) was in favour of the creation of a financial fund fed by a 5% tax on the sales of forest products to the industries in the domestic market or for exports. This tax was never implemented. Therefore the FFF had to live on public funds allocated annually in the State budget. Until 1969, the FFF, at least kept some autonomy, in the management of these funds allocated to the promotion of afforestation of private lands. In 1969 and (decree 49294 of October 1969 and Decree N.º 471/70) the FFF lost that autonomy, with the centralization of the financial incentives to agriculture and forestry provided by the Fundo de Melhoramentos Agrícolas under the management of Comissão Coordenadora e Orientadora da Reconversão Agrícola presided by Junta de Colonização Interna. Even though FFF participated in the activities of this commission, the agency lost most of its previous control over the management of public incentives directed to private forestry, in favour of Junta de Colonização Interna. Four years later (Decree 367/73, of July 20) FFF regained control of the financial incentives to private forestry.

Three years after the Revolution of April 1974, the mission of FFF was shifted away from assistance to private forestry towards communal forests (Decree 78/77, of November 25, 1977). With this change there were two agencies (FFF and Direcção Geral dos Serviços Florestais e Aquícolas) which were partially overlapping. The two bodies finally merged into one Directorate General of Forests in 1983 (Decree 293/83, of July 27).

According to Vieira (1991), the outcomes of the action of this agency from 1965 to 1986 are the following:

a) supply, free of charge, of 97 millions of forest plants;

b) afforestation of 242954 ha, 60000 ha of which within the framework of the Portuguese Forest Plan funded by the World Bank;

c) installation of 60000 ha of grasslands.

Brouwer (1995) provides a more detailed account of some of these actions of FFF by types of measures and agencies through which it received and channeled its credits.

Funding provided by FFF

Instruments	Sources of funds	Period	Area (ha)
Credit to private forest owners	State budget allocations to JCI	1966-69, 1975	1083
	State budget allocations to CCORA	1971-75	9045
	State budget allocations to FFF	1966-86	116806
Provision of plants to private forest owners		1965-86	53136
Technical assistance to private forest owners		1966-84	10035
Direct afforestation of private lands	World Bank	1981-86	58977
TOTAL			**242954**

The installation of pastures was part of an orientation of FFF to promote multiple use forestry. For this purpose the agency prepared integrated regional forest plans, covering multiples uses of forests. Unfortunately only two of these plans were implemented on the field: the plan for Serra de Bornes and the plan for Charneca de Alcácer do Sal.

Another outcome worth to mention of the activity of FFF is that is was the school of the foresters within the Forest Services and in other locations, who played the main role in the implementation of the programmes of financial incentives to private forestry co-funded by the EU, since 1986.

The Portuguese Forest Project (1981-88)

Context and procedural characteristics of the forest policy process

The Portuguese Forest Project (PFP) was prepared in a time when the country was coming out from the peaceful revolution of 1974 which had overthrown a long lasting dictatorial regime. On the economic side, this political change combined with the 1974 "oil chock" brought about serious macroeconomic problems, namely large and increasing government budget and current account deficits from 1974 to 1980 which lead to a stabilization programme supported by an agreement signed with the International Monetary Fund. This helped to reverse the worsening in the macroeconomic situation, but, in 1982-84, the same type of problems happened again which lead to another stabilization programme supported by the International Monetary Fund covering the period from October 1983 to February 1985.

In the first years after the Revolution the decades of right wing economic interventionism were replaced by left wing **interventionism**. When the PFP was prepared and implemented the traces of this traditions were still very string in the economy and in the public administration.

Another outcome of the 1974 Revolution was the occupation of the large farms in Southern Portugal by landless farm workers which took the cork oak forests away from the control of their former owners for some time until they got their land back in the 80s.

Finally it is worth mentioning another outcome of the 1974 which was the nationalisation of many private companies, including some pulp and paper companies which were consolidated in one group called PORTUCEL.

Concerning the Forest Services, except for some changes in the personnel at the top ranks of the agency, their basic structure inherited from the old political regime was not changed. For 20 years after the 1974 Revolution, they remained a centrally managed and specialised directorate general in the Ministry of Agriculture, controlled by professional foresters who knew each other well, since they all came from the single school of forestry existing in the country until the late 1970s. The regional and the local levels were hierarchically dependent on the Director General the Forests and their geographic organisation was structured in view of the management of the public and communal forests. After the golden days of the afforestation of the commons, the Forest Services in the 70s and 80s were suffering from an ageing of human and material resources in many parts of their structure. This fact together with the profile of the personnel of these services described before might have contributed for some institutional inertia to which we will come back later.

With this type of Forest Services, and in a situation where the pulp and paper companies were the most organized stakeholder in the forest sector, the NIPFOs were lacking collective organisation and the environmental groups were still weak, it is no surprise that the forest policy process had the following characteristics[19]:

- **technocratic and central agency driven process**;

[19] For a theoretical perspective on this and other types of approaches to policy planning see Mendes (2000a).

- **without participatory and intersectoral coordination mechanisms**;

- with some **corporatist leaning** towards the needs of the pulp and paper companies.

It is also no surprise that such type of policy process had as an **output** a programme with the following characteristics:

- **fixed targets**;

- strong reliance on instruments appealing to **direct public interventionism;**

- **weak reliance on the private sector** (except the pulp and paper company) for implementation.

Objectives

The major objective of this programme was to overcome a projected shortfall in timber supply to the **export oriented** pine-based and pulp and paper industries through the establishment of commercial forest plantations of conifers and eucalyptus, especially in Northern and Central Portugal where there was more under-utilised potential for these species. So the programme did not cover the cork oak forests in the South (Alentejo) which, by that time, were still mostly in the hands of farm workers' co-operatives resulting from the occupations of the large farms after the 1974 Revolution.

Measures funded, instruments and beneficiaries

Planned and implemented in a period of the Portuguese political history marked by strong **public interventionism** in the economy, this programme, like the previous ones, is still one where the state played a **direct** role in afforestation. More precisely the main direct agents in the implementation of this programme were two **state controlled agencies**: the Forest Services and the nationalised pulp and paper company (PORTUCEL).

The **Forest Services** assumed the direct responsibility for preparing and implementing the afforestation projects in two types of lands:

a) in the **public and communal lands** under the management of those services;

b) in the **lands of NIPFOs** willing to accept afforestation under the following conditions:

- all the technical responsibility and almost all the funding of the investment costs were was on the shoulders of the Forest Services;

- the landowners had to commit themselves to keep their lands in this kind of use and manage the new plantations appropriately;

- the public funding of the investment costs was a **loan** which had to be paid back by the forest owner with 40 % of the revenues from the fellings of the new plantations when they come to age, until the total amortisation of the loan, for no more than 60 years.

The programme also provided a **loan** to PORTUCEL for afforestation of the lands already owned by company, or in new lands bought or leased in for this purpose.

There were also funds available to support the creation of **cooperatives of private forest owners** and for the organisation of a **public forest extension service** within the structure of the Forest Services. We should remember that since their creation in the XIXth century, these services lived most of their life focused on the management of public or

communal forests leaving without enough technical support the three fourths the forest lands in the hands of NIPFOs.

Outcomes and effectiveness

Comparing with previous programmes, the PFP represents an **increase in the annual average of afforestation** supported by public intervention:

- from 1939 until 1965 the average was 9235 ha per year;

- from 1966 until 1980 the average was 12085 ha per year;

- with PFP the average rose to 16489 ha.

Targets and outcomes of the Portuguese Forest Project

	Targets	Outcomes
Time horizon	**1980/85**	**1981/88**
Afforestation (ha)	**150000**	**131908**
1. By the Forest Services		
- total area	*90000*	*71908*
- conifers	60500	50026
- eucalyptus	16000	8429
- other broadleaves	13500	7886
- natural regeneration	-	5586
2. By PORTUCEL (pulp and paper company)		
- total area	*60000*	*60000*
- conifers	30500	n. a.
- eucalyptus	29500	n. a.
Creation of a public forest extension service	**X**	**Nothing was done**
Credit for co-operatives of forest owners	**X**	**Nothing was done**

Source: DGF

Let us compare now the outcomes of PFP with the targets initially set for the programme. The targets for PORTUCEL were fully accomplished. Concerning the Forest Services, there were **large implementation failures**:

- afforestation: from the 90000 ha the Forest Services were supposed to plant, only 71908 ha were established, even after extending the project horizon for three years;

- creation of a forest extension service: nothing was accomplished;

- support for the creation of co-operatives of forest owners: nothing was accomplished.

Distribution by region and ownership category of the afforestation funded by PFP

	Communal forests			Private forests			Total	
Regions	Number	Area		Number	Area			
	of projects	Ha	%	of projects	ha	%	ha	%
Northwest	129	21 778	27,9	197	6 297	12,2	28 075	21,6
Northeast	212	38 442	49,3	63	4 153	8,1	42 595	32,8
North	**341**	**60 220**	**77,3**	**260**	**10 450**	**20,2**	**70 670**	**54,5**
Central West	124	12 488	16,0	191	4 993	9,6	17 481	13,5
Central East	34	4 954	6,4	147	14 965	28,9	19 919	15,4
Ribatejo-Oeste	**1**	**270**	**0,4**	**155**	**9 503**	**18,3**	**9 773**	**7,5**
Alentejo	**0**	**0**	**0,0**	**281**	**10 455**	**20,2**	**10 455**	**8,1**
Algarve	**0**	**0**	**0,0**	**15**	**1 451**	**2,8**	**1 451**	**1,1**
TOTAL	**500**	**77 932**	**100,0**	**1 049**	**51 817**	**100,0**	**129 749**	**100,0**

Source: Louro (1988)

Implementation analysis

Feasibility constraints

Capacity constraints

Contrarily to PORTUCEL, the Forest Services failed to meet their targets in terms of afforestation. One reason which may have contributed to this besides the ones mentioned in the continuation of this section is that, by opting for taking directly in charge the operations of afforestation, the Forest Services took a commitment for which they did not have enough human and material resources. Even with the additional financial means provided by this programme it was not possible to make the necessary changes in due time.

Institutional constraints

The data available are not detailed enough to identify in which type of ownership category was the intervention of the Forest Services more important. However, based on the data in the previous tables, it is a plausible hypothesis that most of the afforestation done by the Forest Services was on the commons of Northern and Central Portugal and not on the lands of NIPFOs. The afforestation in private lands was done mostly by PORTUCEL either by leasing in or by buying lands from private owners.

If this hypothesis is true, as far as the action of the Forest Services is concerned, the PFP was not a radical change in afforestation policy compared to the policy implemented since the 1930s. It was actually an **incremental change** in the continuation of the afforestation of communal lands by the Forest Services, with a new source of funds (World Bank loan instead of state budget). This means that the Forest Services stayed mostly in their familiar places (communal lands), and did not make substantial moves towards the NIPFOs either by relying on their private initiative and providing them financial incentives for afforestation, or by providing indirect measures such as extension services and capacity building (co-operatives).

Still as an hypothesis, we propose two contributing factors to explain these implementation failures:

- **institutional inertia** in the Forest Services making difficult the reconversion from decades of direct state interventionism to a posture of facilitating the private initiative;

- **substantial differences**, from the point of view of the NIPFOs, **between the incentives** provided by the type of afforestation under the responsibility of the Forest Services and the one under the responsibility of PORTUCEL.

Institutional inertia seems a plausible hypothesis given the fact that the Forest Services, since their beginnings in the XIXth century, focused most of their activity on the public and communal forests. Most of the foresters working in those services at the time this programme was conceived and implemented were educated in that type of activity. Also in many segments of the Forest Services, there was an ageing of the human and material resources preventing a more active posture to reach out to the large and dispersed mass of NIPFOs. This type of factor is an example of **"path dependence"** and **"lock in" effects** in policy making and implementation: policies are not independent from their "initial conditions".

Individual rationality constraints

The main differences in the types of incentives for the NIPFOs embodied in the afforestation done by the Forest Services and by PORTUCEL are the following:

a) by opting in for a Forest Services project, a NIPFO not only does not receive any cash, but also might have to spend some money to pay part of the forest investment costs which is not the case if he sells or leases out his land to PORTUCEL;

b) by opting in for a Forest Services project, a NIPFO puts himself under the burden of a debt that him or his successors have to pay back, which is not the case if he sells or leases out his land to PORTUCEL;

c) by opting for a Forest Services project, a NIPFO locks in his land in one type of use which has the following inconveniences:

- it is a use of very long duration;

- the potential benefit may not go to the current land owner (he might be dead when the plantations come to age);

- it is subject to high risks (many of the plantations were with maritime pine, a species very vulnerable to forest fire) beyond the control of the land owner;

- in order to catch the benefits from the forest investment the owner has to incur in forest management costs which are high and not supported by public incentives;

- by locking in his land to this type of use, the land owner might forego potentially more profitable alternative uses (urbanisation, for example);

d) if the forest owner prefers to put his land under a long term lease to PORTUCEL the land use is also frozen for a long time, but, at least here, he gets the compensation of an annual cash rent, with no cost of maintenance of his property.

So with this type of **incentive structure**, it was **not individually rational** for many NIPFO to opt in for the programme, that is, they were better off staying out given the type of reasons we mentioned before.

Incentive compatibility constraints

For those NIPFO who opted in, there were many cases where they **didn't behave in a manner compatible** with the targets of the programme by not fully complying with the duties attached to this option.

We still lack a good empirical study about what remains today of these Forest Services afforestation projects in private lands, but we know about many stories of failures on those that were implemented (destruction by fire, lack of proper maintenance, etc.) and we ear complaints from these forest owners about their disfavoured position compared to the situation of those who opted for the programmes that came after the PFP.

Chapter

9

The EU co-funded afforestation programmes of the 1980s and 90s

Objectives and instruments

The Forest Action Programme (1987-95)

Context and procedural characteristics of the forest policy process

The Forest Action Programme (PAF) came in a different political and social environment than the PFP:

- the country was going to become a member of the EEC in 1986 and therefore was eligible for financial support from the structural funds even before that date, through the pre-accession funds;

- while the industrial demands behind the PFP were still very important, new demands were emerging in the Portuguese society, namely the **environmentalist pressure** against fast growing species and the rise of **land use planning regulations** where the municipalities became major stakeholders, with an agenda not always compatible with the interests of forest owners and forest industries;

- as the problem of forest fires was getting worse and environmental awareness was rising, the type of projects supported by the PFP, that is, afforestation based on monospecific plantations almost exclusively oriented for timber production, was getting more and more criticisms;

- the **large farms in the South** were in the process of being returned to their former owners who, in many cases, were willing to make improvements in their cork oak forests which were left aside in the PFP;

- in this changing environment more attention was called for afforestation with **broadleaves** (fast growing species excluded) and for **stand improvement**;

- on the political and economic fronts, **direct state interventionism was definitely regressing** with privatizations of nationalized companies and a growing appeal to the initiative of the private sector.

In a context of mounting criticisms to the past action of the Forest Services, new social demands to the forest sector on the rise, and a changing economic and political environment

more prone to the private initiative, those with responsibilities in the Forest Services were not able to carry on institutional changes capable of adjusting successfully to this new situation.

During the period through which this programme was prepared and implemented there was no major institutional change in the Forest Services which remained the major public agency for forest policy planning and implementation. The main change was the liquidation of Forest Products Institute (Instituto dos Produtos Florestais - IPF) which had resulted from the consolidation of public agencies existing before the 1974 revolution for the state regulation of the domestic and foreign trade of forest products. This institute was funded by a tax paid by the forest industries suppressed, in a obscure way, during the negotiations of the 1988 state budget in the parliament, due to lobbying of some of these industries. With the extinction of this institute was lost, without proper substitute, what had been, for some decades, the better source of statistical and economic data on the Portuguese forest sector. This loss still waits to be fixed.

Loosing confidence on their own capacities and loosing sight of their public responsibilities in building capacity for the development of the initiative of NIPFOs, the Forest Services turned from a posture of "technocratic and direct interventionism" to one of **"incentive-based regulation"** (Mendes, 2000a) with provision of attractive subsidies paid with EEC cheap money, and **reliance on the private sector (NIPFOs and forest contractors) for implementation**. This policy turn raises the issue of the **transaction costs** faced by the NIPFOs when applying for these public incentives. These costs are different among these owners. The Forest Services could have had an active role in lowering these costs especially with those NIPFOs for whom they were relatively higher. As we will see, the Forest Services were very passive in this matter.

Legislation

The legislation regulating the Forest Action Programme is listed in the following table. it is all made of ministerial orders (*"portarias"*) and other normative decisions under the responsibility of the minister which means that they are pieces of legislation established and signed by one or several ministers only, using powers delegated by the Council of Ministers.

The two main pieces of this legislation are the Ministerial Order N.º 258/87 which establishes the objectives and the incentives for the so called "First Phase" of PAF, and the Ministerial Order N.º 340-A/91 which establishes the so called "Second Phase" of PAF, reasserting the objectives of the first one, but changing the incentives in the way that will be specified later on in this chapter.

PAF legislation

Nature and Reference number	Publication in the Official Journal			Short Description
	Nº	Series	Date	
Ministerial Order N.º 258/87	76	I	1.04.87	Establishes the norms of the Forest Action Programme (1.st Phase)
Ministerial Order N.º 452/87	123	I	29.05.87	Establishes loans for forest owners to finance their part on the investment
Ministerial Order N.º 832-A/87	242	I	21.10.87	Defines norms about forest groupings
Ministerial Order N.º 972/87	300	I	31.12.87	Establishes caps on the amount of investment costs eligible for funding
Ministerial Order N.º	192	I	20.08.88	Brings together norms about the legal status of the beneficiaries, repealing Ministerial Orders

570/88				N.º 258/87 and 832-A/87
Ministerial Decision	192	II	20.08.88	Defines priorities about the incentives provided by PAF and repeals Ministerial Order N.º 972/87
Ministerial Order N.º 16/89	8	I	10.01.09	Updates the eligible amounts of investment costs per hectare and repeals Ministerial Order N.º972/87
Ministerial Order N.º 512/89	153	I	6.07.89	Defines norms for eucalyptus plantations.
Ministerial Order N.º 340-A/91	87 (supl.)	I-B	15.04.91	Establishes the norms of the Forest Action Programme (2.st Phase)
Ministerial Decision	48	II	26.02.93	Broadens the concept of forest groupings eligible for PAF

Objectives

The stated objective of PAF was to promote a better and more intensive use of forest stands through the following types of actions:

a) afforestation of uncultivated land fit fore forestry and marginal agricultural land more suitable for forestry;

b) improvement of existing stands;

c) reforestation of forestland damaged by forest fires;

d) enhancement of multiple use forestry.

Measures funded and instruments

Looking back at the implementation failures of their own direct interventionism in a recent past, the Forest Services switched almost 180º and decided to entrust most of their hopes in the private initiative of forest contractors and forest owners. To do so they thought they had a powerful instrument which was the cheap money coming in from the EEC. In fact, PAF was a forest programme specific to Portugal funded by the EU structural funds at about 75% of the public expenditure involved. This funding was part of a wider EU financial support scheme addressed to overcome structural handicaps in the Portuguese agricultural and forestry sector called PEDAP-Programa Específico de Desenvolvimento da Agricultura Portuguese during the initial years of the country's accession to the EU.

With this kind of financial means, the Forest Services formulated a programme which introduced major changes compared to the PFP:

- instead of loans to be repaid with the revenue from fellings, the financial incentives to forest owners turned to be **matching grants** varying between 30 and 100 % of the total investment cost;

- the favourable treatment given to **eucalyptus** plantations in the PFP suffered drastic reductions and finally was suppressed, which was accompanied with new regulations restricting these plantations;

- the most favourable treatment turned to **other broadleaves**, including the cork oak forests, with some attempts to promote **multiple use** forestry (grazing and agro-forestry, etc.);

- **stand improvement** which was almost left out from the PFP, became a major target for financial incentives to forestry.

Besides (re)afforestation and stand improvement, PAF also funded the following actions:

a) construction and improvement of forest roads;

b) construction and improvement of divisional forest roads for fire prevention;

c) construction of small dams supporting fire fighting;

d) gaming, fishing and recreation;

e) forest extension.

The grants for each of these actions in percentage of the total investment were the following until 1991:

a) individual projects larger than 5 ha:
60%;

b) grouped projects between 5 and 50 ha: 80%

c) grouped projects larger than 50 ha: 90%

d) projects in communal forests or in forest belonging to local public authorities: 90%

e) projects of public interest: 100%

f) forest roads and dams: 100%

Projects with fast growing species (eucalyptus or other with rotations less than 15 years) had a grant rate of only 30%.

In 1991 these incentives were changed as follows:

a) individual projects larger than 5 ha:
40%;

b) grouped projects with two or up to five members:

- between 5 and 25 ha: 60%

- between 25 and 50 ha:
70%

- larger than 50ha: 75%

c) grouped projects with six or more members:

- between 5 and 25 ha: 60%

- between 25 and 50 ha:
70%

- larger than 50ha: 80%

d) projects in communal forests or in forest belonging to local public authorities: 100%

e) projects of public interest: 100%

f) forest roads and dams: 100%

Incentives to projects with eucalyptus were reduced from 1989 onwards.

Beneficiaries

With this type of incentives, the pulp and paper companies and other stakeholders interested in expanding eucalyptus plantations could not count any more on public financial incentives. With the pulp and paper companies almost out from the benefit of this programme, we didn't see the other two main segments of the Portuguese forest industries (wood based and cork industries) to come in. So the main stakeholders of this programme in the private sector were the **NIPFOs** and the **forest contractors**.

The Forest Services remained as an agent directly eligible for public funds, in case they presented projects for **public or communal forests**, these being the type of projects with the most favourable incentives provided by this programme.

So compared with previous programmes, the major innovation in terms of stakeholders brought about by this programme was the development of a **private business of forest contractors**. We still lack an empirical study about the implementation of PAF, but from what we could observe so far on this matter, it is a plausible hypothesis that this network of contractors played a major role in stimulating and assisting the NIFPOs who applied for the public incentives provided by PAF.

Again, like in the PFP, there were funds available in the PAF for the organisation of forest extension services which could have had an important role in lowering the transactions costs faced by the NIPFOs when applying for these incentives. This would have contributed to raise the number of the NIPFOs interested in the programme. However, as we will see in a short while, such role was not played by the Forest Services and might have been played mostly by the forest contractors.

Institutional mechanisms for programme's implementation

The main institution in charge of the implementation of PAF was DGF. This agency was in charge of reviewing and approving the applications. The payment of the grants was made by IFADAP, but this institute played no major role in the review and approval.

The number of applications received by DGF in the initial stage of PAF was very high. Man of them did not fulfil the requirements to be approved. However, that large number of applications led the General Director of Forests to issued a decision signed by the Minister with an order to stop the reception of new applications, with the fear that there would not be enough funds to take care of all of them. This decision had significative effects in slowing down the implementation of the programme. In the second phase of the programme only were reviewed and approved applications sent in the first phase before that decision. Potential new applicants lost motivation to go ahead with their projects.

Forest Development Plan (1994-99)

Legislation

The legislation regulating the Forest Development Plan is listed in the following table. Like in the case of PAF, it is all made of ministerial orders (*"portarias"*) and other normative decisions under the responsibility of the minister.

The main piece of this legislation is the Ministerial Order N.º 809-D/94 in which some non fundamental changes were introduced later on by the Ministerial Orders N.º 606/96 and 199/98.

PDF legislation

Nature and	Publication in the	Short Description

Reference number	Official Journal			
	Nº	Series	Date	
Ministerial Order N.º 809-D/94	211	I-B Supl.	12.09.94	Approves the norms of the Forest Development Plan
Normative Decision N.º 735/94	247	I-B	25.10.94	Establishes norms about forest projects to present under Ministerial Orders N.º199/94 and N.º 809-D/94
Ministerial Order N.º 952/95	179	I-B	04.08.95	Changes N.º1 of article 21 of Ministerial Order N.º 199/94 and articles 14, 15 and 17 of Ministerial Order N.º809-D/94
Ministerial Order N.º 489/96	213	I-B	13.09.96	Approves the norms of the measure supporting the development of forest data collection
Ministerial Order N.º 606/96	248	I-B	25.10.96	Changes norms of Ministerial Order N. º 809-D/94
Ministerial Order N.º 14-A/98	5	I-B Supl.	07.01.98	Changes norms of Ministerial Orders N.º 809-D/94 and N.º606/96
Ministerial Order N.º 83/98	42	I-B	19.02.98	Changes norms of the Forest Development Plan and repeals Ministerial Order N.º 14-A/98
Ministerial Order N.º 199/98	71	I-B	25.03.98	Changes norms of the Forest Development Plan and repeals Ministerial Orders N. º 809-D/94 and 606/96, as well as N.º4 of the Ministerial Order N.º 83/98
Corrective Declaration N.º 10-G/98	125	I-B 3º Supl.	30.05.98	Corrects the text of Ministerial Order N.º 199/98
Ministerial Order N.º 777/98	214	I-B	16.09.98	Changes the Ministerial Order N.º 199/94 and repeals the Normative Decision N.º 735/94
Ministerial Order N.º 924/98	244	I-B	22.10.98	Approves the regulation of the measure supporting the collection of forest data and repeals Ministerial Order nº489/96.

Objectives

The stated objectives of the Forest Development Plan (PDF) were the following:

a) promote the reforestation of burnt forestland, as well as the afforestation of land suitable for forestry;

b) promote the improvement of existing stands, namely through support for construction of forest infrastructures;

c) enhance the multiple use of forests;

d) promote the production of genetically improved and controlled seedlings and support the installation or modernisation of forest nurseries.

Targets of PDF (1994/1999)

	Initial targets
Afforestation or reforestation (ha)	55000
Improvement of existing stands (ha)	165500
Forest roads (km)	n.a.
Divisional roads (km)	n.a.
Dams (number)	n.a.
Multiple use of forests (ha)	n.a.
Forest nurseries and genetic improvement of seedlings (number)	n.a.

Source: MADRP (2003)

Measures funded, beneficiaries and instruments

The PDF was a forest programme specific to Portugal, financed by the EU structural funds within the Common Support Framework for the period 1994/99 at about 75% of the total public expenditure involved..

One feature common to these two programmes is the fact that they pursued the orientation started with PAF towards a stronger reliance on the private sector for implementation and the provision of financial incentives taking the form of **matching grants** with various percentages and subject to various caps according to the type of action supported.

PDF supported the following types of actions:

- **afforestation**;

- **stand improvement**;

- **reforestation** of burnt forestland or forest stands where the increments and under 50% of the potential for their site;

- **maintenance** of the plantations for 5 years after the first restocking;

- installation and amelioration of **forest nurseries**;

- selection and production of **good quality seeds and seedlings**;

- construction and amelioration of **forest roads**, **fire breaks** and **water reservoirs**;

- **multiple use forestry** (grazing, apiculture, gaming, aromatic and medicinal plants, fishing, etc.).

This programme also had the following features:

- it favoured grouped projects consisting of, at least, 5 contiguous, forest holdings;

- it did not support plantations with fast growing species.

PDF pursued the orientations initiated with PAF, taking new steps further:

- financial support for forest nurseries;

- stronger support for multiple use of forest lands;

- financial support for maintenance costs for 5 years after the first restocking;

- tighter restrictions for eucalyptus plantations and other fast growing species;

- more incentives for other broadleaves.

All kinds of forest owners (private, communal or public) were eligible for the incentives provided by PDF, with one exception: there was no support for state owned nurseries.

To be eligible for grants, projects of afforestation or improvement of existing have to cover a contiguous area above a certain threshold specified for each region as is shown in the following table.

Minimum of eligible contiguous forest area by project (ha)

Regions	Individual beneficiaries	Forest groupings
Entre-Douro-e-Minho	2	10
Trás-os-Montes	3	15
Beira Litoral	2	10
Beira Interior	2	10
Ribatejo e Oeste	3	15
Alentejo	5	25
Algarve	2	10

Sources: Ministerial Orders N. 809-D/94, 606/96 and 199/98.

The following table specifies the level of public support by type of project and beneficiary, except those concerning multiple use forestry and public infrastructures.

Percentages and caps on the matching grants

Type of project		Maximum eligible investment cost (1000 esc)	Level of grant (in percentage of the investment cost)		
			Individual	Forest groupings	Public sector beneficiaries
Afforestation	Fast growing species	330/ha	30	40	100
	Maritime pine, cork oak and holm oak stands, other autochthonous species[20]		80	90	100
	Other species		65	80	100
Improvement of existing stands		150/ha	80	90	100
Installation and improvement of forest nurseries	Acquisition of equipment, machinery and infrastructures	45 000/project	50		100
Production of selected seedlings	Preparation and installation of the seedling nurseries	At first 5000/project changed later to no limit[21]	80		Not eligible at first changed later to 100[22]
Maintenance of new plantations	-	Total of 120/ha for 5 years at first, changed later to 10 years[23]	90		100
Research		7500/project	75	-	100

Sources: Ministerial Orders N.º 809-D/94, 606/96 and 199/98.
Note: 1000 esc. = 4.988 €

The following table specifies the level of public support for multiple use forestry by type of project. These projects were eligible only when they were complementary of afforestation, reforestation or improvement. They also could not exceed 30% of the total investment.

Caps on multiple use forestry investment eligible for grants

Eligible actions	Maximum eligible costs (1000 esc)
Aquiculture	2000
Game production and management	5000
Grazing management	
Production of mushrooms and aromatic and medicinal plants	
Recreation[24]	

[20] *Quercus faginea*, *Quercus robur, Quercus pyrenaica*, *Castanea sativa*, *Cupressus spp*, *Pinus pinea*, *Ceratonia siliqua* and *Prunus avium.*
[21] The change was introduced by the Ministerial Order N.º 199/98.
[22] The change was introduced by the Corrective Declaration N.º 10-G/98.
[23] The change was introduced by the Corrective Declaration N.º 10-G/98.
[24] Only public beneficiaries (Central or Local authorities) or communal forests were elegible for this measure.

Apiculture	2000

Sources: Ministerial Orders N.º 809-D/94, 606/96 and 199/98.

The following table specifies the maximum amounts of eligible investment in forest infrastructures and the levels of public support by type of project. These projects should be complementary of afforestation, reforestation or stand improvement. The level of financial support is the same as for the actions which are complemented by these infrastructures.

Caps on the investment in forest infrastructures eligible for grants

Eligible actions	Maximum eligible costs (1000 esc.)	Maximum density
Construction of forest roads	3000/km	40 m
Improvement of forest roads	700/km	
Construction of fire breaks	250/km	20 m/ha
Improvement of fire breaks	120/km	
Construction of dams and water reservoirs	1300 per water point	-

Sources: Ministerial Orders N.º 809-D/94, 606/96 and 199/98.

The fees paid by the forest owners to the forest consultants who assisted them in the application for public funds, supervision of the planting operations and management of the new or improved stands were eligible for public support up to a certain level. The incentives are more favourable in the case of forest groupings and when the forest owners (individually or grouped) have a formal contract with the forest consultant for technical assistance in the management of the forest beyond the initial investment period. The following table gives the details about this kind of incentives as they were determined by the Ministerial Order N.º 199/98.

Amount of forest consultant fees eligible for public financial support (1000 esc.)

Investment per project	Forest nurseries	Other projects			
		Individual		Forest groupings	
		Without management contract	With management contract	Without management contract	With management contract
< 3500	6% inv.	6,25% inv	6,5% inv	6,75% inv.	7% inv.
3501 – 17 500	200+1% inv	200+1,25% inv	200+1,5% inv	200+1,75% inv.	200+2% inv.
17 501 – 45 000	400+0,5 % inv	400+0,75 % inv	400+1.0 % inv	400+1.25 % inv.	400+1,5% inv
45 001 – 90 000	600+0,25% inv.	600+0,5% inv	600+0,75% inv	600+1,0% inv.	600+1,25% inv
>90 001	800	800+0,25 inv	800+0,5 inv	800+0,75 inv.	800+1,0% inv

Institutional mechanisms for programme's implementation

In 1995, by decision of the Minister of Agriculture, Rural Development and Fisheries, the responsibilities for reviewing and proving the applications for funds were all transferred from DGF to IFADAP. As a side note, this minister was the person who was the first president of the board of directors of IFADAP, having played a key role in the initial construction of this institution. One problem of this decision is that from date time until today, DGF has been almost completely off the circuit of implementation of the financial to forestry. Another problem is that IFADAP did not have enough human resources on the ground to take care of these new responsibilities. So, the delays in reviewing and approving the applications increased.

Regulation (EEC) 2080/92

Legislation

Regulation (EEC) Nº 2080/92 of 30 June 1992 was part of the accompanying measures of the CAP 1992 Reform. The preparatory work for its implementation in Portugal was developed from 1992 to 1994. This process ended up in the approval of the Decree N.º. 31/94 and the Ministerial Order N.º 199/94, changed in 1996 by the Ministerial Order N.º 216/96.

This scheme was partially financed by the Guarantee Section of the European Agricultural Guidance and Guarantee Fund (EAGGF).

Objectives

The 4 objectives of the regulation were the following:

- To accompany the reforms in the common agricultural market organisations, especially those affected by structural excess supply;

- To contribute to a long-term improvement in forestry resources,

- To help to manage the countryside in a way which is more compatible with the balance of the environment,

-To fight against the greenhouse effect and absorb carbon dioxide.

Instruments and types of beneficiaries

Types of beneficiaries

The beneficiaries of Reg (EEC) 2080/92 can be the following:

- full time farmers, that is, individuals whose main occupation is farming;

- farmers eligible for early retirement aids (Reg. EEC N.º 2079/92);

- farmers who get at least 25% of their income from farming;

- public authorities from the Central or the Local Administration;

- other rural landowners;

- beneficiaries organised in grouped projects.

Types of financial incentives

The financial incentives are of three types combined all together:

- **matching grants** for investment in afforestation of agricultural land, improvement of forest stands which are part of a agricultural holding and for forest infrastructures (forest roads, fire breaks and water points) complementary of afforestation;

- **aid for maintenance** of the new plantations during 5 years after the first restocking;

- **premium to compensate** for the loss agricultural income due to afforestation to be paid up to 20 years.

This compensation premium is an attractive feature of this scheme which did not exist in PAF and in PDF.

The aid for maintenance also was not part of PAF, butt was incorporate in PDF.

Obviously the aid for maintenance and the compensation premium are only for the applicants approved for grants to afforestation.

Eligibility constraints related to tree species

The matching grants have various percentages and are subject to various caps according to the type of action supported. The percentage of the grants is determined through a combination of the following types of eligibility criteria:

- type of the beneficiary;
- location of the agricultural holding and type of tree species permitted by the regulations and chosen by the beneficiary;
- type of forest products aimed by the new plantation;
- type of eligible action in which the investment in made.

The combinations of these different eligibility criteria and the corresponding restrictions and levels of public grants are presented in the following tables.

Types afforestation and stand improvement projects eligible for grants by types of species and beneficiaries

Types of beneficiaries	Afforestation	Stand

	Fast growing species	Other species	improvement
Full time farmers	Yes	Yes	Yes
Farmers eligible for early retirement aids	No	Yes	Yes
Farmers who get at least 25% of their income from farming	No	Yes	Yes
Public authorities	No	Yes	No
Other beneficiaries	No	Yes	No

Source: IFADAP (1997)

The following table presents the "zonal plans", that is, the regional distribution of the tree species which had to be respected in order to have a project eligible for these public incentives.

Forest tree species allowed in eligible projects for each region

Regions	Species
1- Entre Douro e Minho	Maritime pine, chestnut, northern red oak, English oak, walnut, ash, planetree
2- Terra Fria	Maritime pine, chestnut, northern red oak, cedar, cypress, chestnut, walnut, cherry, ash
3- Terra Quente	Stone pine, cedar, cypress, cork oak chestnut, walnut, cherry
4- Centro Litoral	Maritime pine, chestnut, northern red oak, cherry, ash, planetree
5- Serra d'Aire/Candeeiros	Cypress, aleppo pine, walnut, Portugal oak
6- Estremadura	Maritime pine, chestnut, walnut, ash, planetree
7- Vale do Tejo/Alentejo Litoral	Maritime pine, stone pine, cork oak, ash, planetree
8- Beira Baixa/Alentejo	Stone pine, cork oak, holm oak
9- Serra de São Mamede	Cork oak, chestnut, walnut
10- Alentejo Interior	Stone pine, aleppo pine, holm oak
11-Algarve	Maritime pine, stone pine, aleppo pine, cork oak, ash, carobtree, holm oak, chestnut, arbutus-tree, walnut

Source: IFADAP (1997).

Matching grants for afforestation and complementary infrastructures

The following table presents the percentages and caps on the matching grants for afforestation and complementary infrastructures.

Percentages and caps on the matching grants for afforestation and complementary infrastructures

Action	Caps on grants by type of action supported	Grant in percentage of the investment cost by type of beneficiary			
		Full time farmers (individuals)	Full time farmers (forest groupings)	Farmers who get at least 25% of their income from farming and farmers eligible for early retirement aids	Other private beneficiaries and Public authorities
Afforestation	**Fast growing species**				
	a) Reference investment cost[25] up to 1.872 ECU/ha	50%	60%		
	b) Maximum eligible investment cost between 1.872 and 2.415 ECU/ha	15%	18%		
	Other species				
	a) Reference investment cost up to 942 ECU/ha	90%	100%	90%	100%
	b) Maximum eligible investment cost between 1.872 and 3.623 ECU/ha (conifers)	27%	30%	27%	30%
	c) Maximum cost between 1.872 and 4.830 ECU/ha (broadleaves)	27%	30%	27%	30%
Natural regeneration	**Cork oak, holm oak e conifers**				
	a) Reference investment cost up to 942 ECU/ha	90%	100%	90%	100%
	b) Maximum eligible investment cost between 942 and 1.208 ECU/ha	27%	30%	27%	30%
	Other broadleaves				
	a) Reference investment cost up to 5.313 ECU/km	90%	100%	90%	100%
	b) Maximum eligible investment cost between 1.026 and 1.208 ECU/ha	27%	30%	27%	30%
Construction of forest infrastructures	**Construction of forest roads**				
	a) Reference investment cost up to 5.313 ECU/km	90%	100%	90%	100%
	b) Maximum eligible investment cost between 5.313 and 8.453 ECU/km	27%	30%	27%	30%
	Construction of firebreaks				
	Reference investment cost up to 942 ECU/km	90%	100%	90%	100%
	Construction of water reservoirs				

[25] In this and in the other cases, it is amount of investment cost considered to be "normal" in the review of the applications.

	Reference investment cost up to 4.709 ECU/Unit	27%	30%	27%	30%

Source: IFADAP (1997)

Aid for maintenance

The maintenance aid for applicants with afforestation approved for funding amounts to 85 ECU/ha, being paid annually for 5 years since the year after restocking. The benefit of this aid is conditional on the respect by the applicant of the forest management plan on the basis of which the afforestation grant was approved.

Compensation premium

Applicants with afforestation grants approved can also get a compensation premium for the agricultural income lost in the conversion of farm land to forest. This premium is paid annually, for up to 20 years. Its amount is established per hectare afforested, varying according to the type of beneficiary, the location of the land afforested and the tree species composition of the plantation. This amount is subject to a cap defined according to the type of beneficiary.

The duration of the premium also varies according to the forest outputs intended by the new plantation.

In the case of forest groupings the amount of the premium is calculated individually for each member.

The following tables present in detail these specifications of the premia.

Caps on the compensation premium per forest owner

Full time farmers and farmers who get at least 25% of their income from farming	**28376 ECUs**
Other rural landowners	**18716 ECUs**

Source: IFADAP (1997)

Duration of the premium according to the tree species and the objectives of the plantation

			Objective of the plantation		Duration of the premium	Objective of the plantation		Duration of the premium
			Wood, wood & cork, cork and agro-forestry			Wood & fruit Cork & fruit		
			Seeding (plants/ha)	Planting (plants/ha)		Seeding (plants/ha)	Planting (plants/ha)	
Cork oak, Holm oak			600	400	20	500	300	20
Chestnut	Long rotation hardwood			800	20			
	Short rotation hardwood			800	15			
	Wood & fruit						100	10
Walnut	White			200	20		100	10
	Black			800	20			
Wild cherry tree				800	20		200	10
Oaks for wood, ash, black locust , gleditsia and other broadleaves				800	20			
Carob, arbutus-tree							150	10
Maritime pine and other conifers			1600	1400	20			
Stone pine	Fruit	Grafted					300	10
		Non grafted					800	20
				800	20			

	Wood						

Source: IFADAP (1997)

Amount of the compensation premium per hectare

Species	Zonal plan	Full time farmers			Farmers who get at least 25% of their income from farming			Other beneficiaries		
		< 5 ha (ECU/ha)	5- 50 ha (ECU/ha)	> 50 ha (ECU/ha)	< 5 ha (ECU/ha)	5- 50 ha (ECU/ha)	> 50 ha (ECU/ha)	< 5 ha (ECU/ha)	5- 50 ha (ECU/ha)	> 50 ha (ECU/ha)
Northern red oak	2	250	226	214	214	190	178	178	153	141
	1 e 4	266	242	229	229	205	193	181	169	157
Portuguese oak	5	231	206	194	194	170	158	158	134	122
English oak	1	266	242	229	229	205	193	181	169	157
Chestnut	6	243	219	206	206	182	170	170	146	134
	3 e 11	246	222	210	210	186	174	174	150	138
	2	250	226	214	214	190	178	178	153	141
	9	252	228	216	216	192	180	180	156	144
	1 e 4	266	242	229	229	205	193	181	169	157
Ash	11	246	222	210	210	186	174	174	150	138
	2	250	226	214	214	190	178	178	153	141
	6 e 7	252	228	216	216	192	180	180	156	144
	1 e 4	266	242	229	229	205	193	181	169	157
Walnut	3,5 e 11	246	222	210	210	186	174	174	150	138
	2	250	226	214	214	190	178	178	153	141
	6 e 9	252	228	216	216	192	180	180	156	144
	1 e 4	266	242	229	229	205	193	181	169	157
Planetree	6 e 7	252	228	216	216	192	180	180	156	144
	1 e 4	266	242	229	229	205	193	181	169	157
Wild cherry	3	246	222	210	210	186	174	174	150	138
	2	250	226	214	214	190	178	178	153	141
	4	266	242	229	229	205	193	181	169	157
Cork oak	11	217	193	181	181	157	145	145	121	109
	3 e 8	246	222	210	210	186	174	174	150	138
	7 e 9	252	228	216	216	192	180	180	156	144
Holm oak	8, 10 e 11	246	222	210	210	186	174	174	150	138
Carob tree	11	246	222	210	210	186	174	174	150	138
Arbutus tree	11	246	222	210	210	186	174	174	150	138
Maritime pine	6 e 11	217	193	181	181	157	145	145	121	109
	2 e 7	226	202	190	190	165	153	153	129	117
	1 e 4	235	211	199	199	175	163	163	139	127
Cedar	3	217	193	181	181	157	145	145	121	109
	2	226	202	190	190	165	153	153	129	117
Cypress	3 e 5	217	193	181	181	157	145	145	121	109
	2	226	202	190	190	165	153	153	129	117
Stone pine	3,8 10 e 11	217	193	181	181	157	145	145	121	109
	7	226	202	190	190	165	153	153	129	117

Aleppo pine	5, 10 e 11	217	193	181	181	157	145	145	121	109

Source: IFADAP (1997)

Matching grants for stand improvement

The following table presents in detail the various levels of matching grants (percentages of the total investment and caps) according to the types of beneficiaries and silvicultural operations.

Matching grants for stand improvement

Type of action	Silvicultural operation		Reference costs (up to ECU/ha)	Maximum eligible cost < ECU/ha	Grant in percentage of the investment cost			
					Individual farmers, farmers eligible for early retirement aids & farmers who get at least 25% of their income from farming		Forest groupings	
					Reference cost	Maximum eligible cost	Reference cost	Maximum eligible cost
Stand improvement	Cork oak stands only	Prunning	254	1026	90%	27%	100%	30%
		Restocking	284					
		Brush control of firebreaks	115					
		Sanitary thinnings	145					
		Converting long rotation to short rotation	217					
		Introduction of conifers	423					
	Cork oak and other stands	Restocking	682	845	90%	27%	100%	30%
		Fractioning	682					
		Converting long rotation to short rotation	423					
		Creation of windbreaks	682					
		Pest control	145					
		Protection of young plants	229					
Contruction of infrastructures	Forest roads		< 5 313 (ECU/km)	from 5 313 to 8453 (ECU/km)	90%	27%	100%	30%
	Firebreaks		< 942 (ECU/km)	from 91 to 181 (ECU/ ha) (c)	90%	27%	100%	30%
	Water reservoirs		< 4.709 (ECU/Unid)					

Source. IFADAP (1997)

Financial inputs

Estimation of the initial investment costs

Forest Action Programme

Concerning the financial implementation of PAF, the data available is the following:

public funds (from the Sate Budget and the EU budget) actually paid per year to the beneficiaries of eligible projects actually implemented, aggregated for all the components of PAF (afforestation and others);

investment costs per year, disaggregated into public funds and beneficiary's own investment, for eligible projects approved for funding (projects actually implemented and projects approved but interrupted later on for various reasons), aggregated for all the components of PAF.

There is also data about the areas of afforestation, reforestation and stands improvement per year for the eligible projects actually implemented.

This database is not disaggregated enough to provide direct information on the investment costs for afforestation and reforestation per year and for the eligible projects that were actually implemented. Therefore we had to resort to an estimate. This was obtained as follows:

from the amount of public funds paid per year for the whole programme, we obtained the corresponding investment costs per year for the whole programme assuming the same proportion between the former and the latter as in the eligible projects approved for funding, for the whole programme (all components and all years together);

from the investment costs per year t for the whole programme estimated as explained above, we obtained the part corresponding to investment costs in (re)afforestation assuming that the former were in the following proportion to the latter:

$$\frac{2x_t + y_t}{2x_t}$$

where x_t stands for the area of (re)afforrestation in year t and y_t stands for the area of stands improved in year t, corresponding to all the eligible projects actually implemented during that year.

Implicit in the proportion presented above is the assumption made in the preparatory documents of PAF (MAPA-DGF, 1986) according to which the costs per hectare of (re)afforestation are double of the costs per hectare of stand improvement.

PAF – Estimation of the investment costs in afforestation and reforestation matched by public incentives paid

Years	Area of (re)afforestation (ha)	Area of stand improvement (ha)	Total public funds paid (€)	Total investment costs (€)	Investment costs in (re)afforestation (€)
1987/88	20530	5387			
1987	n.a.	n.a.	11016366	11999798	10608041
1988	n.a.	n.a.	12200502	13289642	11748287
1989	17410	52156	20614279	22454517	8989449
1990	20892	41512	18807927	20486912	10276906
1991	15319,4	19644	14260432	15533462	9464999
1992	16905,8	21947,9	17497366	19059358	11557266

1993	11312,9	9995,8	13530722	14738610	10222455
1994	6054	11361,5	9719167	10586798	5461767
1995	5141,4	10195,7	3866640	4211816	2114865
1996	564,3	163,6	1771691	1929850	1685520
1997	0	0	68315	74414	64992
TOTAL	114129,8	172363,5	123353407	134365176	82194547

The investment costs for the whole programme include not only the costs of (re)afforestation and stand improvement, but also the costs of the other components of PAF, namely the construction and improvement of forest roads and dams to support fire fighting. The data available is not disaggregated enough to know the specific amount of these costs. So a share of them is included in our estimate of the investment costs of (re)afforestation.

The basis and results of this estimate are presented in the table above.

Forest Development Plan

Concerning the financial implementation of PDF, the data available is the following:

investment costs, for every year from 1994 to 2001/02, disaggregated into public funds and beneficiary's own investment, for eligible projects actually implemented aggregated for all the components of PDF;

percentage of the total investment costs in (re)afforestation corresponding to the eligible projects actually implemented aggregated for all the components of PDF, for every year from 1995 to 1999.

The whole and final series for the investment costs mentioned in (a) is available in the final official report about the implementation of PDF (MADRP, 2003). The percentages mentioned in (b) are available in the reports for every year from 1995 to 1999 (MADRP, 1996, 1997, 1998, 1999, 2000), but not in the final report. Those yearly reports also include data on the same type of costs mentioned in (a), but these amounts are provisional values, not final ones.

So to obtain the investment costs in afforestation per year, from 1994 to 2001, we used the investment costs per year for the whole programme, as given in the final report, and the percentages corresponding to afforestation and reforestation as given in the yearly reports for 1995-99. For 1994 we assumed the same percentage as for 1995. For 2000 and 2001/02 we assumed the same percentage as for the whole programme (all years together), as given in the final report.

The basis and results of this estimate are presented in the following table. The underestimate a little the investment costs in (re)afforestation according to PDF final report, they represent 45,8% of the total investment costs for the whole programme. According to our estimate they represent 45,8%.

PDF – Estimation of the investment costs in afforestation and reforestation matched by public financial incentives paid

Year	Total investment costs (€)	Investment costs in afforestation and reforestation	
		% percentage of total invest. costs	€
1994	388000	48,3	187404
1995	4841000	48,3	2338203
1996	23462000	50,3	11801386
1997	23541000	49,0	11535090
1998	19688000	36,1	7107368
1999	22466000	42,7	9592982
2000	22680000	45,8	10387440

2001/02	15822000	45,8	7246476
TOTAL	132888000	45,3	60196349

Regulation 2080/92

For Regulation 2080/92 we also don't have data disaggregated by year for each component of the programme: afforestation, management of natural regeneration, improvement of existing stands, construction and improvement of forest roads and infrastructures supporting forest fire fighting. However, afforestation was, by far, the main component of this programme. In the total area of projects approved for funding in the period 1994-99 which amounted to 173254,4 ha, afforestation represented 95,3%, management of natural regeneration 0,7% and improvement of existing stands 4% (IFADAP, 2001).

In this situation, we did not try to estimate the share of the total investment costs corresponding specifically to afforestation, assuming that the total amount of these costs could be considered as being oriented to this purpose. These costs are presented in the following table. They refer to the projects approved for funding in the period 1994-99, excluding those which were approved but cancelled until December 31, 1999.

Reg. 2080/92 – Investment costs of the projects approved and not cancelled until 31/12/99

Years	€
1994	18381801
1995	37452474
1996	19644227
1997	31133903
1998	27163760
1999	35315150
Total	169091315

Source: IFADAP (data collected in June 2000)

Levels of investment and public expenditures

From 1987 to 1999 the amount invested in forestry within the framework of the three programmes mentioned above was **436344492 €** in current prices (**541746675 €**, at 2000 prices). From this amount, **392037052 €** (89,8 %) were public funds, the rest being investment costs borne by beneficiaries (mostly private, but also some public). About 75% of these public funds were transfers from the EU, the rest coming almost totally from the State budget.

Averaging with respect to the area of forest existing in 1995 (DGF, 2001), those amounts represent an investment of **130.28 €/ha (161.75 €/ha at 2000 prices)** and a public expenditure of **117.05 €/ha (145.81 €/ha at 2000 prices)**. This corresponds respectively to **8.69 €/ha.year (10.78 €/ha.year at 2000 prices)** and **7.80 €/ha.year (9.72 €/ha.year at 2000 prices)**.

Consumer price index (base 2000) used to convert current values into values at 2000 prices

Years	CPI
1987	41.36
1988	48.35
1989	54.41
1990	61.76
1991	68.84
1992	75.37
1993	80.06
1994	84.01
1995	87.50
1996	90.44

1997	91.91
1998	94.76
1999	96.69
2000	100.00
2001	104.04
2002	107.90

Source: INE

The following tables present these amounts by year and by type of actions funded by these programmes. This data was not obtained as is, directly from published or unpublished official sources. It is based on this kind of sources, but since they don't provide enough detail and disaggregation for building a table such as the one presented here, we had to go through some estimations explained in the coming sections.

The data refers to applications approved for funding and financed until December 31, 1999. The table ends in 2001/02 to take into account payments made for applications to PDF which were extended until that time.

The table does not include the increase in Public Administration's costs due to the existence of these programmes. According to our estimates, they were around 189000 €/year.

The other forestry activities supported by these programmes besides (re)afforestation are essentially the improvement and protection of existing stands through restocking, brush control, construction and repair of infrastructures (forest roads, dams and other equipments supporting fire fighting).

The public expenditures correspond to investment grants awarded to the beneficiaries, the great majority being private forest owners.

Investment costs, public expenditure (investment granst) and costs borne by beneficiaries in programmes of financial incentives to forestry (PAF, PDF & Reg. 2080/92) from 1987 to 2001
(in euros, at current prices)

Years	Total			Afforestation and reforestation			Other		
	Total	Public expenditure	Cost borne by beneficiaries	Total	Public expenditure	Cost borne by beneficiaries	Total	Public expenditure	Cost borne by beneficiaries
1987	11999798	11016366	983432	10608041	9738669	869372	1391757	1277697	114060
1988	13289642	12200502	1089140	11748287	10785467	962820	1541355	1415035	126320
1989	22454517	20614279	1840238	8989449	8252727	736722	13465068	12361552	1103516
1990	20486912	18807927	1678985	10276906	9434672	842234	10210006	9373255	836751
1991	15533462	14260432	1273030	9464999	8689304	775695	6068463	5571128	497335
1992	19059358	17497366	1561992	11557266	10610101	947165	7502092	6887265	614827
1993	14738610	13530722	1207888	10222455	9384684	837771	4516155	4146038	370117
1994	29356599	26762543	2594056	24030972	21885885	2145087	5325627	4876658	448969
1995	46505290	41999305	4505985	41905542	37935379	3970163	4599748	4063926	535822
1996	45036077	39904126	5131951	33131133	29693599	3437534	11904944	10210527	1694417
1997	54749317	49193733	5555584	42733985	38648483	4085502	12015332	10545250	1470082
1998	46851760	42158476	4693284	34271128	31048183	3222945	12580632	11110293	1470339
1999	57781150	51434275	6346875	44908132	40622911	4285221	12873018	10811364	2061654
2000	22680000	19068000	3612000	10387440	8733144	1654296	12292560	10334856	1957704
2001/02	15822000	13589000	2233000	7246476	6223762	1022714	8575524	7365238	1210286
TOTAL	**436344492**	**392037052**	**44307440**	**311482211**	**281709073**	**29773138**	**124862281**	**110327979**	**14534302**
Average (€/ha)	**130.28**	**117.05**	**13.23**	**93.00**	**84.11**	**8.89**	**37.28**	**32.94**	**4.34**
Average (€/ha.year)	**8.69**	**7.80**	**0.88**	**6.20**	**5.61**	**0.59**	**2.49**	**2.20**	**0.29**

Sources: data collected directly or estimated from MA (1992, 1993, 1994), MADRP (1995, 1996a, 1996b, 1997a, 1997b, 1998a, 1998b, 1999a, 2000a, 2003), MAPA (1988, 1989, 1990, 1991) and IFADAP (2001, and unpublished data)

Investment costs, public expenditure (investment grants) and costs borne by beneficiaries in programmes of financial incentives to forestry (PAF, PDF & Reg. 2080/92) from 1987 to 2001 (in euros, at 2000 prices)

Years	Total			Afforestation and reforestation			Other		
	Total	Public expenditure	Cost borne by beneficiaries	Total	Public expenditure	Cost borne by beneficiaries	Total	Public expenditure	Cost borne by beneficiaries
1987	29012845	26635125	2377720	25647886	23545937	2101948	3364959	3089187	275772
1988	27488841	25236019	2252822	24300639	22309103	1991536	3188202	2926917	261285
1989	41267761	37885702	3382059	16521150	15167174	1353976	24746611	22718528	2028083
1990	33169286	30450929	2718357	16638800	15275183	1363617	16530486	15175746	1354740
1991	22563961	20714753	1849208	13748890	12622113	1126777	8815070	8092640	722431
1992	25288514	23216017	2072497	15334519	14077793	1256726	9953995	9138225	815770
1993	18410571	16901751	1508820	12769266	11722774	1046492	5641305	5178977	462328
1994	34945273	31857382	3087892	28605796	26052345	2553451	6339477	5805037	534440
1995	53148903	47999206	5149697	47892048	43354719	4537329	5256855	4644487	612368
1996	49795988	44121635	5674352	36632797	32831947	3800851	13163190	11289688	1873502
1997	59567257	53522782	6044475	46494576	42049550	4445026	13072681	11473232	1599449
1998	49442012	44489255	4952758	36165846	32764717	3401129	13276166	11724538	1551628
1999	59758452	53194383	6564068	46444912	42013049	4431864	13313540	11181335	2132205
2000	22680000	19068000	3612000	10387440	8733144	1654296	12292560	10334856	1957704
2001/02	15207011	13060806	2146205	6964811	5981849	982962	8242200	7078957	1163243
TOTAL	**541746675**	**488353745**	**53392929**	**384549377**	**348501396**	**36047981**	**157197298**	**139852350**	**17344948**
Average (€/ha)	**161.75**	**145.81**	**15.94**	**114.81**	**104.05**	**10.76**	**46.93**	**41.76**	**5.18**
Average (€/ha.year	**10.78**	**9.72**	**1.06**	**7.65**	**6.94**	**0.72**	**3.13**	**2.79**	**0.35**

PAF – Investment costs, public expenditure (investment grants) and costs borne by the beneficiaries (in euros, at current prices)

Years	Total investment	Costs borne by the beneficiaries	Public grants paid by sources of funds		
			Total	State Budget	EAGG
1987	11999798	983447	11016351	3304891	7711460
1988	13289642	1089127	12200515	3050133	9150382
1989	22454517	1840231	20614286	5153576	15460710
1990	20486912	1678977	18807935	4701984	14105951
1991	15533462	1273030	14260432	3565113	10695319
1992	19059358	1561992	17497366	4374348	13123018
1993	14738610	1207888	13530722	3382683	10148039
1994	10586798	867631	9719167	2429790	7289377
1995	4211816	345176	3866640	966665	2899975
1996	1929850	158160	1771690	440164	1331526
1997	74414	6099	68315	17079	51236
TOTAL	**134365176**	**11011756**	**123353420**	**31386427**	**91966993**
	100%	**8.2%**	**91.8%**	**23.4%**	**68.4%**
			100%	**25.4%**	**74.6%**

Sources:

a) Public expenditure (amounts paid) according to the annual reports of *PEDAP-Programa Específico de Desenvolvimento da Agricultura Portuguesa* (MAPA, 1988, 1989, 1990, 1991, MA, 1992, 1993, 1994; MADRP, 1995, 1996a, 1997a, 1998a)

b) Total investment: our own estimates based on the public expenditure and assuming the same ratio between public expenditure and total investment in this case as for the case of the projects approved for funding, as these are reported in the sources mentioned in a)

c) Costs borne by the beneficiaries: own estimate obtained by subtracting public expenditure from total investment

PDF – Investment costs, public expenditure (investment grants) and costs borne by the beneficiaries (in euros, at current prices)

Years	Total investment	Costs borne by the beneficiaries	Public grants paid by sources of funds		
			Total	State Budget	EAGG
1994	388	56	332	83	249
1995	4841	704	4137	1034	3103
1996	23462	3369	20093	5023	15070
1997	23541	2881	20660	5165	15495
1998	19688	2301	17387	4347	13040
1999	22466	3598	18868	4717	14151
2000	22680	3612	19068	4767	14301
2001/2002	15822	2233	13589	3397	10192
TOTAL	**132889**	**18755**	**114134**	**28533**	**85600**
	100%	**14.1%**	**85.9%**	**21.6%**	**64.4%**
			100%	**25.0%**	**75.0%**

Source: MADRP (2003).

Reg. (EEC) 2080/92– Investment costs, costs borne by beneficiaries and investment grants approved (in euros, at current prices)

Years	Total investment	Costs borne by the beneficiaries	Investment grants paid by sources of funds		
			Total	State Budget	EAGG
1994	18381801	1670426	16711375	4177844	12533531
1995	37452474	3456807	33995667	8498917	25496750
1996	19644227	1604792	18039435	4509859	13529576
1997	31133903	2668484	28465419	7116355	21349064
1998	27163760	2392284	24771476	6192869	18578607
1999	35315150	2748875	32566275	8141569	24424706
TOTAL	**169091315**	**14541668**	**154549647**	**38637412**	**115912235**
	100%	8.6%	91.4%	22.9%	68.6%
			100%	25%	75%

Sources:

a) investment and total public expenditure: unpublished data collected from IFADAP, in June 2000, referring to the projects approved and not cancelled until December 31, 1999

b) state budget and EAGG expenditures: estimated from the total public expenditure assuming they represent respectively 25% and 75% of this total

Reg. (EEC) 2080/92– Investment grants, maintenance aid and compensation premia paid (in euros, at current prices)

1994	Investment grants	7813804
	Compensation premium	0
	Maintenance aid	0
	Total	**7813804**
1995	Investment grants	16623103
	Compensation premium	2730218
	Maintenance aid	4446768
	Total	**23800089**
1996	Investment grants	20885162
	Compensation premium	4454465
	Maintenance aid	1577029
	Total	**26916656**
1997	Investment grants	22673801
	Compensation premium	12956390
	Maintenance aid	1886977
	Total	**37517169**
1998	Investment grants	19637100
	Compensation premium	15536532
	Maintenance aid	2787816
	Total	**37961448**
1999	Investment grants	24886114
	Compensation premium	19001836
	Maintenance aid	4087808
	Total	**47975758**

Source: unpublished data collected from IFADAP

Administrative costs

During the first phase of PAF most of the tasks of reviewing the applications for funds and monitoring the implementation of the programme were with the Forest Services (DGF). This agency carried on these responsibilities essentially by appealing to existing personnel who had had some experience in the past in terms of dealing with private forestry, but was underutilized at the time the programme was launched. This fact contributes to keep down the opportunity costs of this staff.

In the second phase of PAF the responsibilities of the Forest Services moved gradually to IFADAP, the public institute in charge of managing the implementation of the programmes in agriculture, forestry and fisheries co-financed by EU structural funds. IFADAP took definitely most of the administrative responsibilities in 1994, keeping this role for the rest of the period under analysis.

Both the Forest Services and IFADAP did not have a heavy structure specifically allocated to the administration of the forest programmes. The final report about the "Agriculture Sub-Programme" of the Second Common Support Framework (MADRP, 2003) which PDF belongs to provides data about the money spent in projects aimed at the reinforcing the management, monitoring and evaluation capacities of the institutions with administrative responsibilities in the programmes included in this part of the Second CSF. The data is broken down by institutions, but not by programme. The Forest Services absorbed 2,8% of the total amount spent for this purpose, that is, 1116528€ for the period 1994-2001/02. This percentage does not include the costs referring to the specific involvement of IFADAP in the administration of the forest programmes. There is only the global percentage for IFADAP which includes all the programmes under the responsibility of this institution.

Another way to use the data available in the report mentioned above to estimate administrative costs for PDF is to assume that the share of this programme in the total amount spent in the "Agriculture Sub-Programme" of the Second CSF for projects aimed at the reinforcing the management, monitoring and evaluation capacities is the same as the share of PDF in the total investment in all the programmes included in the Agriculture Sub-Programme. This share is equal to 3,8%. This leads to an amount of **1515288€** for PDF, as far as these projects in management, monitoring and evaluation capacities are concerned. We will retain this estimate assuming that it includes the **1116528€** referred above for the Forest Services and the money spent with PDF administration by IFADAP.

This estimate is not yet disaggregated by year. To do it we will assume the same share of 3,8% for all the from 1994 to 2001/02 and apply it to the total amount spent per year in the Agriculture Sub-Programme in those projects reinforcing the management, monitoring and evaluation capacities. The results are presented in the following table for years 1994 to 2002. For the previous period going from 1987 to 1993 which refers to the implementation of PAF, we assumed the same time series as for PDF, since the administrative burden was not very different.

Estimates of the costs with projects of enhancement of the management, monitoring and evaluation capacities of public agencies in charge of the programmes of financial incentives to forestry

Years	Value at current prices (€)	Value at prices of year 2000 (€)
1987	85576	206904
1988	352830	729808
1989	251332	461907
1990	207784	336412
1991	218044	316731
1992	204326	271106
1993	113202	141405
1994	85576	101867
1995	352830	403234
1996	251332	277896
1997	207784	226069
1998	218044	230099

1999	204326	211318
2000	113202	113202
2001	54796	52666
2002	27398	25391

Because the administration of Regulation 2080/92 was shared by the same institutions and personnel as the ones in charge PDF, it may not be a bad assumption to consider that the costs estimated cover also the improvement in administrative capacities needed to implement Regulation 2080/92.

Beneficiaries

Overview

The main beneficiaries of these programmes were the **non industrial private forest owners**. Some of the funds were also channelled to communal forests under the management of Forest Services. This is a major change in Portuguese forest policy since, for about one hundred years, the main beneficiaries were the public and the communal forests.

Because these incentive schemes appealed to the free initiative of forest owners without doing very much to provide assistance to them in the preparation of the applications and in the implementation of the investment plans, the result was that small scale forestry was disfavoured in the allocation of public support compared to larger scale forestry. Communal forests were also relatively less benefited than before. These two effects together imply that, with these programmes, **the regional distribution of public support to forestry shifted southwards** were there are larger forest holdings and less communal forests.

Concerning the data on the beneficiaries, the gaps are worse than for the amounts invested. There are some data on the total **number** of **applications** approved for funding, for all forest activities together, but it is not possible to have or estimate data on the applications for each type of activity per year and for the whole horizon of these programmes. For some years it is available the total number of applications, disaggregated in terms of private and public applications, but most of the time this disaggregation is not available. "Public" applications are projects submitted by the Forest Services mostly for the communal forests which they manage. Since the ownership of these forests is with the local communities and not with the State, they are not public forests in the full sense of the word.

Another limitation of this kind of data is that it refers to "applications" for funds. So it does not represent the number of individual forest owners, or members of local communities whose land (individually owned, or in common ownership) was the object of the projects funded by these programmes:

- there are cases of forest owners who filed more than one application for different forest holdings and got them approved;

- private forest owners who filed applications for grouped projects are counted as one application;

- public applications for projects in communal forests are counted as one application.

A third limitation of this data is that we cannot match the numbers of private and public beneficiaries, even for all the forestry activities together, with the corresponding investment.

As a final cautionary note about this data, one should remember that, because of the asymmetric distribution of forest land ownership in Portugal, comparisons of the number of beneficiaries with the total number of forest holdings in the country [409524 private and 1140 public, in 1995, according to estimates published by the Forest Services (DGF, 1999)], or averages per beneficiary don't mean very much.

With all these limitations, an appropriate use one can make of this data is for drawing the following hypothesis whose test is beyond the scope of this project: many of the private forest owners who applied for these programmes make up the **membership basis of the forest owners' associations** which emerged in the 90s. These organisations were created to answer the demand of technical assistance by private forest owners, many of whom had applied, or wanted to apply for these financial incentives. Also the total number of beneficiaries of these programmes, as reported in the following table, is of the same order of magnitude as the total number of members of forest owners' associations.

Number of applications approved in EU co-funded programmes of financial incentives to forestry from 1987 to 1999

	Years	Total			PAF			PDF			Reg.		
		Total	Private	Public	Total	Private	Public	Total	Private	Public	Total	Private	Public
Number of applications approved for funding	1987	319	n.a.	n.a.	319	n.a.	n.a.	0	0	0	0	0	0
	1988	615	541	74	615	541	74	0	0	0	0	0	0
	1989	752	702	50	752	702	50	0	0	0	0	0	0
	1990	49	48	1	49	48	1	0	0	0	0	0	0
	1991	89	74	15	89	74	15	0	0	0	0	0	0
	1992	129	98	31	129	98	31	0	0	0	0	0	0
	1993	223	n.a.	n.a.	223	n.a.	n.a.	0	0	0	0	0	0
	1994	606	n.a.	n.a.	0	0	0	0	0	0	606	n.a.	n.a.
	1995	2795	n.a.	n.a.	0	0	0	1023	844	179	1772	n.a.	n.a.
	1996	1751	n.a.	n.a.	0	0	0	910	810	100	841	n.a.	n.a.
	1997	2189	n.a.	n.a.	0	0	0	765	670	95	1424	n.a.	n.a.
	1998	1996	n.a.	n.a.	0	0	0	782	653	129	1214	n.a.	n.a.
	1999	2599	n.a.	n.a.	0	0	0	1111	925	186	1488	n.a.	n.a.
	Total	**14112**	**n.a.**	**n.a.**	**2176**	**n.a.**	**n.a.**	**4591**	**3902**	**689**	**7345**	**n.a.**	**n.a.**
Number of applications approved and not cancelled		**n.a.**	**n.a.**	**n.a.**	**2124**	**n.a.**	**n.a.**	**4542**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**n.a.**

Sources: data collected directly or estimated from MA (1992, 1993, 1994), MADRP (1995, 1996a, 1996b, 1997a, 1997b, 1998a, 1998b, 1999a, 2000a, 2003), MAPA (1988, 1989, 1990, 1991) and IFADAP (2001, and unpublished data)

Another group of people who benefited directly from these programmes includes the **foresters and forest contractors** who worked for the forest owners in the preparation of the applications for grants and in the execution of the afforestation and stand improvements. When PAF was launched the market for this kind of services was underdeveloped. So one of the indirect effects of these programmes was to stimulate the emergence of this supply of services to forestry. According to our own estimation, in 1995 there were about 3750 equivalent full time workers in forest contractors' firms.

Forest Action Programme (PAF)

Looking first at the types of beneficiaries of PAF as presented in the next table, 70,2 % of the total investment supported by PAF was for private forestry. From the remaining 29,8 %, more than half was for public projects in the North which were almost entirely in communal lands. These projects, however, represented only 17,4 % of the total investment supported by PAF which is much lower than what happened in the PFP. So with PAF, the direct

engagement of the Forest Services in communal forests was regressing. Also in most of the projects in private forests supported by PAF there was neither the direct intervention of the Forest Services, nor the direct investment of the forest industries (pulp and paper or other). So it is here that comes in our hypothesis about the major role played by forest contractors, since most of the NIPFOs are not large enough to plan and implement forest projects on their own.

Distribution by region and ownership category of the total investment funded by PAF

Regions	Public projects			Private projects		
	Number of projects	1000 escudos	%	Number of projects	1000 escudos	%
Northwest	88	2 335 368	31,6	183	1 228 478	7,1
Northeast	120	1 977 833	26,7	166	3 761 323	21,6
North	208	4 313 201	58,3	349	4 989 801	28,9
Central West	125	1 657 909	22,4	181	1 115 790	6,4
Central East	24	623 791	8,4	215	3 460 266	19,9
Ribatejo Oeste	26	340 268	4,6	303	1 876 481	10,8
Alentejo	20	249 756	3,4	437	3 046 302	17,5
Algarve	5	214 978	2,9	246	2 909 979	16,7
TOTAL	408	7 399 903	100,0	1 731	17 398 619	100,0

Source: IFADAP

Looking now in more detail to what types of NIPFOs might have been more active in opting in for this programme, the data available are insufficient to give a clear answer, since only indirect evidence is provided on this subject. These data are about the distributions by regions and by tree species of the areas of new or improved forests supported by the programme. What these distributions show us compared to the PFP is the following:

- while with PFP 54,5 % of the plantings were in the North, with PAF the percentage of the North in afforestation and stand improvement fell to 21,3 %;

- the Central region also lost ground;

- the region which was on the rise was Alentejo;

- this regional shift is consistent with what happened in the tree species distribution, where the maritime pine (the dominant species in Northern and Central Portugal) fell from 49,9% in the PFP to 33,9% in the PAF, and cork oak (the dominant tree in Alentejo) rose from 1,4% in the PFP to 36,0% in the PAF.

Regional distribution of the areas of afforestation and stand improvement funded by PFP and PAF

Regions	PFP (afforestation)		PAF					
			Afforestation		Stand improvement		Total	
	ha	%	ha	%	ha	%	ha	%
North	70 670	54,5	40 443	35,6	28 671	13,6	69 114	21,3
Centre	37 400	28,8	29 137	25,7	33 395	15,8	62 532	19,3
Lisbon & Tejo Valley	9 773	7,5	13 137	11,6	43 823	20,8	56 960	17,6
Alentejo	10 455	8,1	13 861	12,2	88 395	41,9	102 256	31,5
Algarve	1 451	1,1	16 984	15,0	16 720	7,9	33 704	10,4
TOTAL	129 749	100,0	113 561	100,0	211 054	100,0	324 615	100,0

Source: Instituto Florestal

Tree species composition of the areas of afforestation and stand improvement funded by PFP and PAF

Species	PFP (afforestation)		PAF					
			Afforestation		Stand improvement		Total	
	Ha	%	ha	%	Ha	%	ha	%

Maritime pine	65 083	49,9	46 938	41,3	63 180	29,9	110 118	33,9
Eucalyptus	37 929	28,8	10 375	9,1	5 107	2,4	15 482	4,8
Cork oak	1 809	1,4	22 307	19,6	94 534	44,8	116 841	36,0
Others	27 087	20,5	33 941	29,9	48 233	22,9	82 174	25,3
TOTAL	**131 908**	**100,0**	**113 561**	**100,0**	**211 054**	**100,0**	**324 615**	**100,0**

Source: Instituto Florestal

Regional distribution of the area of afforestation and stand improvement in projects approved for funding by Reg. 2080/92 (ha)

Regions	Afforestation		Stand improvement	
	Ha	%	ha	%
Northwest	1719,54	1,0	62,56	0,9
Northeast	31375,2	19,0	321,1	4,7
Central West	955,6	0,6	12,9	0,2
Central East	21378,4	13,0	642,8	9,4
Ribatejo Oeste	10190,9	6,2	3074,7	44,9
Alentejo	76997,2	46,7	2480,0	36,2
Algarve	22402,7	13,6	256,2	3,7
TOTAL	**165019,6**	**100,0**	**6850,3**	**100,0**

Source: data collected from IFADAP

These data is enough to state, as a plausible hypothesis, that with PAF, there was a major shift in the beneficiaries of the public incentives compared to the PFP, the forest owners in Alentejo gaining ground and the forest owners in Northern and Central Portugal loosing their dominant position in this matter. This shift was maintained with the other programmes. In terms of species, cork oak and other long rotation broadleaves emerged as the main beneficiaries of public support instead of eucalyptus and maritime pine. This is an expected outcome, given the profile of private forest ownership distribution (small scale forestry predominant in Northern and Central Portugal; large scale agro-forestry predominant in Alentejo), the lack of collective organisation of NIPFOs in the regions of small scale forestry and the total inaction of the Forest Services during the PFP and the PAF to promote this kind of capacity building, in spite of the funds available for this purpose.

This should not be taken as a criticism to the NIPFOs in Alentejo who did their best to apply for the public incentives available in the PAF. It is simply an attempt to explain why things happen the way they did. Also the revival of the cork oak forests in Alentejo is certainly an welcome result of this programme after almost fifty years of stagnation and even degradation of what is still the forest product where Portugal has the leading position in the world, but where shortness in supply is creating increasing problems to the industry.

Outputs

The 343009 ha of afforestation and reforestation and the 380601 ha of stands improved with the financial support of PAF, PDF and Reg. 2080/92, in the period 1987-99, represent respectively 11% and 12.2% of the area of forest and other wooded land existing in the country in 198-85, when PAF was launched.

Areas of afforestation, reforestation and stand improvement supported by EU co-funded programmes (PAF, PDF & Reg. 2080/92) from 1987 to 1999

Years	Total		PAF		PDF		Reg. 2080	
	(Re)affor.	Stand improv.	(Re)affor.	Stand improv.	(Re)affor.	Stand improv.	(Re)affor.	Stand improv.[26]
1987/88	20530	44154	20530	44154	0	0	0	0

[26] There were also 1285 ha of natural regeneration funded by this programme, not included in the table.

1989	17410	52156	17410	52156	0	0	0	0
1990	20892	41511	20892	41511	0	0	0	0
1991	15319	19644	15319	19644	0	0	0	0
1992	16906	21948	16906	21948	0	0	0	0
1993	11313	9996	11313	9996	0	0	0	0
1994	34714	38251	6054	11480	8165	24776	20495	1995
1995	70286	63673	5141	10196	24090	51186	41055	2291
1996	24947	13450	564	164	4491	12643	19892	643
1997	40715	29888	0	0	9501	29189	31214	699
1998	36234	31161	0	0	9829	30892	26405	269
1999	33743	14768	0	0	7694	13805	26049	963
TOTAL	**343009**	**380601**	**114130**	**211249**	**63770**	**162492**	**165109**	**6860**

Sources: data collected directly or estimated from MA (1992, 1993, 1994), MADRP (1995, 1996a, 1996b, 1997a, 1997b, 1998a, 1998b, 1999a, 2000a, 2003), MAPA (1988, 1989, 1990, 1991) and IFADAP (2001, and unpublished data)

Besides afforestation, reforestation and stand improvement which were the major components of these programmes, PAF and PDF also funded the following actions:

- construction or improvement of forest roads: 12808 km (3,8 m per ha of forest land existing in 1995)

- construction or improvement of fire breaks: 4962 km (1,5 m per ha of forest land existing in 1995)

- construction or improvement of water points: 1361 points (0,0005 per ha of forest existing in 1995)

- multiple use forestry (bee keeping, gaming, aquiculture, grazing, parks for recreation, etc.): 12121 ha

- private forest nurseries (in PDF only): 25.

Forest infrastructures, multiple use forestry projects and private forest nurseries funded by programmes of financial incentives to forestry from 1987 to 1999

Years	Total			PAF			PDF				
	Forest roads (km)	Fire breaks (km)	Number of water points	Forest roads (km)	Fire breaks (km)	Number of water points	Forest roads (km)	Fire breaks (km)	Number of water points	Multiple use forestry	Number of forest nurseries
1987/88	1065	762	0	1065	762	0	0	0	0	0	0
1989	1625	672	235	1625	672	235	0	0	0	0	0
1990	1391	455	180	1391	455	180	0	0	0	0	0
1991	1083	372	152	1083	372	152	0	0	0	0	0
1992	908	369	136	908	369	136	0	0	0	0	0
1993	433	154	54	433	154	54	0	0	0	0	0
1994	n.a.	n.a.	n.a.	385	119	61	n.a.	n.a.	n.a.	n.a.	n.a.
1995	n.a.	n.a.	n.a.	249	77	36	n.a.	n.a.	n.a.	n.a.	n.a.
1996	n.a.	n.a.	n.a.	29	2	5	n.a.	n.a.	n.a.	n.a.	n.a.
1997	n.a.	n.a.	n.a.	0	0	0	n.a.	n.a.	n.a.	n.a.	n.a.
1998	n.a.	n.a.	n.a.	0	0	0	n.a.	n.a.	n.a.	n.a.	n.a.
1999	n.a.	n.a.	n.a.	0	0	0	n.a.	n.a.	n.a.	n.a.	n.a.
2000	n.a.	n.a.	n.a.	0	0	0	n.a.	n.a.	n.a.	n.a.	n.a.
2001/02	n.a.	n.a.	n.a.	0	0	0	n.a.	n.a.	n.a.	n.a.	n.a.
TOTAL	12808	4962	1361	7168	2982	859	5640	1980	502	12121	25
Density per ha	0,0038	0,0015	0,0004								

Sources: data collected directly or estimated from MA (1992, 1993, 1994), MADRP (1995, 1996a, 1996b, 1997a, 1997b, 1998a, 1998b, 1999a, 2000a, 2003), MAPA (1988, 1989, 1990, 1991) and IFADAP (2001, and unpublished data)

The public support for stand improvement and forest infrastructures aims at increasing the productivity of the stands and improving the protection against the risk of forest fires. Not enough time has passed since the conclusion of these programmes to evaluate their contributions for that risk. The only fact we can state for sure is that, during the period of 1987-99, the **total area of forest burnt was 620712 ha which is almost double the area of afforestation and reforestation** supported by these programmes.

Effectiveness analysis

Programme effects

Risk analysis

In the quantification of the effects we took into account the **risk** of tree mortality due to forest fires. Therefore **all** the estimated effects presented here are **expected** values obtained by multiplying the risk free effects by the **survival probabilities**. These probabilities were calculated assuming a **Weibull distribution,** as will be explained in the section on cost-benefit analysis.

Time horizon and time profile of the programme effects

The effects quantified in the tables refer to the stands installed with the support of the programmes selected for evaluation until the end of their rotation periods, without taking into consideration what may happen after that, in terms of reforestation. Therefore the effects vanish after the rotation period of the oldest stand. The results are presented in a way that shows the time profile of the different effects.

Contribution to the expansion and improvement of forests

From 1987 to 1999, the three programmes contributed to increase the initial area of forest in Continental Portugal by 11%. The countervailing factor on which they could not yet have a decisive influence during this period was on the **risk of forest fire** because, during the same period, the total area of forest burnt amounted to 620712 ha, which is **almost double of the total area of afforestation and reforestation** supported by these programmes.

Breaking down this area by species shows that these programmes contributed to **diversify the tree species composition** of Portuguese forests. Since the contributions to the increase in the areas of eucalyptus and maritime pine were respectively 4% and 6.8%, while they were much higher in all the other species, these programmes contributed to reduce the focus of the previous afforestation programmes on those two species. **Cork oak** was, by far, the major beneficiary. There were also significative contributions to increase the area of other **long rotation broadleaves**.

Areas of afforestation, reforestation and stand improvement supported by PAF, PDF and Reg. 2080/92 (1987-99)

		ha	Variation or incidence with respect to the forest area in Continental Portugal at a reference period	
			Reference period	%
Afforestation and	TOTAL	343009	1980-85	11.04
	Maritime pine	85530	1980-85	6.83

Reforestation	Stone pine	39649	1980-85	75.08
	Other conifers	29434	1980-85	54.82
	Eucalyptus	15395	1980-85	3.99
	Cork oak	102379	1980-85	15.42
	Chestnut	14527	1980-85	46.71
	Other broadleaves	56096	1980-85	8.39
Stand improvement		**380601**	**1980-85**	**12.2**

Sources:

a) programme effects: data collected directly or estimated from MA (1992, 1993, 1994), MADRP (1995, 1996a, 1996b, 1997a, 1997b, 1998a, 1998b, 1999a, 2000a, 2003), MAPA (1988, 1989, 1990, 1991) and IFADAP (2001, and unpublished data)

b) areas for the reference period: data from the 2.nd revision of the Forest Inventory collected from DGF

Contingent on results that may come from future empirical studies based on representative samples of these plantations, what this data suggests is that these programmes, by contributing to the diversification of the tree species composition towards broadleaves, may contribute to **reduce the risk of forest fires in the long run**. If this problem has not been reduced yet it is not only because the major effects of these programmes are still too come, but also probably because of the negative contribution of other factors which cannot be solved by these programmes alone. One of these factors is rural outmigration with the corresponding abandonment of farming and the increase in scrublands in those places where afforestation of the abandoned lands did not happen.

Contribution of afforestation and reforestation to increase the growing stock

The following table presents the contributions of the afforestation and reforestation components of these programmes to the growing stock. The reference point shown in the first line is the year and the growing stocks for the last Forest Inventory (1995). To simplify the presentation of the effects, we only gave the estimates for the years of inflexion in the trends of the expected growing stocks.

Expected effects of the afforestation and reforestation programmes on the growing stock

Years		Conifers (except stone pine), eucalyptus and chestnut		Stone pine		Oaks and other broadleaves	
		1000 m^3	Variation (%)	1000 m^3	Variation (%)	1000 m^3	Variation (%)
Total growing stock in Continental Portugal at the reference year (1995)		139773	----	4970	----	8828	----
Years of inflexion points	2032	20400	14.6	3519	70.8	16267	184.3
	2044	1238	0.9	4668	93.9	21153	239.6
	2068	0	0	6908	139.0	30275	342.9
	2079	0	0	1493	30.0	34194	387.3
	2113	0	0	0	0	45259	512.7
Final year (2125)		0	0	0	0	5484	62.1

The estimates are aggregated in three groups of species. The first one includes the conifers (except stone pine), eucalyptus and chestnut. This is the group more oriented towards timber production. The other two include species where the major orientation is for non wood forest products:

a) stone pine: production of pine cones and amenities;

b) cork oak: production of cork

c) other oaks: protection of soil, water and landscape quality.

Concerning the effects of the **stand improvement** component of these programmes, it is very risky to make a projection without data on representative samples of the stands improved. Most experts on this matter say that it is relatively easy to obtain **increases around 25% in the growing stock and annual increments**.

Contribution of afforestation and reforestation to increase the production of cork, pine cones and other non wood forest goods and services

The following graphs summarize our projections about the expected effects of these programmes on the production of cork, pine cones and other non wood forest products (resin, honey, mushrooms, plants, acorns and grazing, game and informal recreation in forests).

These estimates are based on the growth and yields models used for cost-benefit analysis, presented in the chapter about this kind of evaluation.

The projections about the other non wood forest products are not in physical terms, but in aggregate value for all this set of outputs, at prices of 2001. The main basis for this projection is our estimation of the total economic value of forest production in Continental Portugal for the year 2001 presented in chapter 2 (Mendes, 2005a). A summary of the methodology followed for the projection of these outputs is presented in the chapter on efficiency analysis.

For **cork** the projections show that the programmes will contribute to raise the production harvested up to around **4,4%**. This **moderate** impact has to do with the fact that we were cautious in not assuming optimistic yields for this product. The reasons are the following:

a) as will be referred in the section on goal effectiveness, there is some empirical evidence about relatively high death rates in young cork oak stands supported by these programmes, especially PAF;

b) the cork producing regions are facing an increasing problem of rural exodus and labour shortage which is leading to abandonment of farming or to agricultural extensification.

This exodus is detrimental to cork production because labour shortages increase the costs of cork oak maintenance and cork extraction. Abandonment of farming expands the area of scrublands. These two facts contribute to raise the risk of forest fires. This was not a big issue in the past, but it is becoming a relevant threat nowadays.

The projections for **pine cones** show an enormous increase in production. This projection should be considered with the following cautionary notes:

a) it is based on average yields per tree of the same magnitude as those reported by good experts on this species (Alpuim *et al.*, 1998) which are below the ones for the regions where there has been more afforestation with stone pine and far below the yields corresponding to the "best practices";

b) this projection assumes that all the areas afforested with stone pine will be producing pine cones with yields at the levels mentioned above;

c) many of the older stands of stone pine don't have this productive orientation because, contrarily to what happened during the implementation of these programmes and afterwards, when those stands were installed the commercial interest in pine nuts was much lower;

d) because of what we have just said in b) and c), the projections of the programme effects on pine cone production are as high as is presented in the graph below.

To take care of the possibility that these projections are still optimistic in terms of future production of pine cones, in the CBA analysis we computed the internal rates of return for the

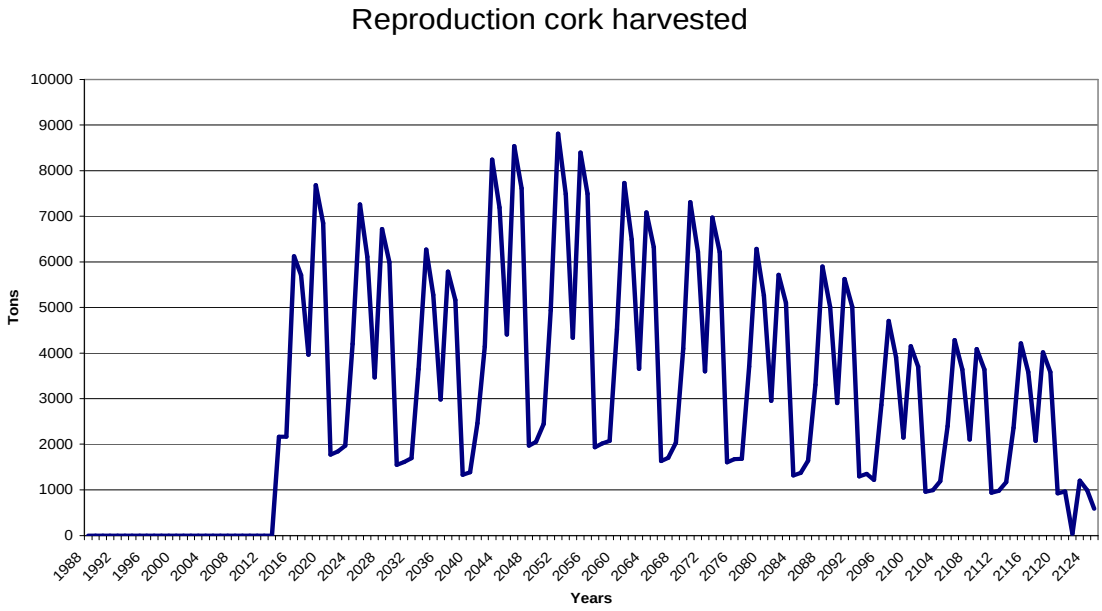
case where there were no benefits from these stands other than the production of positive externalities. The results showed that those rates did not go down to unacceptable levels of social profitability.

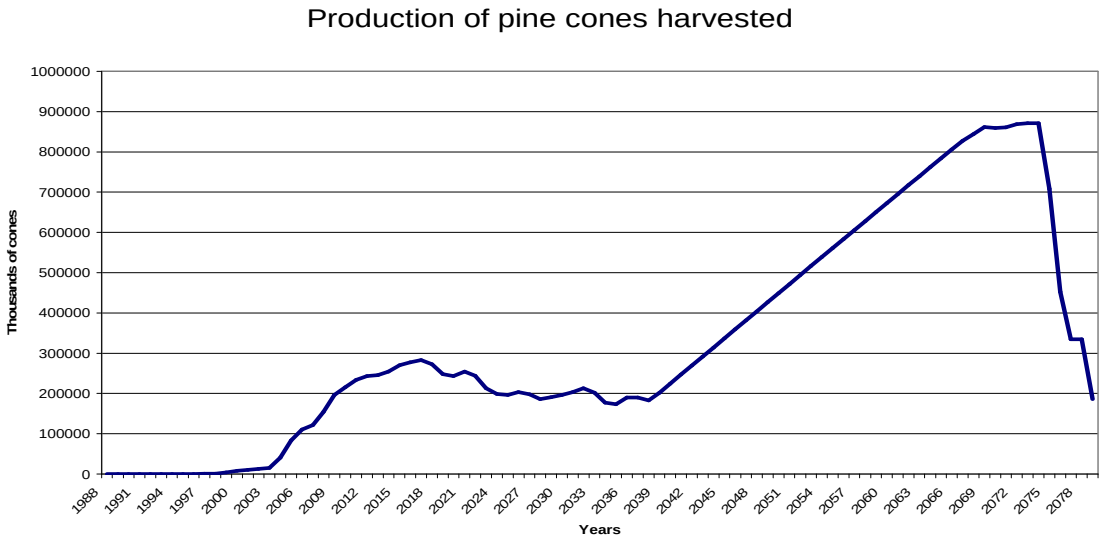
Concerning the effects on the production of other **non wood forest products**, we considered the following ones: **resin, honey, mushrooms, plants** (aromatic, medicinal and cooking), **acorns, grazing, game and informal recreation**. As can be seen in the graph representing these projection, the expected value of these products generated by the areas afforested and reforested remains above 8000000 €/year, that is **23,3 €/ha.year**, throughout most of their lifetime. This is about **25% more** than the value of these products in 2001.

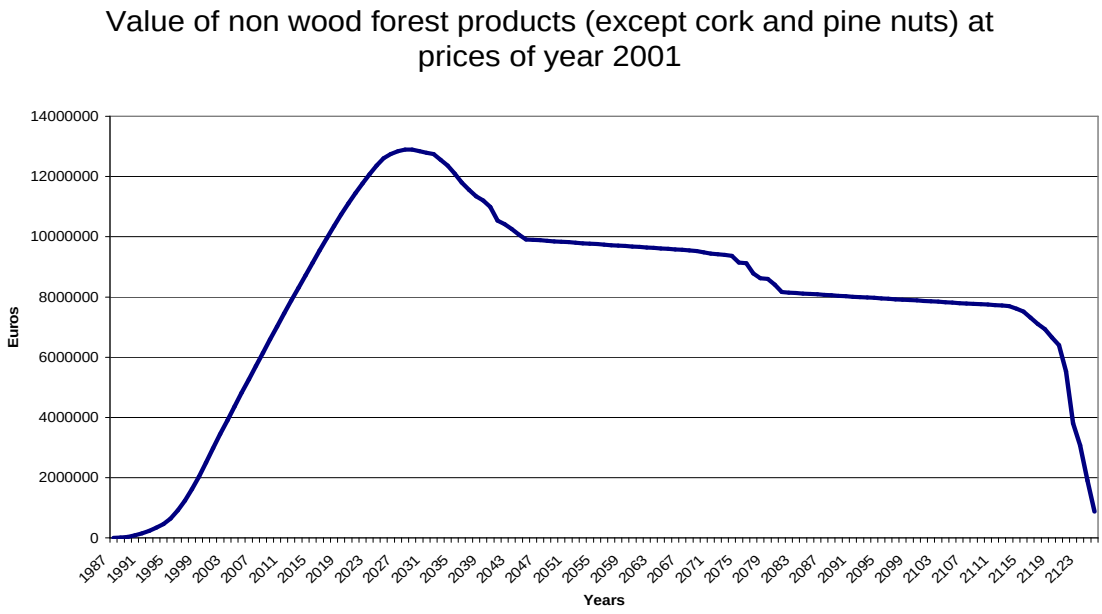
Expected effects of afforestation and reforestation programmes on the production of cork, pine nuts and other non wood forest products

Reproduction cork			Pine cones			Other NWFP		
Years	Average production (t/year)	Variation (%)	Years	Production (1000 cones)	Variation (%)	Years	Value of production (1000 €)	Variation (%)
Reference period (1979/87)	119378	----	Reference period (1980s and 90s)	70000	----	Reference period (2001)	32712	----
2016/24	4457	3.7	2016/23	254555	363.7	2016/24	11040	33.7
2043/51	5265	4.4	2068/75	842947	1204.4	2113/21	6976	21.3

Sources: the estimates for cork and pine cones are based on the forest management models used for CBA analysis







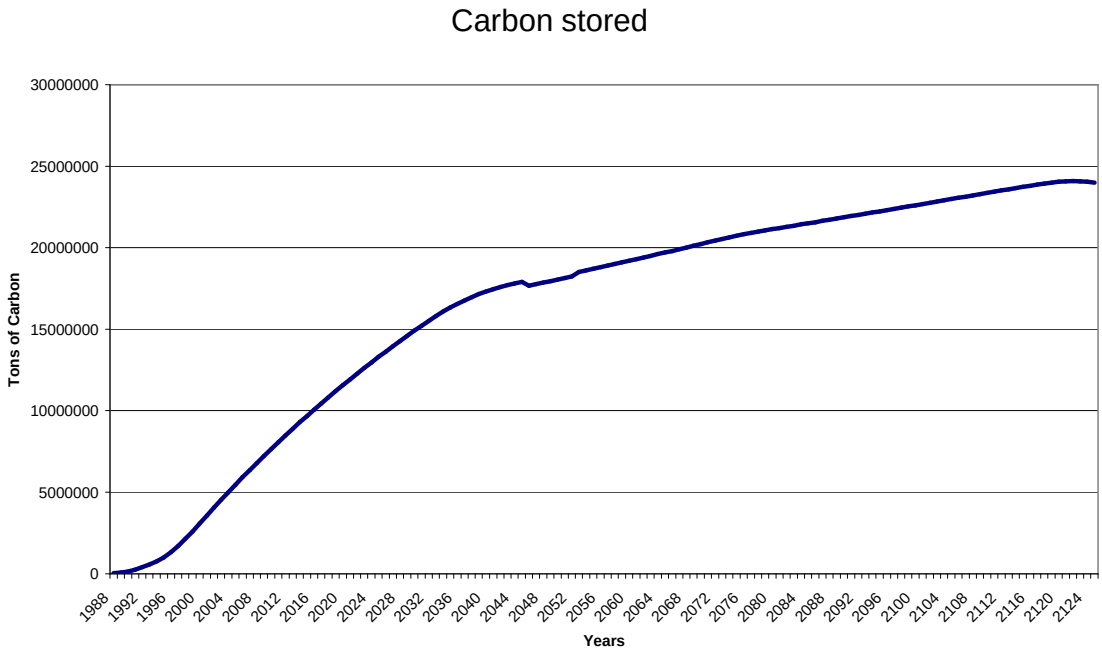
Contribution of afforestation and reforestation to increase carbon sequestration and to protect soil, water and landscape quality

The following graph shows the evolution of the carbon stored in the **new** forests generated by these programmes (afforestation and reforestation), without taking into account the effects due to stand improvement. This estimation includes the **above stump woody biomass and the stump and root biomass**. As in the previous projections, we took into account the possibility of destruction by forest fires by computing expected quantities and not risk free quantities

The projections were extended beyond the rotation periods, keeping the weighting by decreasing survival probabilities. The idea here is that after harvesting, carbon remains stored in the wood products obtained from these forests, but some of this carbon is gradually released to the atmosphere.

A summary of the methodology followed to build up these projections is presented in our chapter on efficiency analysis.

At the final year of these projections the total carbon stock generated by the afforestation and reforestation components of these programmes represents an **increase around 25%** with respect to the total stock estimated for 1995 by the FAO (UNECE/FAO, 2000).



Based on our estimation of the total economic value of forest production in Portugal for 2001 (Mendes, 2005a), we made a projection of the effects of afforestation and reforestation on the production of other positive externalities, besides carbon sequestration, such as the protection of agricultural soil and water resources and the conservation of landscape quality. This projection leads to results of the same magnitude and time profile as the ones that have been presented for the non wood forest products (except cork and pine nuts).

Effects on employment

Based on our estimations about employment in the Portuguese forest cluster presented in chapter 2, we can anticipate the possible effects of these programmes in the following way:

a) they did not and will not have a significative influence on employment in the pulpwood and pulp and paper industries because they did not support eucalyptus very much;

b) they may have some contribution to counteract the declining employment in the sawmilling industry, but that would not be enough to reverse this trend because of other more influential factors and also because some of this industry works with imported wood to supply the furniture industry;

c) employment in the furniture industry will not be substantially influenced by these programmes because its main wood suppliers are out of the country.

What remains as main segments of the Portuguese forest sector where these programmes may have a significative impact in terms of employment are the following ones:

a) providers of services and other inputs: **forest contractors, forest nurseries and forest owners' associations**;

b) **cork related activities**.

This means that we are talking about a universe involving around **32250 workers** in 1995. It is hard to say more about this than the possibility that the programmes may contribute to sustain the employment in those activities in the coming years, more precisely up to the mid of the XXIth century. However, they will not be able to achieve this alone, without the contribution of other measures counteracting the negative influences affecting the vitality of the cork oak stands, the competitiveness of the cork industries and the sustainability of the forest owners' associations.

Institutional effects: the emergence of forest owners' associations

These programmes generated a demand by the non industrial private forest owners for supply of technical advice. When the first programme (PAF) was launched the dominant strategy in the Public Administration was to respond to that demand by setting up a **public** forest extension service. There were funds allocated for that in PAF, but the implementation of this component was a **total failure**, in the sense that no public forest extension service came out of that PAF. In spite of this, not very much was done in the other two programmes to provide direct support to an alternative strategy.

However, since the demand by the forest owners was still there and they could not find direct support in these three programmes, they look for it in other public programmes not directly related to forestry. With this public support from other programmes not targeted to forestry, a growing number of **forest owners' associations** appeared since the middle of the 90s. This happened especially in the Northern and Central (Entre-Douro-e-Minho, Trás-os-Montes, Beira Litoral and Beira Interior) regions where **small scale forestry** is more salient.

In a country where 93.4% of the forest land is privately owned and forest ownership is fragmented, the emergence of this movement is probably the **major structural effect of these programmes**, even though it is an **indirect** one. The existence and sustainability of these organisations, if it is achieved in the long run, will be the main **insurance policy** against the destruction of the effects of these programmes by fire or land abandonment.

Goal effectiveness

Stated goals

The general objective of the **Forest Action Programme (PAF)** was to promote a better and more intensive use of forest stands through the following types of actions:

1) **afforestation**, especially of uncultivated land fit for forestry and marginal agricultural land;

2) **improvement of existing stands**;

3) **reforestation** of burnt forests;

4) support to **multiple use** forestry.

In the initial document of PAF formulation (MAPA-DGF, 1986) there were **fixed targets** set for these actions, as presented in the following table.

PAF: targets and outcomes (1987-97)

	Initial targets for 10 years	Outcomes (until Dec 31, 1997)
Afforestation (ha)	400 000	114 130
Improvement of existing stands (ha)	400 000	211 246

Establishment of grazing areas (ha)	100 000	0
Forest roads (km)	7 700	7 168
Fire breaks (km)	3 400	2 982
Dams and other water points	400	859
Creation of public forest extension services	X	nothing was done

Sources: MAPA-DGF (1986), MA (1992, 1993, 1994), MADRP (1995, 1996a, 1997a, 1998a), MAPA (1988, 1989, 1990, 1991)

The stated objectives of the Forest Development Plan (PDF) were the following:

a) **afforestation** of land suitable for forestry;

b) **reforestation** of burnt forests;

c) **improvement of existing stands**, namely through construction of forest infrastructures;

c) enhancement of **multiple use** forestry;

d) production of genetically improved and controlled seedlings and installation or modernization of **forest nurseries**.

The following table shows what was achieved and what was planned for some of these actions.

PDF: targets and outcomes (1994-99)

	Targets	Outcomes	Effectiveness ratios (%)
Afforestation and reforestation (ha)	55000	63370	115.2
Improvement of existing stands (ha)	165500	163969	99.1
Forest roads (km)	n.a.	5640	
Fire breaks (km)	n.a.	1980	
Dams and other water points (number)	n.a.	502	
Multiple use forestry (ha)	n.a.	12121	
Forest nurseries (number)	n.a.	25	

Sources: MADRP (2003)

Reg. 2080/92 has four objectives:

- to accompany the **changes planned in the rules of the agricultural common market organisations**;

- to contribute to a **long-term improvement** in forest resources;

- to contribute towards forms of countryside management more compatible with **environmental balance**;

-to fight against the greenhouse effect and **absorb carbon dioxide**.

We could not find an official quantification of these goals for Portugal, in the period under analysis. Official target setting in this programme was done in financial terms. There were targets set for the public funds (State budget and EU co-funding) to be allocated to this programme, but not a quantification of the desired targets for each of the four objectives of the Regulation. Based on different pieces of unpublished data we could collect on this, we constructed the following table of financial goal effectiveness ratios.

Financial effectiveness ratios of Reg. 2080/92

Year	%
1994	95
1995	99
1996	64

1997	75
1998	97
1999	99

Goal achievement, at the aggregate level, for afforestation, reforestation and forest infrastructures

The initial targets set for PAF correspond to more than double of the annual rates of afforestation accomplished during the programme that just preceded it, which had been funded by the World Bank. This **initial optimism in target setting** was partially motivated by the expectations of the project team leaders that half of the funds of PEDAP (the first package of EU structural funds addressed to Portuguese agriculture and forestry) were going to be allocated to forestry. This expectation did not become true. So those initial targets had to be revised downwards, coming closer to what could be achieved with the PEDAP funds that were actually allocated to forestry. So, with these revisions, at the aggregate and quantitative levels, **goal effectiveness was relatively good in terms of afforestation, reforestation, stand improvement and forest infrastructures**. Goal effectiveness in these components was also good for PDF and Reg. 2080/92.

Still about the initial optimism in target setting in the case of PAF, besides the false expectations about the availability of public funds, there are also other reasons worth to be mentioned.

One is that initial conditions matter, initial conditions here being the fact that the initiative and responsibility for the preparation of PAF relied entirely on foresters in high position in the Forest Services. This generation of foresters had a good enough training and experience, as far as industrial demand and silvicultural feasibility constraints are concerned, but had poor knowledge or optimistic expectations about other kinds of feasibility constraints (human resources and organisational capacities within the Forest Services to carry on implementation), as well as about individual rationality and incentive compatibility constraints. This was not a new thing in Portuguese forest policy. In previous occasions of afforestation target setting the approach followed was similar. We can easily get a grasp on the way this was done by reading the list of criteria considered to come up to the amount of land fit for afforestation as stated in the PAF preparatory document (MAPA-DGF, 1986, p. 47):

a) uncultivated land fit for forestry;

b) marginal agricultural land where farming is or will be abandoned;

c) degraded forests;

d) availability of rural labour force;

e) timber demand by forest industries.

This kind of criteria led to estimates of potential increases in forest land as those presented at the end of chapter 2. The table presented there was built upon estimates of the potential forest land developed for what initially intended to be the second phase of the World Bank. This second phase was replaced by PAF.

Among successive generations of foresters since the mid of the XIXth century when the forest land amounted to 1240000 ha and the uncultivated land amounted to 5462862 ha, there was this dream of making Portugal a "forest country". The emergence of the wood working and pulp and paper industries, especially since the 60s, added an important new factor to this orientation for afforestation. So "path dependence" and "lock in effects" as far as PAF

afforestation target setting is concerned go as far back as that mid of the XIXth century situation.

Another example of path dependence effect contributing to that optimistic target setting is the fact that there was very little participation in the programme formulation by relevant stakeholders. So the preparation team was not well aware of some relevant feasibility, individual rationality and incentive compatibility constraints. It was like this during the dictatorship times and it remained in the same way at least until PAF was prepared and even later on. Here again an example of path dependence.

Since there has not been before a programme of public financial incentives for private forest owners as attractive as PAF, the initial number of applications was relatively high compared to the amount of funds that finally became available and the capacity of the Forest Services to review and monitor the applications. This led to a decision of the Secretary of State in charge of PAF taken on July 14, 1989, to stop the acceptance of new applications for grants. For the rest of the programme the applications processed were chosen among those that had already been presented up to that time. According to the opinion of some the foresters who were involved in the review and approval of the applications at that time, this was a fatal blow to the motivation of many forest owners for participating in this programme and even in future programmes because they lost trust in the Public Administration. It was also a fatal blow to some private contractors who had invested in machinery based on optimistic expectations about the flow of application approvals. Being under financial stress was not a good thing for having them to carry on the afforestation works in a technological and economical efficient way.

Survival rates at the forest management unit level

If, at the aggregate level, there were enough (or more than enough) demand to exhaust the supply of public incentives that were made available, this does not mean that, at the forest management unit level, afforestation, reforestation, stand improvement and forest infrastructures were always implemented in a technological and economical efficient way. In the chapter on implementation analysis we refer some of these failures which we will not repeat here.

We lack a good survey of a representative set of projects supported by these programmes providing longitudinal data about their life course and survival rates. A first step in this direction is the study done for the region of Algarve by Louro (1999) which arrived at the survival rates presented in the following table, referring to the final years of the decade covered by the EFFE project.

Survival rates of the stands supported by PAF, PDF and Reg. 2080/92 (number of live plants/total number of plants installed in %)

Programmes	Species	Average survival rate	Standard deviation
PAF	Maritime pine	78	28
	Stone pine	54	34
	Eucalyptus	83	11
	Cork oak	31	26
	Holm oak	10	12
PDF	Maritime pine	76	11
	Stone pine	53	27
	Cork oak	75	29
	Holm oak	45	16
Reg. 2080/92	Maritime pine	72	17
	Stone pine	74	20

	Cork oak	57	27
	Holm oak	51	22

Source: Louro (1999)

These results help to understand why resorting to maritime pine was often a risk avoiding strategy to cope with uncertainties and lack of sufficient knowledge about the possibilities of survival of the other species.

These results also may leave us to think that from PAF to the subsequent programmes (PDF, Reg 2080/92) there might have been some relative quick technological learning process resulting in higher survival rates of the plantations in these last two programmes, even if we take into account that the stands surveyed for PDF and Reg 2080/92 were obvious younger than the stands surveyed for PAF.

However, for Reg. 2080/92, according to the evaluation report prepared by IFD (2001, p.80), *"the exceptionally dry conditions in 1995 led to many trees dying, of the order of 70%. Special measures had to be taken to replant many plots. In the first few years of the programme in particular, failures can also be attributed to the beneficiaries having a lack of information, to a lack of nurseries and specialised enterprises and to inadequate quality control. Subsequently the success rates were more satisfactory, being between 70 and 80% before replacing dead plants under difficult climatological conditions, and 90% in more favourable areas."*

Diversification of the tree species composition

In these programmes there was a purpose of promoting the diversification of the tree species composition of Portuguese forests, reducing the emphasis on the two major wood producing species (maritime pine and eucalyptus) existing in the country.

This goal was seen as a mean to achieve other goals, namely the following ones:

a) increase the supply of long rotation hardwoods to the domestic furniture industry;

b) reduce the risk of forest fires, as long rotation broadleaves are less vulnerable to this risk than maritime pine and eucalyptus forests;

c) improve landscape quality;

d) promote multiple use forestry.

If we compare the distributions by species of the areas afforested and reforested with the support of these programmes with the tree species composition of the Portuguese forest at the beginning of the 80s, just before PAF was launched, we come to the conclusion that they all contributed positively to this goal. The following table presents data on this distribution, including the programme funded by the World which just preceded PAF (PFP/WB).

Tree species composition of the Portuguese forests before and with the afforestation and reforestation supported by PAF, PDF and Reg. 2080/92

		Maritime pine	Eucalyptus	Cork oak	Other species	TOTAL
Forest Inventory (1980-85)	ha	1252300	385800	664000	806100	3108200
	%	40.3	12.4	21.4	25.9	100.0
PFP/WB	ha	65083	37929	1809	27087	131908
	%	49.9	28.8	1.4	20.5	100.0
PAF	ha	47267	10375	22350	34138	114130
	%	41.4	9.1	19.6	29.9	100.0
PDF	ha	32465	4733	9127	17445	63770
	%	50.9	7.4	14.3	27.4	100.0
Reg. 2080/92	ha	5797	286	70902	88124	165109

	%	3.5	0.2	42.9	53.4	100.0
PAF+PDF+	ha	85529	15394	102379	139707	343009
Reg 2080/92	%	24.9	4.5	29.8	40.7	100.0

Sources:
a) Forest Inventory: data collected from DGF
a) PFP: data collected from DGF
b) PAF, PDF and Reg. 2080/92: data collected directly or estimated from MA (1992, 1993, 1994), MADRP (1995, 1996a, 1996b, 1997a, 1997b, 1998a, 1998b, 1999a, 2000a, 2003), MAPA (1988, 1989, 1990, 1991) and IFADAP (2001, and unpublished data)

PAF – area of afforestation and reforestation by species (ha)

Year/Species	Maritime pine	Eucalyptus	Cork oak	Stone pine	Chestnut	Other conifers	Other broadleaves	Total
1987/88	14106	1904	2524	274	1006	59	657	20530
1989	9195	2768	3570	783	653	60	381	17410
1990	5619	3713	3327	658	1088	5486	1001	20892
1991	5534,5	1574,3	2308,8	319,4	359,7	4285,9	936,8	15319,4
1992	5571,9	397,1	4478,4	282,8	576,5	4615,6	983,5	16905,8
1993	2575,7	19	3993,2	264,6	486,8	2912,2	1061,4	11312,9
1994	2924,6	0	1031	72,8	201,4	1373,4	450,8	6054
1995	1410,6	0	1075,7	35,5	253,2	2057,4	309	5141,4
1996	330	0	42	0	119	49	24,3	564,3
Total	47267,3	10375,4	22350,1	2690,1	4743,6	20898,5	5804,8	114129,8

Sources: data collected directly or estimated from MA (1992, 1993, 1993, 1994), MADRP (1995, 1996a, 1997a, 1998a), MAPA (1988, 1989, 1990, 1991)

PDF – area of afforestation and reforestation by species (ha)

Year/Species	Maritime pine	Eucalyptus	Cork oak	Holm Oak	Stone pine	Chestnut	Other conifers	Other broadleaves	Total
1994	3391,99	389,95	2246,78	112,47	1112,82	42,5	447,11	421,11	8164,73
1995	14985,45	227,26	2964,67	324,93	1290,74	766,64	1398,74	2131,43	24089,86
1996	2427,66	5,13	808,47	14,55	285,34	132,64	449,12	367,68	4490,59
1997	5080,05	68,79	1345,72	171,46	795,24	451,26	739,73	849,14	9501,39
1998	4720,06	750	1108,65	133,95	818,4	299,54	1258,75	739,76	9829,11
1999	1859,85	3292,01	652,7	575,2	586,24	45,37	391,66	291,4	7694,43
Total	32465,06	4733,14	9126,99	1332,56	4888,78	1737,95	4685,11	4800,52	63770,11

Sources: data collected directly or estimated from MADRP (1996b, 1997b, 1998b, 1999a, 2000a, 2003)

Reg. 2080/92 – area of afforestation and reforestation by species (ha)

Year/Species	Maritime pine	Eucalyptus	Cork oak	Holm Oak	Stone pine	Chestnut	Other conifers	Other broadleaves	Total
1994	676,1	20,4	8763	3073,1	4642,1	1133,4	130,4	2056,1	20494,6
1995	1470,7	147,2	16647	7407,8	7585,2	2233,8	630,6	4932,5	41054,8
1996	582,1	53,8	7685,1	3421,1	3715,6	1125,5	443,6	2865,6	19892,4
1997	1122,2	12,1	12375,6	5896,5	6093,2	1354,9	701	3658,2	31213,7
1998	759,7	23,2	13003	3873,8	4246,4	1059,1	703,3	2736,4	26404,9
1999	1186,36	29,47	12427,92	1523,68	5787,76	1139,12	1241,47	2713,13	26048,91
Total	5797,16	286,17	70901,62	25195,98	32070,26	8045,82	3850,37	18961,93	165109,31

Sources: unpublished data collected directly from IFADAP referring to approved applications for grants

Compared to the period just before PAF was launched, the data presented clearly shows very big changes in the tree species composition benefited by public support to forestry:

- support to eucalyptus plantations which was still present in the first phase of PAF, was reduced to very low levels after that;

- there was also a big drop in publicly supported afforestation with maritime pine, but not as big as what happened with eucalyptus;

- the gainers are cork oak and the other species (stone pine and broadleaves).

This is a wide swing in forest policy, during a relatively short period of time. It may not endure in the future if EU financial support, namely from Reg 2080/92, is reduced. Increase in support to cork oak has benefited from the fact that cork oak stands are agro-forestry systems which fit in the goals covered by this regulation. Decrease in support to maritime pine is due, in part, to the decline of the intervention of Forest Services in the management of communal forests, mainly located in Northern and Central Portugal.

Underlying this wide swing in forest policy orientations are not only the goals behind the push for diversification in the tree species composition we mentioned before, but also the assumption that eucalyptus plantations have positive private profitability, at acceptable levels for private stakeholders, whereas cork oak and long rotation hardwoods don't.

Multiple use forestry

Together with the goal of diversification in the tree species composition of forests, there was also the goal of enhancing multiple use forestry, which meant to promote the production of non wood forest products and services. In the overall outcomes of these programmes, this remained a relatively minor component, even though its existence was a change compared to the programme existing before PAF where timber oriented afforestation was the overwhelming goal.

Public provision of extension services to private forest owners

In PAF, like in the preceding programme funded by the World Bank, one of the goals was to set up a **public** forest extension service. In both programmes the implementation of this component was a **total failure**, since none was done in this area. If this implementation failure had a virtue, it was to make clear the inability of the Forest Services to become the main **direct** provider of technical assistance to private forest owners. In a country where 93.4% of the forest land is owned by private people, this should have been a very big issue in forest policy for a long time. The fact is that, also for a long time, the major orientation in forest policy was either not to put due emphasis on this question, or to live on the illusion that the Public Administration could become the main direct supplier of this kind of services.

These implementation failures did a lot to burry this illusion, but it did not die completely, since it still comes back frequently and in various forms. In spite of these come backs, the situation evolved as follows:

a) forest owners' associations finally emerged in the Portuguese forest sector, which was an **indirect effect** of these programmes, since neither in PDF, nor in Reg. 2080/92 there was explicit and direct support for this kind of organisations;

b) these organisations became, since then, the main direct provider of technical assistance to private forest owners;

c) the main role of the Public Administration in this matter has been to provide financial support to those organisations, even though, during the period under analysis this support was not given by the programmes of financial incentives to forestry;

d) at the initial stage of their lives and still at the current stage of their development, forest owners' associations are very much dependent on public support, but the good ones are making progress towards less reliance on public funds.

Behavioural effectiveness

Substitution and complementarity effects between public and private funds

At this stage of our research we don't have appropriate data to do empirical studies about the effects of these programmes on the microeconomic behaviours of forest owners. Concerning the issue of substitution of public funds for private funds in forest owners' investment, what we can state, without that kind of study available, are just some tentative hypotheses. One is that this kind of substitution effect may not have been very important for the following reasons:

a) private investment in forestry tends to focus more on eucalyptus plantations which were left out of these programmes since the end of the first phase of PAF;

b) eucalyptus plantations continued to expand after they were dropped out from public support.

So more than a substitution effect, what probably happen with these programmes was a complementarity, or a triggering effect concerning the investment in the other species, especially cork oak. Without the availability of these public incentives, this investment probably would not have happened. We base this hypothesis on the observation of the trends in the areas of these species in the Portuguese forests. In fact, the area of cork oak was stagnating before these programmes started, but this trend was reversed after PAF was launched.

These programmes also seem to have contributed to maintain the recovery of the area of other broadleaves.

Forest owners' associations, forest contractors and other forest services providers

We can consider as behavioural effects of these programmes their indirect impact on the development of the forest owners' associations and forest contractors which we already mentioned in previous sections of this report.

Supporting and impeding factors of private forest owners' application for public incentives

The kind of microdata we could get a hold on with some relevance for investigating private forest owners behaviours with respect to these programmes was about some of the characteristics of the members of the largest forest owners' association in Portugal (in number of members), and about whether or not they applied for these programmes and which kind of project they carried on in case they obtained financial aid. With this kind of data we estimated a series of **multinomial logit models** (Mendes, 1999c; Tavares, 2004) to investigate how some of the forest owners' characteristics about which we could have data influenced their probability of applying or not for the following types of projects supported by these programmes:

a) individual afforestation projects only;

b) grouped afforestation projects only;

c) individual and grouped afforestation projects.

From these models we concluded that individual characteristics of the forest owners, in particular the **size** of their forest lands and the **proximity** to their forest holdings, proved to be statistically significant variables to predict their probability to implement afforestation projects. Concerning the size effect, we concluded grouped projects are more like to be carried out by small owners, than by larger owners.

Concerning the distance effect, we concluded that proximity of residence to the forest holdings increases the probability of the forest owner to apply for financial incentives to an individual or a grouped project.

Another interesting result concerning distance effects is that the more a forest owner lives away from his forest the less he is likely to join in grouped projects. This means that **local community ties** play a positive role in get grouped projects going.

Finally one more result of this work worth to be mentioned is the relation between the fact that a forest owner invest in his forest with the support of these programmes and his level of **commitment to the forest owners' association**. A proxy for this commitment was whether or not he pays all his membership fees and in due time. The results here show a positive correlation between this level of commitment and investing in forestry.

Conclusions

The data collected shows that there seems to have been enough demand by forest owners to exhaust the supply of public incentives made available by these for afforestation and reforestation. So there was **relatively good goal effectiveness in terms of afforestation and reforestation, at the aggregate level**. Also, at the aggregate level, there seems to have been **relatively good goal effectiveness in terms of diversification of the tree species composition**.

Where there has been probably some effectiveness problems is when we get down to the forest management unit level and look at the survival rates of the plantations already during their early ages and in the longer run. Contingent on studies that are needed based on representative samples of these plantations, there is some evidence showing that **survival rates might have been relatively low** for some species (cork oak), at least, in the initial waves of projects. There is also some evidence that foresters and forest contractors involved in this process went through a **quick learning process** which may have contributed to attenuate this problem.

Also, during the course of these programmes, **there does not seem to have been enough complementary efforts in improving the efficiency of the fire prevention and extinction system** which was needed to protect these and the other forests from the risk of burning.

In the longer run, the major factor which will contribute to sustain the effects of these programmes in terms of expansion and improvement of the Portuguese forest is the ability of the non industrial private forest owners to become **actively engaged** in the necessary activities for a sustainable management of their forests. The outcome initially desired by the public authorities in terms of the technical support to private forest owners needed to achieve this goal which consisted in the **public** provision of extension services was a total failure. An **indirect** effect of these programmes showed an alternative and more effective way to handle this issue. That was the creation of **forest owners' associations** which emerged in growing numbers since the mid of the 90s, benefiting from public support from other programmes. Even though it is an indirect effect, this is probably **the major structural change brought about by these programmes** in a country where 93.4% of the forest land is privately owned and forest

ownership is very fragmented, but where, until then, private forest owners were totally lacking the necessary collective organisation to carry on proper sustainable forest management.

Implementation analysis[27]

Feasibility constraints

Natural resource constraints

The relatively high rate of non forest land unfit for farming contributed for **afforestation** and **reforestation** programmes to be predominant relatively to programmes for the **protection** and **conservation** of forest resources.

Protection against the risk of **forest fires** should have been a high priority in Portuguese forest policy since mid 60s when the rural exodus was on the rise, but this did not happen. The result was that the area of forest burnt during the course of PAF; PDF and Reg. 2080/92, that is, from 1987 to 1999 was almost equal to the double of the area afforested and reforested with the support of those programmes. Some of this area burnt included plantations supported by those programmes.

Budget constraints

In a country where private forestry is very important and where there was not a long tradition of public policies targeting this kind of stakeholders, accession to the EU structural funds contributed to raise public and private investment in private forestry.

During the course of the programmes evaluated here, this **triggering effect** of foreign funds did not bring about efforts to build up sustainable sources of **national** funds to complement or substitute for those EU contributions.

In 1996 there was a new forest policy law which included an article determining the creation of a **Forest Fund** based on national financial resources, but the beginning of the implementation of this mechanism was triggered only by the big forest fires of 2003 (Mendes, 2004d, 2004e).

Human resources and institutional constraints

Concerning human resources and institutional capacities, some examples of impeding factors of a successful implementation of forest programmes for private forestry in Portugal are the following (Mendes, 2004d):

- **centralisation** in the public administration;

- weak public **participatory mechanisms** in policy making and implementation;

- long tradition of the Forest Services to focus their action on the management of **public and communal forests;**

- insufficient **collective organisation** of private forest owners;

- heavy emphasis of **forest education** on silviculture and other technological matters and insufficient training in socio-economics, forest extension and forest policy.

[27] Part of these results were presented in the paper by Mendes (2004d).

Since support to private forestry was not a priority of the Forest Services for a very long time, their structure was not prepared for a quick switch towards an incentive regulatory posture, as happened when PAF was launched. To complicate things further this agency kept its centralised nature which is another example of a path dependence phenomenon. So the tasks of reviewing and deciding about the all the applications were concentrated in a very small group of foresters, working in the headquarters, in Lisbon, chosen from the also small number of those who had some previous experience in dealing with private forestry. They worked very hard and did the best they could, but the task was huge. They had almost no possibilities to go on the field and interact with the applicants. Monitoring after approval was left to the personnel on the field, but here also the human resources were not enough for doing a good job.

Things got worse when the Forest Services gradually lost their competencies in the review, approval and monitoring of the applications for grants to the benefit of IFADAP, the public institute in charge of the financial management of the EU structural funds for agriculture, forestry and fisheries. From a simple paying agency of the grant applications approved by the Forest Services, IFADAP gained the rights of review, approval and monitoring. IFADAP was less prepared than the Forest Services for these tasks. Also, for some time, there was some tension and lack of coordination between the two agencies with detrimental effects for implementation.

One detrimental result of these organisational problems was the delay in reviewing and approving the applications and in paying the corresponding grants. These delays had the following consequences:

- they did not favour the motivation of forest owners to continue or to join in the programme;

-they put under severe financial stress the forest contractors who were very much dependent on the reception of the grants by the forest owners to get paid for their services, inducing them to raise the prices of afforestation works.

It is probably the awareness of these problems together with those mentioned in the previous section that was behind the decision taken on July 14, 1989, by the Secretary of State in charge of the Forest Services, after advice by the Director General of Forests, to stop the process of accepting new applications for grants. In fact, this is what we can conclude from reading a public speech of this Director General made on that occasion (Soares, 1989). For the rest of the programme the applications processed were chosen among those that had already been presented up to that time. According to the opinion of some the foresters who were involved in the review and approval of the applications at that time, this was a fatal blow to the motivation of many forest owners for participating in this programme and even in future programmes because they lost trust in the Public Administration. It was also a fatal blow to some private contractors who had invested in machinery based on optimistic expectations about the flow of application approvals. Being under financial stress was not a good thing for having them to carry on the afforestation works in a technically and economically efficient way. For the Director General of Forests who proposed that stop in the acceptance of new applications these criticisms came from some foresters in the Forest Services who were making extra money in preparing applications for private forest owners (Correia, 1990).

Knowledge constraints

Since research about the technical and economical aspects of the measures supported by the forest programmes (e.g. species more appropriate for each site to be afforested, methods for

conducting afforestation works, etc.) was insufficient and **not well tested at the local level,** or when this knowledge was available, it was **not well disseminated** among forest owners and forest contractors, this knowledge gap contributed to lowering the survival rates of the (re)afforestation and forest conservation projects. This situation was more frequent during the initial period of PAF. It became less frequent afterwards because of the **learning process** which was happening as the implementation of the programmes was moving forward.

In the initial formulation of PAF the aggregate targets for the areas of afforestation and stand improvement were broken down by regions and by species. One aim of this disaggregated target setting was to decrease the focus of the previous World Bank programme on pine and eucalyptus and expand the area of hardwood broadleaves. The targets by regions and by species were based on a kind of knowledge unable to catch the variations in natural conditions at the local level conditioning the viability of each species. The results of this situation were some implementation failures to which we will turn now. One was the low survival rate of many plantations carried out according to the programme guidelines at the macro level, but not adapted to the local conditions. Aware of this possible outcome, what many forest contractors did was to go for a less riskier option which was to plant maritime pine, a species with higher survival rates (Baptista, 1994; Louro, 1999). So the outcome was to get closer to the programme targets in terms of total area afforested, but with more of pine than initially planned. The bad side of this situation, aggravated by the lack of complementary collective organisation of individual owners to carry on the maintenance of the plantations in the future was that, in some areas, the programme may have contributed to an increased risk of forest fires. So nowadays some of these plantations are gone.

For Reg. 2080/92, according to the evaluation report prepared by IFD (2001, pp.81, 82 and 129), *"A great need for* ***experimentation and advice*** *on techniques has been expressed. In Portugal, the specific needs of the plantations on agricultural land are little known, particularly concerning how stands of valuable broadleaves, which had not been planted much before, should be managed (Quercus sativa, Prunus lusitanica, Juglans sp., Fraxinus sp.)."*

Also *"deficiencies have been observed in the level of awareness and training of the beneficiaries. Other characteristic is the absence of or only a minor forestry tradition among the farmers who planted forests with 2080. ...it was found that:*

- There was no link between the existing training system and the objectives of the regulation; the beneficiaries had had a very inadequate training, or even none at all, and in all cases not a very suitable one ;

- The fact that the training instruments used were mainly agricultural, and so far had little competence in forestry."

Complementarity between financial incentives and forest plant provision

An afforestation and reforestation programme of the size initially planned for PAF required the availability of forest nurseries capable of supplying plants in the needed quantities and qualities. The situation at the beginning of the implementation was that almost all the existing nurseries were the ones owned by the Forest Services. They did not have neither the capacity, nor the entrepreneurial dynamics for supplying private forest owners as needed. They had been set up to supply the Forest Services for the afforestation they did in the communal lands until the 70s, but they did not go much beyond those needs.

With the start of PAF private entrepreneurs jumped in this business as well as importers of forest plants, but this was often done at the price of low quality of the material planted. So part of the low survival rates of some plantations come from here.

This lack of complementarity was less severe in the programmes which came after PAF, but still existed, as is mentioned in the evaluation report prepared by IDF for Reg. 2080/92 (IDF, 2001, pp.82, 88): *"Inadequate supervision in the nurseries has been mentioned in Portugal. It is probable that this problem has been under-estimated due to a lack of information. The uncertainties regarding origin are particularly prevalent in species which have so far been little used for afforestation but which are very interesting from the point of biodiversity as well as in the context of the diversification of activities (species producing fruits, etc.).*

... The heavy and sudden demand for plant material, combined with the under-production of nursery plants, had created a local dearth of material. To remedy this, plants have been imported from within or outside the European Union, where the prices were lower. Batches of plants from countries in eastern Europe (Hungary in particular for broadleaved varieties) crossed the Netherlands, Germany or France on their way to the south, without any guarantee of their quality."

Political factors

Since the degree of coordination and political strength of public and private stakeholders interested in forest policy was weak, this did not favour the position of forest policy in the ranking of public policy priorities. That also did not favour the necessary **intersectoral coordination** with other relevant policies (Mendes, 2004a, 2004c). One of the areas where this coordination was badly needed, but failed, was in the area of prevention, detection and extinction of forest fires: financial incentives to forestry depended on the Ministry of Agriculture and forest fires extinction depended on the Ministry of Internal Affairs.

Modes of matching targets to instruments

As forest programmes tended to give more room in their targets for the **provision of forest public goods and other positive externalities**, as was the case with PAF, PDF and Reg. 2080/92 compared to previous programmes, the mix of policy instruments and the institutional capacities which were needed to implement them were not yet rich enough to attain this kind of targets in a sustainable way, for the long run. Certainly, the generous public financial support these programmes provided to private forest owners can be seen as a way to pay them for those environmental services. The problem here is that these payments relied too much on **external** sources of funds (EU structural funds) and not on **new institutional arrangements** between forest owners and the rest of the Portuguese society for the internalization of those externalities.

The Forest Fund announced by the Forest Policy Law of 1996 could have been a step in this direction, but its implementation did not start during the course of these programmes.

A particular problem in this area is that there is often a tendency in Portuguese forest policy to rely more on **command and control** instruments, than on **economic instruments** adapted to private forestry, including here **market oriented** instruments and **incentive based voluntary mechanisms** richer than simple public grant provision (Mendes, 2004a, 2004c). The problem with the command and control approach is that it tends to impose new duties, or to increase existing duties impending on private forest owners, without caring enough about the appropriate compensations to provide to private owners.

Complementarities between instruments

As mentioned before, the degree of **intersectoral coordination** between forest policy and other relevant polices was very weak (Mendes, 2004a, 2004c). This situation was an impeding factor of a successful implementation of forest programmes for several reasons:

there were situations where beneficiaries had to face **conflicting regulations** in the implementation of their projects funded by those programmes;

intersectoral coordination was also needed for implementation success, in what concerns the goals of enhancing **multiple use** forestry and increase the provision of forest public goods;

finally, as was already mentioned before, the area where intersectoral coordination was more badly needed was in improving the efficiency of the forest prevention, detection and extinction system.

Another type of complementarity which could also have been very important for the success of programmes, such as these ones, targeting private forestry, in a country where this private forest ownership is very fragmented, is the linkage between financial incentives and support for technical assistance (through public or associative organisations) to private forest owners who are willing to apply for these programmes. When there are no public forest extension services and forest owners associations are barely starting, the provision of those services relies mostly on private providers. For smaller forest owners this was probably a barrier to entry in these programmes, the result being a **distributional effect**: forest owners with larger holdings tend to capture relatively more public financial support than forest owners with smaller holdings.

Individual rationality constraints

Diversity of forest owners' characteristics and motives

Even within a small region, private forest owners are of **different types** and have **different forest holding motives**. The research on this topic is just starting in Portugal, so that knowledge about this reality was not part of the design of these programmes.

Because of that diversity in forest owners' characteristics and motives, **opportunity and transaction costs** for participating in public programmes are also diverse among private forest owners. A weak knowledge about these costs and their variability contributes to implementation failures.

One way to improve knowledge about the relevant characteristics and motives of private forest owners and to incorporate that knowledge in policy making and implementation could have been through active and qualified **participation** of forest owners' associations in the policy process. When this participation exists individual rationality problems tend to be weaker. The forest owners and their organisations feel more involved in policy making, public policies can respond better to their needs and are more easily revised when it is needed. The problem in Portugal is that the organized channels for participation were weak during the course of these programmes and did not work on a regular and active basis (Mendes, 2004a, 2004c).

Private and social profitability

With the exception of plantations based on fast growing species (eucalyptus), and the purchase and conservation of forests for amenity self-consumption by some forest owners, it is difficult to raise private investment in Portuguese forestry, not only for conservation purposes, but also for production purposes, without the support of public financial incentives. This is due to the fact that forest projects have negative cash flows for many years until turning to positive

net benefits which is a barrier to entry for many private owners. This situation is aggravated by the risk of forest fire. This risk was high and increasing during the course of the programmes we evaluated.

Since the kind of afforestation and reforestation supported by those programmes seems to be socially profitable, according to our CBA analysis, this kind of public intervention may be justified in order to help forest owners overcoming the barriers mentioned above.

The changes in the financial incentives brought about by PAF, and the other two programmes compared to the ones provided by World Bank programme and by previous programmes brought them to levels where it became individually rational to many private forest owners to participate in the programme. The individual rationality constraint for private forest owners was brought even lower by the type of informal contractual arrangements established between most of the forest contractors and the forest owners they worked for: the contractor waited for the payment of their services until the forest owner received the grant. This means that forest contractors were providing zero interest credit to the forest owners.

In these conditions, and given the fact that there had never been an incentive scheme to private forestry as favourable as this, the initial number of applications for grants was relatively high. However, these incentives, by themselves, were not enough to bring in even more forest owners, especially those with smaller holdings because applying for grants involved transaction costs which remained high for most of them. We turn to this issue next.

Participation of private forest owners in forest programmes providing financial incentives involves **opportunity costs** for them (e.g. costs related to alternative land uses such as construction, for example, alternative uses of the forest owners' capital and time, etc.). Even when financial incentives are generous, these opportunity costs may be high enough to motivate forest owners to stay out of the programme.

Besides opportunity costs, there are also transaction costs when a forest owner applies for these public incentives. He has to prepare an application, spend time and money in looking for technical assistance and in dealing with the public bureaucracy managing the programme. Because of this, the implementation of these programmes could have been more successful if they had lowered this kind of costs and provided active support to **forest owners' associations** or other organisations able to assist forest owners in their applications.

Even though, the programmes evaluated here did not provide direct support for these organisations, they triggered their birth and development.

Financial incentives and fiscal instruments

During the course of these programmes, there was no major attempt to coordinate financial incentives with fiscal instruments in order to improve forest management.

Forest financial incentives and integrated rural development

Another area of very weak integration of public polices during the course of these programmes relates to forest policy and rural development policy. One bad outcome of this situation was the fact that risk of forest fires tended to increase in areas where rural exodus was worse, so that some of the new plantations and stands improved with support of these programmes were destroyed by fire.

Incentive compatibility constraints

Weaknesses in monitoring capacities

Asymmetric information problems (moral hazard, adverse selection) are more severe when forest programmes address a large population of private forest owners who are dispersed and not well known by the public agencies in charge of programme implementation, as it is the case of Portugal. There are signs that the monitoring capacities of the public agencies in charge of these programmes were not as strong as they should have been. There were cases of **overbudgeting**, or of projects approved for areas larger than the actual ones. However, there is no basis to say that there were widespread problems of this nature.

For Reg. 2080/92, according to the evaluation report prepared by IFD (2001, p. 127), *"The cumbersome administrative and financial aspects of the procedure and in particular the slow payment of the aid (which, it would appear, can cause delays of one to two whole years) is condemned; and it would appear that the change in the payment procedure of 2080 - caused by transferring the charges from the EAGGF Guidance Section to the EAGGF Guarantee Section, is partly the cause of these problems.*

It is a general phenomenon common apparently to most of the countries, which would appear to be linked to the superposition of several levels of administrative authority between the State and the regions (which causes endless toings and froings of validations and authorisations) ; and also to the fact that 2080 is of less importance than other agricultural measures and that it is rarely treated as a priority when processing dossiers.

In Italy, Spain and Portugal, authorities which were unable to carry out regular checks at the beginning of the programme have only been carrying out checks during the last two years. These checks have sometimes given rise to certain beneficiaries being asked to reimburse the aid (as the plantations had failed due to lack of maintenance or because the species planted were not suitable or were not those indicated on the aid application).

The fact of passing from no controls to a sometimes rigorous control has created a feeling of lack of understanding which has made beneficiaries hesitate before planting any future plantations."

Still concerning monitoring, there are **very insufficient data collection networks** and no good and comprehensive data sets publicly available concerning the actual implementation of these programmes. The data gaps mentioned in this report are an example of this kind of problem.

Policy evaluation and policy research capacities

Since monitoring capacities were not strong, policy evaluation and policy research capacities were also weak.

Incentives for (re)planting vs. incentives for maintenance

When the financial incentives for afforestation and reforestation support the costs of planting, but not the costs of maintaining the plantations, at least, during their initial years of life, it often happens that they are not appropriately managed by the forest owners. This was a problem with PAF, but not with PDF and Reg. 2080/92.

Incentive compatibility problems within the Public Administration

One kind of incentive compatibility problem within the Public Administration concerns infrastructures supported by these programmes. Some of them were promoted by

municipalities more interested in the political visibility of these projects, than on their actual contribution to improved forest management.

Incentive compatibility problems within the private sector

In the implementation of PAF we can find several examples of failures to meet complementarity constraints which led to failures to meet incentive compatibility constraints. One example concerns the complementarity between financial incentives to private forestry and capacity building, more precisely, collective organisation of private forest owners for the provision of extension services and other inputs for forest development. In Portugal the predominance of private forestry is overwhelming (93,4% of the forest land) and forest ownership is often fragmented, especially in the Northern and Southern regions. When PAF was formulated and implemented collective organisation of private forest owners was almost inexistent. During the dictatorship times this kind of organisations was not well regarded and was even stopped by the Government. Also during that period the Forest Services had, most of the time, an attitude of either no interest or no capacity to support private forestry, or an attitude of direct interventionism. With the coming of democracy things started to change and in the World Bank programme of the first half of the 80s there were funds available for the Forest Services to support the start up of forest owners' associations and public forest extension services. These components of the programme were a total implementation failure. With PAF return the purpose of setting up forest extension services under the responsibility of the Forest Services. Again the result was a total implementation failure. According to the Director General of Forests of that time, the reason for failure was a feasibility constraint of "administrative and bureaucratic" nature (Soares, 1989). What this probably means is that there were legal restrictions for hiring new personnel in the Public Administration, since the macroeconomic policy was becoming restrictive to meet the criteria for joining the Monetary and Economic Union.

Let us now see what were some of the consequences of this failure in promoting forest owners' associations.

1) Owners of small holdings tended to be excluded from the programme even if they were willing to apply because they were not able to find the services of professional foresters to do the necessary technical work for preparing the applications. Private firms of foresters supplying this kind of services tended to take large projects.

2) Situations where owners of small holdings were brought in the programme happened in places where private firms of foresters were active in promoting grouped projects, such as in the Northern region of Trás-os-Montes which has a new university with a forestry department from where came out some young foresters who started up their own private business (Baptista, 1994). This is again another example of a path dependence phenomenon. As we mentioned before, this kind of grouped projects were eligible for the highest rates of subsidisation. The intention of the policy makers here was to promote land consolidation and effective grouped management of the afforested lands under some form of collective organisation of the forest owners. What actually happened in most of these cases is that there was no such land consolidation and no move towards effective grouped forest management. After the afforestation works were finished and the forest contractor was paid for his services with the PAF grant the forest was more or less left to the individual management of each of the forest owners in the "group" which means, in many cases, no active management. So it is no surprise if many of these plantations are in poor shape today, or disappeared with forest fires.

Referring to our typology of implementation constraints, this situation of fake grouped projects is an example of failure to meet an incentive compatibility constraint: forest owners pushed by forest contractors participated in the programme and both gained with that, but the incentives were not used in a way fully consistent with the programme goals.

3) In a situation where public forest extension services were missing and forest owners' associations did not exist, forest contractors played the role of disseminating information about the programme, motivating private owners to apply for grants, providing technical advice to them and preparing the applications (Baptista, 1994; Almeida & Carvalho, 1996). The problem here is that they rarely stayed on with the forest owners after the afforestation works and the payment of their services were done. So, for the maintenance of the new or improved forests, the forest owners were left alone, without technical assistance. The result, in many cases, was abandonment or poor management.

Still in this kind of problems, the evaluation report prepared by IFD (2001, p.82) for Reg. 2080/92 refers a problem which also happened in the other programmes:"*a high proportion of the beneficiaries called in outside enterprises for planting and maintenance. Although this could be considered to be a guarantee of quality, unfortunate effects have been seen: the quality of the services provided by the enterprises is not always guaranteed.Very much in demand, they have not always carried out the work with care (lack of precautions taken when working the ground or during planting, unsuitable equipment, etc.). There is a risk that in ten years time there may be unfortunate consequences connected with the species not adapting well, as the enterprises sometimes made their choices according to the amounts of aid for afforestation (field surveys among forestry enterprises).*

For these reasons there may be a considerable degree of uncertainty about the quality of the plantations which may be expected. Unsuitable practices often have consequences which can only be seen years after planting."

For Reg. 2080/92, there is a specific incentive compatibility which to know whether or not the forest owners who applied for this scheme did that with the purpose of reducing agricultural surplus. According to IFD (2001, p. 85), *"In Portugal, the improvements were made mainly in the regions of Lisbon and the Tage Valley and Alentejo. The operations carried out consisted of supplementing natural regeneration when it was inadequate, by increasing the density of the plantations by 20 to 30%, in such a way as to reach a density of 400 to 450 plants/ha (for a final density in the long term of 80 to 100 plants/ha).*

This density, which is higher than in traditional silvipastoral systems (80 plants/ha), corresponds to a forestry situation which aims to produce high-quality cork, at the expense of grazing. This means that the farmer has to redirect his activity toward forestry. In order to improve the quality of the cork, pruning operations (2537 ha), cutting away deadwood (1666 ha) was also carried out on the cork plantations."

This means that the implementation of the regulation was not aimed at reducing agricultural surplus, but at improving the productivity of an existing agro-forestry system, in terms of one forest product (cork), possibly at the expense of some livestock production which is not in excess supply.

Social Cost-Benefit Analysis

Measures evaluated

Only the afforestation and reforestation components of these programmes were considered. The other major action supported by these programmes was stand improvement.

Since there are no good empirical surveys about the types and expected effects of these improvements and since the collection of this kind of data is beyond the scope of this project, there were left out from this analysis. The variability in the initial situations of the improved stands and the resulting variability in the improvements made are too wide to work on the basis of some kind of representative case. For afforestation and reforestation this problem is less severe.

The evaluation was done for all these three programmes together since they were either a continuation (PDF and 2080/92 followed up on PAF) or complements of each other (PDF and 2080/92).

Incremental nature of costs and benefits

The relevant values of costs and benefits for CBA analysis are the incremental ones, that is, the differences between their values in the situations with and without the programme.

We dealt with this issue in the simplest possible way. We assumed that without the programmes, the afforestation and reforestation they supported would not have happened at all. In the case of Portugal and for the kind of species mostly supported by these programmes, this is a realistic assumption.

Social nature of costs and benefits

Our evaluation is limited to social CBA, in line with the main focus of this project.

Because we stick to social analysis, it was not necessary to take into account the public financial incentives: since they are a cost for the public authorities and a benefit for the beneficiaries, they net out, at the aggregate level. We will talk later about how we handled the possible transaction costs involved in the processing of these transfers.

We did not develop the private social CBA for two reasons, at least. One reason has to do with the need to evaluate the real options involved in forest projects when we are dealing with private agents. Because allocating economic resources to forestry is a long run investment, where forest owners face multiple possible choices and irreversible consequences from these choices, a good approach to private CBA should attempt to evaluate those real options. This is not an easy task:

a) it has to be put in the specific context where the forest owner has to take his decisions;

b) it is methodologically more demanding than traditional CBA analysis.

Since microeconomic data representative enough of the wide diversity of forest owners existing in Portugal was not available and collecting it was beyond the scope of this project, we did not have a good way to overcome the first of those two problems. So we constrained our efforts, at this stage, to a methodological exercise of application of real options theory to private CBA of forest investments in different regions of Portugal. A master's thesis was written on this topic for the case of eucalyptus plantations (Cunha, 2002).

Another reason why, at this stage of the research, we are constrained in terms of the empirical relevance of what we can do in this area is the fact that, given the risk of forest fires, private CBA has to take this major fact into consideration and, to do so, empirical knowledge of the attitudes of forest owners towards risk is necessary. The appropriate empirical research on this topic is not available yet.

With the data presented in the section about maintenance costs and benefits from wood, cork and pine nuts one could easily compute the private CBA indicators. This computation, however, would suffer from not taking care of the two issues we have just mentioned.

Areas of afforestation and reforestation

We tried to go as far as possible, in terms of obtaining and working with areas of afforestation and reforestation reported to years where they were actually installed with financial support paid by these programmes. However, for Reg. 2080/92 this was not possible. Therefore, for this programme, the areas are reported to the years where the application was approved for payment of public incentives.

These areas were disaggregated by species, in the following way:

a) maritime pine;

b) stone pine;

c) other conifers;

d) cork oak;

e) chestnut;

f) eucalyptus;

g) other broadleaves.

Initial investment costs

The initial investment costs are the values obtained from official sources, or from our own estimates when there were data gaps, as was presented in a previous section. They include the costs covered by public incentives and the costs paid by the beneficiaries. All these costs were converted in values for the year 2000, using the official consumer price index.

The official sources don't include the costs of land acquisition and this is one gap we did not fill in. The reason is that the cases of land acquisition for afforestation or reforestation are extremely rare. Only in the case of eucalyptus plantations by pulp and paper companies, they may have some relevance. This situation, however, for the most part, falls outside of these programmes. What they have supported was essentially afforestation and reforestation in communal forests or by non industrial private forest owners in land which usually they inherited.

For the "other broadleaves" these were the only costs we estimated. The assumption here is that this group is essentially made of species and stands whose almost exclusive purpose is to produce non marketable forest goods and services, under a forest management regime where active and costly interventions by the forest owners are minimal, or almost inexistent.

Transaction and administrative costs

Transaction costs are mainly of two kinds:

a) the costs (in money and time) borne by private forest owners in the activities of preparation and negotiation of their applications for public incentives;

b) the costs borne by the Public Administration in the preparation and monitoring of these programmes.

Most of the first type of costs corresponds to the fees paid by the forest owners to the forest consultants and forest contractors they hired to prepare the forest management plans required to apply for the public incentives and to carry on the plantings when they are approved. Based on our knowledge about the way these programmes were implemented, we can safely assume that these costs are already included in the amount of the initial investment as they were estimated in a previous section. We should remember here that the rules of these programmes make this kind of costs eligible for public financial support.

The second type of costs refers to what is called in the EFFE project "administrative costs". We estimated their values based on fragmentary data from official sources, as explained in a previous section about the programme inputs. Keeping the estimations as close as possible to an incremental concept of cost, we considered only the costs corresponding to the new capacity building that was necessary in the Public Administration for the preparation and monitoring of these programmes.

Maintenance costs and marketed output benefits

Assumptions about the forest owners' technologies and behaviours

In the next sections we are going to present in detail the models of forest management for the different species, with the calendar and nature of the silvicultural operations and the corresponding costs estimated for 1 hectare, at prices of the year 2000. Most of the time, these are our own estimates based on data about input prices and technologies we collected from a wide variety of sources and experts.

Since we evaluated outputs at **stumpage prices**, or prices on the tree, we did not estimate **harvesting costs**. The input and output prices are constant prices for the year 2000. They come from official sources cited in the text and from expert knowledge.

Assuming **constant returns to scale**, we computed the totals for each species and programme multiplying these unit costs by the total areas of afforestation and reforestation.

The forest management models which we built for this purpose were based on recommendations coming from the Forest Services and the researchers. They correspond to some kind of **"best practice"** recommendations. This means that, by using them, we are assuming and active and well informed management behaviour by the forest owners involved in these programmes.

The costs and revenues presented in this section are **risk-free** values. This means they do not yet take into account the several types of risks that might endanger one plantation. In our risk analysis we will take care of the following risks:

- the risk of mortality right after planting due to problems such as the bad quality of the (re)afforestation works, the inadequacy of the plantation to the type of site where it was installed, and others;

- the risk of fire ignition on the site the stand is located;

- the risk of post-forest fire mortality.

These risks will be dealt with in another section

Marketed goods and services

The forest management models we set up to estimate the costs of maintenance, thinning and harvesting were also the basis for estimating the revenues corresponding to the main marketed forest goods:

a) **timber** for pulpwood, sawnwood and fuelwood;

b) **cork**

c) **pine cones**.

Timber was evaluated at stumpage prices. Cork and pines cones were evaluated at the price on the tree, without harvesting cost.

Like for the estimation of the maintenance and thinning costs, the calculation of the physical production of these outputs was based on our own estimations constructed from information on growth and yields coming from a variety of sources in forest research, Forest Services and practioners.

Also, like in the case of costs, this estimation assumed and active and well informed management behaviour by the forest owner. However, we tried to be prudent in terms of the levels of expected physical production, keeping to the middle ground of the quantities that were reported by the different sources used in this work.

The outputs considered for the group of "other broadleaves" are the following ones: marketed or non marketed non wood forest products (besides cork and pine nuts), carbon storage and other forest public goods.

Rotation periods

The silvicultural models adopted here all have **fixed rotation** periods. For all the species, except eucalyptus, they are one rotation models. For eucalyptus the model considers four rotations after which the plantation has to be replaced.

We considered the following timeline for each of the species included in the evaluation of the benefits of marketed goods and services:

- maritime pine, other conifers, chestnut and eucalyptus: 45 years which, in the case of eucalyptus, means 4 cuts, and, in the case of the other species, one cut (the clear cut, at the end of the rotation period of 45 years);

- stone pine: 80 years;

- cork oak: 126 years.

Maritime pine

The following table presents the model of silvicultural operations considered for maritime pine. This model is a slightly adapted version of the one recommended by the Forest Services for the afforestation and reforestation projects based on maritime pine (Louro *et al.*, 2000).

The operating costs are based on expert knowledge information.

The timber production corresponding to thinnings and the final harvest is based on the growth and yield tables of Oliveira (1985) for a stand in the middle classes of productivity (trees 20 m high, at 40 years of age) in the Northern and Central Portugal, assuming thinnings from below.

The timber prices are stumpage prices. The source is the price collection network of the Forest Services (*SICOP-Sistema de Informação de Cotações de Produtos Florestais na Produção*). We picked the prices from the SICOP leaflet (2003). The price for the timber coming from the first thinning is the price of timber sold for posts and poles. The price for the timber coming from the other thinnings and the final harvest is the price of timer sold for sawmilling.

Operating costs and timber revenues for maritime pine at constant prices for the year 2000

Age (years)	Silvicultural operations	Risk-free costs (€/ha)	Risk-free revenues (€/ha)
0	Planting (1562 plants/ha)	1000 €[28]	
1	Restocking		
3	Brush control	250 €	
8	Brush control	225 €	
10	Stand cleaning (removal of dead plants and plants of bad quality, reducing the stand density to 1000-1200 trees/ha)	400 €	
13	Brush control	225 €	
15	Pruning of the best trees (300-500/ha)	350 €	
18	Brush control	225 €	
20	Thinning from below (removal of 20-40% of the trees)		49m^3 ob X 35,72 €/m^3 ob = 1750 €
25	Brush control	225 €	
30	Thinning from below (removal of 20% to 30% of the trees)		76m^3 ob X 44,39 €/m^3 ob = 3374 €
35	Brush control	225 €	
40	Thinning from below (removal of 20%-30% of trees)		46m^3 ob X 44,39 €/m^3 ob = 2042 €
45	Final harvest (clear cut of 300-500 trees/ha)		240m^3 ob X 44,39 €/m^3 ob = 10654 €

Cork oak

The following table presents the model of silvicultural operations considered for cork oak. This model is an adapted version of the one recommended by the Federation of Forest Owners' Associations to which belong most of this kind organisations from the cork producing regions (Machado, n.d.). The model is for pure cork oak stands that is stands where cork oak is the only tree species and the only goal is the production of cork.

The operating costs are based on expert knowledge information.

The cork yields per tree correspond to stands in areas in the middle range of cork productivity, according to our own reading of the case studies presented by Feio (1989). The yields curve we considered corresponds to a production of 190 kg of cork (virgin cork excluded) on average, per hectare and year, from the second until the last harvest. This is in line with the averages referred by most experts on this matter [Goes, 1991; Machado, n.d. (c)] The most

[28] Here and in the next tables, we included an estimate of the initial investment costs per hectare. This estimate is only to have these tables complete. They were not used as the basis for calculating the total investment costs for the whole programmes. For these totals we used instead the investment costs as they were reported by the official sources, or which we estimated from those sources, as explained in the section about the financial inputs.

recent version of the Forest Inventory (DGF, 2001) refers, for 1995, an average productivity of 170 kg of cork, per hectare and per year, for pure cork oak stands.

The prices of reproduction cork are prices "on the tree", that is, prices before harvesting costs. The source is the price collection network of the Forest Services (SICOP-Sistema de Informação de Cotações de Produtos Florestais na Produção). We picked the prices from the SICOP leaflet (SICOP, 2003). The price for the second harvest was assumed to be 60% of the price of reproduction cork, as assumed by Feio (1989).

Operating costs and cork revenues for cork oak at constant prices for the year 2000

Age (years)	Silvicultural operations	Risk-free costs (€/ha)	Risk-free revenues (€/ha)
0	Planting (625 plants/ha)	800 €	
1	Restocking		
3	Brush control	300 €	
5	Brush control	225 €	
10	Thinning (removal of 30% of the trees)*, brush control and pruning	225 € + 275 €	
15	Brush control and thinnings* (removal of 30% of the trees)	225 €	
18	1.st cork harvest (virgin cork)*		
22	Thinning (removal of 30% of the trees)*, brush control and pruning	225 € + 300 €	
27	2.nd cork harvest		6 kg/tree X 300 trees X (60% X 2,33€/kg) = 2516 €
30	Thinning (removal of 30% of the trees)*, brush control and pruning	225 € + 300 €	
36	Cork harvest		8 kg/tree X 200 trees X 2,33€/kg = 3728 €
40	Pruning	300 €	
45	Cork harvest, brush control and thinning (removal of 30% of the trees)*	225 €	10 kg/tree X 140 trees X 2,33€/kg = 3262 €
54	Cork harvest		15 kg/tree X 140 trees X 2,33€/kg = 4893 €
63	Cork harvest		15 kg/tree X 140 trees X 2,33€/kg = 4893 €
65	Thinning*, brush control and pruning	225 € + 300 €	
72	Cork harvest		15 kg/tree X 120 trees X 2,33€/kg = 4194 €
81	Cork harvest		15 kg/tree X 120 trees X 2,33€/kg = 4194 €
85	Thinning* and brush control	225 €	
90	Cork harvest and pruning	300 €	15 kg/tree X 100 trees X 2,33€/kg = 3495 €
99	Cork harvest		15 kg/tree X 100 trees X 2,33€/kg = 3495 €
105	Thinning* and brush control	225 €	
108	Cork harvest		15 kg/tree X 75 trees X 2,33€/kg = 2621 €
115	Pruning	300 €	
117	Cork harvest		15 kg/tree X 75 trees X 2,33€/kg = 2621 €
125	Thinning* and brush control	225 €	
126	Cork harvest		15 kg/tree X 75 trees X 2,33€/kg = 2621 €

(*)The costs and revenues of thinnings and virgin cork are considered to cancel out. For this reason they are not included in the table.

Eucalyptus

The following table presents the model of silvicultural operations considered for eucalyptus. This model reflects the practices adopted by the pulp and paper companies in the eucalyptus forests under their management. The information on the silvicultural operations and the corresponding costs was collected directly from foresters working for those companies and is taken from Cunha's MSc thesis (Cunha, 2002).

The data on the pulpwood production for the first and second corresponds to the growing stock at years 12 and 24, in the Central Coast region (a region in the middle range of

productivity), as it is calculated by the growth and yield model GLOBULUS 2.1 developed by Tomé *et al.* (2001). For the third harvest we assumed the same production as in the first and for the last one 70% of the third one.

The wood prices are stumpage prices for pulpwood in the year 2000. The source is the price collection network of the Forest Services (SICOP-Sistema de Informação de Cotações de Produtos Florestais na Produção). We picked the prices from the SICOP leaflet (SICOP, 2003).

Operating costs and timber revenues for eucalyptus at constant prices for the year 2000

Age (years)	Silvicultural operations	Risk-free costs (€/ha)	Risk-free revenues (€/ha)
0	Planting (1250 plants/ha) and restocking (10-15% of the initial density)	1160 €	
1	Fertilization	62,5 €	
2	Brush control	90 €	
3	Fertilization and infrastructures cleaning (paths and fire stoppers)	100 €	
6	Brush control and infrastructures cleaning (paths and fire stoppers)	100 €	
11	Infrastructures cleaning (paths and fire stoppers)	10 €	
12	1st harvest		135 m^3 o.b. X 22,01€/m^3 = 2971 €
13	Fertilization	55 €	
14	Rod selection	90 €	
15	Fertilization and infrastructures cleaning (paths and fire stoppers)	100 €	
18	Fertilization and infrastructures cleaning (paths and fire stoppers)	100 €	
23	Infrastructures cleaning (paths and fire stoppers) and 2.nd harvest	10 €	170 m^3 o.b. X 22,01€/m^3 = 3742 €
25	Fertilization	55 €	
26	Rod selection	90 €	
27	Fertilization and infrastructures cleaning (paths and fire stoppers)	100 €	
30	Fertilization and infrastructures cleaning (paths and fire stoppers)	100 €	
34	Infrastructures cleaning (paths and fire stoppers) and 3.rd harvest	10 €	135 m^3 o.b. X 22,01€/m^3 = 2971€
37	Fertilization	55 €	
38	Rod selection	90 €	
39	Fertilization and infrastructures cleaning (paths and fire stoppers)	100 €	
42	Fertilization and infrastructures cleaning (paths and fire stoppers)	100 €	
45		10 €	95 m^3 o.b. X 22,01€/m^3 = 2091€

Stone pine

The following table presents the model of silvicultural operations considered for stone pine. This model is a slightly adapted version of the one recommended by the Forest Services (Louro *et al.*, 2000). The model considers as main goal for stone pine stands the production of pine nuts and timber.

The operating costs are based on expert knowledge information.

Operating costs and revenues for stone pine at constant prices for the year 2000

Age (years)	Silvicultural operations	Risk-free costs (€/ha)	Risk-free revenues (€/ha)

0	Planting (833 plants/ha)	800 €	
1	Restocking		
3	Brush control	250 €	
8	Brush control	225 €	
10	Pruning and harvesting of pine cones	700 €	4200 cones X 0,125 €/cone = 525 €
11	Harvesting of pine cones		4800 cones X 0,125 €/cone = 600 €
12	Harvesting of pine cones		5400 cones X 0,125 €/cone = 675 €
13	Harvesting of pine cones		6000 cones X 0,125 €/cone = 750 €
14	Harvesting of pine cones		6600 cones X 0,125 €/cone = 825 €
15	Harvesting of pine cones		7200 cones X 0,125 €/cone = 900 €
16	Harvesting of pine cones		7800 cones X 0,125 €/cone = 975 €
17	Brush control, thinning from below (removal of 20-30% of the trees) and harvesting of pine cones	225 €	20 m^3 ob X 23 €/m^3 ob = 460 € + 8400 cones X 0,125 €/cone = 1050 €
18	Harvesting of pine cones		7500 cones X 0,125 €/cone = 938 €
19	Harvesting of pine cones		8000 cones X 0,125 €/cone = 1000 €
20	Harvesting of pine cones		8500 cones X 0,125 €/cone = 1063 €
21	Harvesting of pine cones		9000 cones X 0,125 €/cone = 1125 €
22	Harvesting of pine cones		9500 cones X 0,125 €/cone = 1188 €
23	Brush control, thinning from below (removal of 20% of the trees) and pruning	450 €	10 m^3 ob X 23 €/m^3 ob = 230 € + 10000 cones X 0,125 €/cone = 1250 €
24	Harvesting of pine cones		6300 cones X 0,125 €/cone = 788 €
25	Harvesting of pine cones		6600 cones X 0,125 €/cone = 825 €
26	Harvesting of pine cones		6900 cones X 0,125 €/cone = 863 €
27	Harvesting of pine cones		7200 cones X 0,125 €/cone = 900 €
28	Brush control, thinning from below (removal of 20% of the trees)	225 €	10 m^3 ob X 23 €/m^3 ob = 230 € + 7500 cones X 0,125 €/cone = 938 €
29	Harvesting of pine cones		5200 cones X 0,125 €/cone = 650 €
30	Harvesting of pine cones		5400 cones X 0,125 €/cone = 675 €
31	Harvesting of pine cones		5600 cones X 0,125 €/cone = 700 €
32	Harvesting of pine cones		5800 cones X 0,125 €/cone = 725 €
33	Harvesting of pine cones		6000 cones X 0,125 €/cone = 750 €
34	Harvesting of pine cones		6200 cones X 0,125 €/cone = 775 €
35	Harvesting of pine cones		6400 cones X 0,125 €/cone = 800 €
36	Harvesting of pine cones		6600 cones X 0,125 €/cone = 825 €
37	Harvesting of pine cones		7000 cones X 0,125 €/cone = 875 €
38	Brush control, thinning from below (removal of 20% of the trees) and pruning	450 €	10 m^3 ob X 23 €/m^3 ob = 230 € + 7400 cones X 0,125 €/cone = 925 €
39	Harvesting of pine cones		3900 cones X 0,125 €/cone = 488 €
40	Harvesting of pine cones		4000 cones X 0,125 €/cone = 500 €

Operating costs and revenues for stone pine at constant prices for the year 2000 (cont.)

Age (years)	Silvicultural operations	Risk-free costs (€/ha)	Risk-free revenues (€/ha)
41	Harvesting of pine cones		4700 cones X 0,125 €/cone = 588 €
42	Harvesting of pine cones		5400 cones X 0,125 €/cone = 675 €
43	Harvesting of pine cones		6100 cones X 0,125 €/cone = 763 €
44	Harvesting of pine cones		6800 cones X 0,125 €/cone = 850 €
45	Harvesting of pine cones		7500 cones X 0,125 €/cone = 938 €
46	Brush control and harvesting of pine cones	225 €	8200 cones X 0,125 €/cone = 1025 €
47	Harvesting of pine cones		8900 cones X 0,125 €/cone = 1113 €
48	Harvesting of pine cones		9600 cones X 0,125 €/cone = 1200 €
49	Harvesting of pine cones		10300 cones X 0,125 €/cone = 1288 €
50	Harvesting of pine cones		11000 cones X 0,125 €/cone = 1375 €
51	Harvesting of pine cones		11700 cones X 0,125 €/cone = 1463 €
52	Harvesting of pine cones		12400 cones X 0,125 €/cone = 1550 €
53	Harvesting of pine cones		13100 cones X 0,125 €/cone = 1638 €
54	Harvesting of pine cones		13800 cones X 0,125 €/cone = 1725 €
55	Brush control and pruning	350 €	14500 cones X 0,125 €/cone = 1813 €
56	Harvesting of pine cones		15200 cones X 0,125 €/cone = 1900 €
57	Harvesting of pine cones		15900 cones X 0,125 €/cone = 1988 €
58	Harvesting of pine cones		16600 cones X 0,125 €/cone = 2075 €
59	Harvesting of pine cones		17300 cones X 0,125 €/cone = 2163 €
60	Harvesting of pine cones		18000 cones X 0,125 €/cone = 2250 €
61	Harvesting of pine cones		18700 cones X 0,125 €/cone = 2338 €
62	Harvesting of pine cones		19400 cones X 0,125 €/cone = 2425 €
63	Brush control and harvesting of pine cones	225 €	20100 cones X 0,125 €/cone = 2513 €
64	Harvesting of pine cones		20800 cones X 0,125 €/cone = 2600 €
65	Harvesting of pine cones		21500 cones X 0,125 €/cone = 2688 €
66	Harvesting of pine cones		22200 cones X 0,125 €/cone = 2775 €
67	Harvesting of pine cones		22900 cones X 0,125 €/cone = 2863 €
68	Harvesting of pine cones		23600 cones X 0,125 €/cone = 2950 €
69	Harvesting of pine cones		24300 cones X 0,125 €/cone = 3038 €
70	Harvesting of pine cones		25000 cones X 0,125 €/cone = 3125 €
71	Brush control and harvesting of pine cones	225 €	25700 cones X 0,125 €/cone = 3213 €
72	Harvesting of pine cones		26400 cones X 0,125 €/cone = 3300 €
73	Harvesting of pine cones		27100 cones X 0,125 €/cone = 3388 €
74	Harvesting of pine cones		27800 cones X 0,125 €/cone = 3475 €
75	Harvesting of pine cones		28500 cones X 0,125 €/cone = 3563 €
76	Harvesting of pine cones		29200 cones X 0,125 €/cone = 3650 €
77	Harvesting of pine cones		30000 cones X 0,125 €/cone = 3750 €
78	Harvesting of pine cones		30000 cones X 0,125 €/cone = 3750 €
79	Harvesting of pine cones		30000 cones X 0,125 €/cone = 3750 €
80	Harvesting of pine cones and clear cut		300 m^3 ob X 23 €/m^3 ob = 6900 € + 30000 cones X 0,125 €/cone = 3750 €

Chestnut

The following table presents the model of silvicultural operations considered for pure stands of chestnut exclusively oriented towards wood production. This model is a slightly adapted version of the one recommended by the Forest Services (Louro *et al.*, 2000).

The operating costs are based on expert knowledge information.

The wood production are our own estimates. The wood prices are stumpage prices in the year 2000, obtained from SICOP (SICOP, 2003). The price for wood resulting from

thinning is the price of chestnut fuelwood. The price for wood from the final cut is the price of chestnut wood for sawmilling.

Operating costs and timber revenues for chestnut at constant prices for the year 2000

Age (years)	Silvicultural operations	Risk-free costs (€/ha)	Risk-free revenues (€/ha)
0-1	Planting (1250 plants/ha) and restocking	1000 €	
3	Brush control	300 €	
5	Thinning and pruning	300 €	
6	Thinning and pruning	300 €	
7	Thinning and pruning	300 €	
8	Thinning and pruning	300 €	
9	Thinning and pruning	300 €	
10	Thinning and pruning	300 €	
11	Thinning and pruning	300 €	
12	Thinning and pruning	300 €	
15	Thinning from above and pruning	240 €	0,175 m^3 o.b./tree X 300 trees X 20,1€/m^3 o.b. = 1055 €
18	Pruning	240 €	
21	Pruning	240 €	
22	Thinning from above and pruning	240 €	0,44 m^3 o.b./tree X 330 trees X 20,1€/m^3 o.b. = 2920 €
29	Thinning from above		1,27 m^3 o.b./tree X 120 trees X 20,1€/m^3 o.b. = 3065 €
36	Thinning from below		1,92 m^3 o.b./tree X 70 trees X 20,1€/m^3 o.b. = 2700 €
45	Final cut		350 m^3 o.b. X 63,63€/m^3 o.b. = 22270 €

Social benefits of carbon storage

The estimation of the social benefits corresponding to carbon storage was carried out for the period 1987-2125 (year of the final cut of the last stand generated by these programmes) as follows:

a) we considered for each year, from 1987 to 1999, the total area (re)afforested with the following groups of species:

- group A - conifers (except stone pine), eucalyptus and chestnut;

- group B - stone pine;

- group C - oaks and other broadleaves (except, eucalyptus and chestnut);

b) we assumed an average annual increment per hectare afforested or reforested of 6 m^3 for group A[29] and 3 m^3 for groups B[30] and C[31];

c) with (a) and (b) we estimated the total growing stock of wood until the year of final cut of the stands (45 years for group A, 80 years for group B and 126 years for group C);

d) beyond the year of final cut we assumed that the stock of wood remained constant;

d) based on the stock estimated in (d) we estimated the corresponding biomass assuming the following conversion factors based on information from TBFRA 2000 (UNECE/FAO, 2000) for Portugal:

[29] This is of the same order of magnitude as the average annual increment assumed for maritime pine in section 7.
[30] This is of the same order of magnitude as the average annual increment assumed for stone pine in section 7.
[31] This is within the interval considered by Tomé (2001) for long rotation hardwoods in Portugal.

i) 0.52 tons of woody biomass/m^3 of growing stock for groups A and B and 0.55 tons of woody biomass/m^3 of growing stock for group C;

ii) 0.24 tons of biomass /m^3 of growing stock for all the three groups;

e) still based on the calculations used in the TBFRA 2000, we assumed that 50% of the biomass is made of carbon;

f) from the total stock of carbon stored we calculated the annual flow evaluated at 20 €/ton (Fankhauser, 1995).

Benefits of other non wood forest products, informal recreation, game and protection of soil, water and landscape quality

In another paper presented in chapter 2 (Mendes, 2005a) we estimated the total economic value of forest production in Continental Portugal for 2001. We obtained the following results for some products that have not been considered so far in this analysis:

Value of other non wood forest products, informal recreation, game, protection of soil, water and landscape quality in Continental Portugal, in 2001

Products		Value (€)
Marketed or marketable non wood forest products (except cork)	Resin	3089000
	Honey	7619000
	Mushrooms	16250000
	Plants picked for sale	1400000
	Acorns and grazing in forests	112377000
	Game	21383000
	Sub-total	**162118000**
	Average per hectare	**48,40**
Non marketable forest products and positive externalities	Informal recreation	16500000
	Protection of agricultural soil	49209000
	Protection of water resources	28934000
	Forest landscape and biodiversity conservation	56695000
	Sub-total	**151338000**
	Average per hectare	**45,18**
TOTAL		313456000
Average per hectare		**93,59**

For CBA we assumed that the amounts of benefits presented above correspond to forests which are 30 years old or more, remaining more or less stable until the end of the stand's lifetime. From the initial year until year 30 we assumed linear growth in the amounts of these benefits.

Because this estimate did not include all the forest products, it is reasonable to round the average of these benefits up to 100 €/ha.year divided more or less evenly between marketed or marketable non wood forest products (besides cork) and non marketable forest products and positive forest externalities.

Considering the three groups of species we defined for the estimation of the benefits of carbon storage, the value of forest landscape is probably much lower for group A, than for groups B and C. Group C is also responsible for most of the value of acorns and grazing. Therefore we considered, for stands with 30 years of age or more, a value of 60 €/ha.year for group A, 75 €/ha.year for group B and 120 €/ha.year for group C.

Costs of forest fire prevention, detection and extinction

When dealing with social CBA in the case of the Portuguese forest sector, it is necessary to take into consideration the increment in the costs of fire prevention, detection and extinction generated by these programmes. Based on our own work about the total economic value of forest production in Continental Portugal for the year 2001 (Mendes, 2005a) presented in chapter 2, we developed an estimate for these social costs which was included in the CBA analysis. This estimate was constructed as follows:

a) based on the work of Mendes (2005a), we arrived at an average cost per hectare of 15,88 €;

b) we assumed that about the year 2005 (when the last plantations supported by these programmes will be 5 years old) those costs will amount to 5450000 €/year and they will remain at this level for the rest of the horizon considered in this evaluation;

c) that amount of 5450000 €/year is based on the total area afforested and reforested with the support of the three programmes considered here and on the average cost of 16 €/ha;

d) this cost grows linearly since 1992, up to 5450000 € in 2005.

Incremental costs of fire prevention and fire fighting

Year	€
1992	380000
1993	770000
1994	1160000
1995	1550000
1996	1940000
1997	2330000
1998	2720000
1999	3110000
2000	3500000
2001	3890000
2002	4280000
2003	4670000
2004	5060000
2005 and after	5450000

Risk analysis

Because of the salience of forest fires in Portugal, we carried on a risk analysis. This was done in a simplified way, as follows:

a) assuming risk neutrality (an appropriate assumption, in social CBA, but certainly not in private CBA), we made an estimation of the expected values of all benefits and costs, except the initial investment costs, the administrative costs and the costs of fire prevention, detection and extinction, assuming that there will be no uncertainty in this group;

b) assuming that the kind of uncertainty governing the life of a forest stand is only a pure death stochastic process (we consider only the possibility of destruction by fire or other factors, without taking natural regeneration into account), the probabilities used to compute in each year the expected values of costs and benefits are the survival probabilities $S(t)$, that is, the probability that a stand survives up to age t without being destroyed by fire, or by other factors.

The problem here is to pick an appropriate distribution for these probabilities. Following a lot of research on tree mortality, we assumed a Weibull distribution with an

increasing hazard rate, that is, we assumed that the probability of tree mortality increases with age.

$$S(t) = \exp\left(-\lambda t^{\gamma}\right)$$

Having done this, the remaining problem was to obtain the values of the relevant parameters, fitting well each of the species and the average conditions of the country. Unfortunately we lack the necessary empirical research on this topic. Therefore, what we did was no more than an exercise based on our own best guesses about the values of these parameters. These guesses are presented in the following table.

The rationale behind these guesses is the following:

a) the values of the scale parameters are close to the percentage of area of each species burnt, on average per year, from 1990 to 1999, as we could calculate it from data of the Forest Services published by Pereira & Santos (2003);

b) the value of the shape parameter was calibrated in order to obtain values for the survival probabilities, at 30 years of age, consistent with the map of the probabilities of forest fire, in that horizon, in Continental Portugal prepared by Pereira & Santos (2003), assuming that the regions of high (30 to 40% in 30 years) or very high (more than 40%) probabilities are dominated by maritime pine, the regions of medium (20 to 30 %) or low probabilities are dominated by eucalyptus and the regions of very low probabilities (up to 10%) are dominated by oaks or stone pine.

Parameters of the Weibull distribution used in risk analysis

Species	Scale parameter (λ)	Shape parameter (γ)
Maritime pine	0.0165	1.005
Stone pine	0.0003	1.005
Other conifers	0.0165	1.005
Eucalyptus	0.008	1.005
Cork oak	0.00175	1.005
Other oaks	0.00175	1.005

Results

The results of the social CBA based on the data and assumptions we have just presented are given in the following table.

The real internal rates of return for all the four situations considered in the table, including those where we account for the risk of forest fire, show values well above acceptable levels of social profitability and these values are unique solutions, given the time profile of the net benefits. This is also true either we account for positive externalities and non wood forest products (besides cork and pine cones) or not. Obviously, accounting for these outputs, most of which are not appropriated by the forest owners, raises the IRR about 2%.

Social Internal Rates of Return and Net Present Values of afforestation supported by EU co-funded programmes in 1987-99 (PAF, PDF and Reg. 2089/92)

	With all social costs and benefits included	Without the benefits of positive externalities and non wood forest products besides cork and pine cones, and with the costs of fire prevention, detection and extinction
Without risk of forest fire	IRR: 8.6%	IRR: 6.5%

	NPV (at 2%): 12058 €/ha NPV (at 3%): 6375 €/ha NPV (at 4%): 3447 €/ha	NPV (at 2%): 89016 €/ha NPV (at 3%): 4347 €/ha NPV (at 4%): 2053 €/ha
With risk of forest fire	IRR: 7.9% NPV (at 2%): 10054 €/ha NPV (at 3%): 5183 €/ha NPV (at 4%): 2708 €/ha	IRR: 6.1% NPV (at 2%): 7515 €/ha NPV (at 3%): 3526 €/ha NPV (at 4%): 1557 €/ha

For reasons that are explained in our chapter on effectiveness analysis, to take care of the possibility that the expected yields of pine cones in the stone pine stands are "optimistic" we ran a sensitivity analysis for the "worst case scenario" where we kept all the costs (investment and operating costs) with these stands, but took away all the benefits corresponding to pine cones and wood production, leaving only the production of positive externalities. In this case, the IRR would be the ones shown in the following table.

These results show that, even if future effects on pine nut production are lower than what we projected, the internal rates of return for the whole set of these three programmes will be above acceptable levels of social profitability.

Consistently with these results, the net present values (NPV) are also positive in all of the four situations considered, and have high values, obviously within the range of discount rates up to the levels of the IRR. The averaging of the NPV was calculated over the total areas afforested or reforested with the support of these programmes. One could argue that we should also add other areas owned by the beneficiaries or their neighbours in which management may improve directly as a result of these investments. If we do this, the average NPV would still remain at relatively high levels.

Social Internal Rates of Return and Net Present Values of afforestation supported by EU co-funded programmes in 1987-99 (PAF, PDF and Reg. 2089/92) without the benefits of pine nuts and stone pine wood

	With all social costs and benefits included	Without the benefits of positive externalities and non wood forest products besides cork and pine cones, and with the costs of fire prevention, detection and extinction
Without risk of forest fire	IRR: 6.9%	IRR: 4.5%
With risk of forest fire	IRR: 5.9%	IRR: 3.6%

Conclusions

Contingent on the quality of the data and the assumptions on which these results are based, the main one being that there is active forest management according to "best practices" knowledge, at the current stage of this research, the main conclusion is that, from a social point of view, these programmes are profitable and worth to have been undertaken, even considering the risk of some of their effects being damaged by forest fires.

The problem is that reaching this social profitability is impaired by the time profile of costs and benefits. For the first two decades of their lifetime, at least, most of these investments have negative net benefits. Faced with this problem, it is understandable that forest owners with lands having potential for commercial forestry (production of timber, cork and pine cones)

took the opportunities made available by the provision of public incentives to overcome this barrier to entry and invest in the improvement or expansion of their forests.

Another option has been to go for fast growing species, mostly eucalyptus, in spite of the lack of public incentives for that, since the end of the first phase of PAF. Focus of the public incentives on other species, namely conifers, cork oak and other long rotation broadleaves, contributed to counterbalance this tendency.

After the investment period, another option to cope with the negative net benefits in the initial periods is to manage the trade off between lowering the intensity of forest management operations with the corresponding increase in the risk of forest fire and doing the opposite with the corresponding increase in the amount of maintenance costs. Sharing some of these costs by setting up forest owners' associations is a way out that a growing number of forest owners are considering more and more seriously. In a country where forest ownership is overwhelmingly private and fragmented, this institutional effect of the programmes evaluated here may be the main factor which will help private forest owners in the future to keep up with the standards of sustainable forest management which were assumed in the projection of costs and benefits. If this assumption fails to hold in the coming years the positive conclusions of this evaluation have to be revised downwards.

Chapter

10

Some public incentives for forest owners' organisations in the 90s

Introductory note

As was said before, forest owners' organisations emerged in the 90s probably in response to the demand of forest owners for the technical assistance they needed in order to apply for the EU co-funded afforestation programmes. We have also pointed out that these programmes did not provide incentives targeting these organisations. One reason is that the idea of the Forest Services, at least when they prepared the Forest Action Programme (PAF); was to set up a public forest extension service. The complete failure of this strategy did not lead immediately to a new one clearly in favour of forest owners' associations.

Therefore for those organisations which got started in the 90s they had to look for support outside the framework of those afforestation programmes. This chapter will present some of the incentive schemes to which many of these organisations applied. However, this does not give a complete picture of the public expenditures in this domain. To have that picture it is necessary to wok with each of the organisations in order to identify other sources of public support from de Central Public Administration and from the municipalities. This is time consuming task and not an easy one to carry on because the organisations themselves don't have this data treated and quickly available.

Public incentives during the 1st Common Support Framework (1989-93)

Most of the public support to forest owners' organisations during the 90s was provided by programmes included in the three Common Support Framework (CSF) regulating the transfers of EU structural funds since Portugal's accession:

- the 1st CSF, which ran from 1989 to 1993;

- the 2nd CSF, which ran from 1993 to 1999;

- the 3rd CSF, which started in the year 2000 to last until 2006.

In the 1s CSF there was a programme called PROAGRI supporting the installation of farmers' organisations, mainly through **matching grants** for investment and operating costs lasting for **5 years**. These grants supported the creation or development of 132 organisations (Pinto, 1994), but **only one of these was a forest owners' association** (Costa, 2002). This association was located in the Ribatejo & Oeste region.

Public incentives during the 2nd Common Support Framework (1994-99)

The PROAGRI programme continued throughout the 2nd CSF, but with less favourable grants than in the previous CSF. In fact, after 1996, by imposition of the European Commission, a modulation was introduced in the **matching grants** supporting personnel costs going from 85% of those costs in the 1st year, to 35% in the 5th year.

Even though this programme, like the previous one, did not include any special provisions for forest owners' organisations, the demand for funds form this type of organisations finally got started with 39 new or existing organisations supported by the programme. As once can infer from the following table, one of the major players in this rise of the forest owners' organisation movement in this period is FORESTIS. This organisation was created in 1992, in Porto, with the mission of being the promoter and the federation of local forest owners' organisations mainly throughout the regions of small-scale forestry in Northern and Central Portugal. As one can see in the following table, 24 out of the 39 forest organisations supported by PROAGRI during this period were from the Northern and Central West regions where FORESTIS has been more active. So, in brief, we can say that this 2nd CSF **played an important role in supporting the take off of forest owners' organisations in the regions of small-scale forestry**.

Forest owners' organisations supported by PROAGRI during the 2nd Common Support Framework (1994-99)

Regions	Cooperatives		Associations		Other forest organisations	TOTAL
	Forestry	Agriculture & Forestry	Forestry	Agriculture & Forestry		
Entre-Douro-e-Minho		1	9		2	12
Trás-os-Montes		1	5			6
Beira Litoral	1	1	3	1		6
Beira Interior		1	5	1		7
Ribatejo e Oeste			2		2	4
Alentejo			3			3
Algarve			1			1
TOTAL	**1**	**4**	**28**	**2**	**4**	**39**

Source: Costa (2002)

Public incentives during the 3rd Common Support Framework (2000-06)

In the 3rd CSF there is finally a special programme to support forest owners' organisations in two ways:

a) support for the creation of new organisations;

b) support for the creation of extensions of organisations existing for 2 years or more.

As in previous programmes, the support takes the form of **5 years modulated matching grants**:

- 100% of the personnel and operating costs in the 1st year declining gradually until 60% in the 5th year;

- 85% of the investment costs.

Until the month of May 2002, the number of applications approved for this programme reached 74, which shows a substantial increase, compared to the previous programme. Again **the regions of small-scale forestry have been the most active** in this process, in terms of number of applications.

One interesting conclusion we can infer from the table presented below with the purposes of the applications is the following:

- in the **Northwestern region**, the current generation of applications is mostly for **extensions** of the associations created during the 2nd CSF;

- in the **Central region**, the current programme is mostly for the **creation** of new organisations.

So the movement of creation of forest owners' organisations in the regions of small scale forestry originated in North-western Portugal during the period of the 2nd CSF, mostly through the action of FORESTIS and is now moving south, again partly through the action of FORESTIS.

Applications approved or for approval for funding by the 3rd CSF in May 2002

Regions	Continuation of support from the PROAGRI programme	Creation of new organisations	Creation of a forestry section in an existing cooperative	Creation o an extension in an existing association	TOTAL
Entre-Douro-e-Minho	9	3	2	8	22
Trás-os-Montes	1	5	2	2	10
Beira Litoral	2	12	3		17
Beira Interior	2	10	2	1	15
Ribatejo e Oeste		2			2
Alentejo		2		3	5
Algarve	1	2			3
TOTAL	**15**	**36**	**9**	**14**	**74**

Source: Costa (2002)

Chapter 11

Forest taxation in the 80s and 90s

Value added tax

One important feature of the VAT regime is that there is the possibility of tax exemptions. These are called simple or incomplete exemptions when the economic agent does not liquidate the tax on his sales, but also cannot deduct the tax supported on its expenditures. When the economic agent does not liquidate the tax on his sales but can deduct the tax on his expenditures acquisitions, it is the case called "complete or zero tax rate exemption". Silvicultural operations are considered in the incomplete exemptions case. When forest owners sell their own wood (either standing or cut), this operation also falls in this category.

Forest goods and services had a 0% tax rate until 1992, raised to 5% since then. This means that when the producer opted for giving up the incomplete exemption he would not pay any tax at all, until 1992, or would pay a reduced amount, since 1992. Machinery exclusively or mainly destined to silviculture was also subject to the reduced tax rates.

Personal income tax

Income from forestry is taxable either as complementary income of other activities, or in the special category of "agricultural income" (category D) which may also include income from agricultural production. During the first five years of implementation of the current regime of personal income taxation (1989 to 1993), partial or total tax exemptions were considered, under a transitory regime:

when incomes from activities in agriculture and forestry were no greater than 14963.94 €, they were fully excluded from taxation;

when incomes from those activities were obtained in forest holdings with a declared value for property tax of no more than 7481.97 € they were totally excluded from taxation;

when incomes from agriculture and forestry were not included in any of the two previous situations, only 40% of their value was considered, under Category D.

Until 2000, the first two of these situations were maintained in the legislation, as tax exemptions, and the third one was also kept every year as a tax benefit.

Corporate tax

Concerning the profit taxation period, the normal regime for the corporate tax is one year, but silvicultural activities can be treated differently, since there is a large period between

the moment when most of the costs occur and the moment when revenues are obtained. When the forest stand exists for more than one year, the part of the costs corresponding to the percentage that is harvested in the year under consideration can be corrected for the inflation. The legal regime of the corporate tax also specifies the situation of pluri-annual works, allowing for the calculation of the revenues according to two criterions: the percentage of the work that has actually been achieved and the conclusion of the work.

When the corporate tax was reformed, in the end of the 80s, firms having their main activity in forestry benefited from a reduced tax rate, until 1993. While other activities were initially subject to a 36.5% (or 36%) tax rate, those activities were subject to a 12.5% tax rate in 1989, 16% in 1990, 20% in 1991, 25% in 1992 and 31% in 1993.

Property tax

Concerning the property tax there is a different tax rate for rural properties where forests are included (0.8% of the patrimonial value) and for urban properties (1.1% to 1.3% of the patrimonial value, from 1989 until 1994; 0.8% to 1%, in 1995 and 1996; 0.7% to 1.3%, since 1997).

Chapter 12

The forest policy process since mid 90s[32]

Proposals for forest policy reform in the 90s

The context: a generalized feeling of crisis

The Forest Services

Probably the main driver of the events in Portuguese forest policy in the mid 1990s is a generalized feeling of crisis in all the major stakeholders of the forest sector. The reasons of each of them for that kind of attitude were different, but they were all converging towards a move for changing the existing policies.

The Forest Services were in a mood of crisis both at the central and at the regional level. In 1995, a reform in the structure of the Ministry of Agriculture terminated a secular form of organisation of those services based on centralized and hierarchical control. The staff at the local and regional level was incorporated in the Regional Directorates of the Ministry of Agriculture, under the direct responsibility of the regional director who was not necessarily a forester. The staff at the central level remained in a Directorate General of Forests, without strong connections and direct responsibilities over the foresters working at the regional level. What had been the main mission of the Forest Services since their beginnings in the XIXth century, that is, the direct management of the public and communal forests (in this case after the afforestation of the commons from the 1930s to the 1960s), was shifted to the authority of the regional directors of the Ministry of Agriculture, together with the corresponding staff and revenues. For a profession which was used to live and be ruled in a vertical and endogamic way (that is by directors of the same profession), this was a big shock.

At the central and regional level, the public foresters were also still in the process of learning how to move from a secular posture of direct interventionism in public and communal forest towards a posture of incentive regulator of private forestry. The "Forest Action Programme" co-funded by the EU, which ran from 1986 to 1993, was the first major programme requiring this new kind of posture. So, in the mid 1990s, the public foresters were just coming out from this new experience.

[32] This chapter is taken from Mendes (2004a, 2004c).

They were also facing the failures of some "command and control" regulations on private forestry. One of them is related to the implementation of two decrees of 1988 (Decrees N.º 172/88 and 174/88) requiring private forest owners to report lopping and felling of individual trees and trees in stands, rows, and hays to the Forest Services and to apply for a license to do the final felling. Through this mandatory reporting and licensing system which only applied to eucalyptus and maritime pine, the Forest Services could have a say in the orientation of private forest management. However, the outcomes of this legislation were not very significant, most of the lopping, thinnings and fellings in private forests continuing to be done outside the control of the Forest Services. This was a second unsuccessful trial of the same kind of legislation produced in 1927 (Decree 13658, of May 20, 1927).

The chapters of the Forest Policy Law of 1996 concerning the preparation and implementation of regional forest plans and the approval and monitoring of mandatory forest management plans for public, communal and private forests of a certain size are another attempt to set a new basis for that kind of "command and control" intervention in private forests, after the implementation failures of the legislation of 1927 and 1988.

Faced with an increasing risk of forest fire which was taking every year a heavy toll on the historical accomplishment of the Forest Services, namely the pine forests of Northern and Central Portugal, the agency was complaining, for a long time, against the lack of professional training of volunteer fire fighters in the local fire departments to whom was legally committed the responsibility of extinguishing forest fires. For that reason Forest Services were in favour of developing a network of professional fighters of forest fires, under their supervision, for the operations of preventive silvicultural works off the season of forest fires, and detection and first intervention, during the summertime. This was the furthest the Forest Services could go in terms of responsibilities in forest fire fighting, since it is a domain almost impossible to take away from the control of local fire departments and their supervising public agency, the Ministry of Internal Affairs.

There is still another domain where the Forest Services were loosing influence in the mid of the 1990s. This loss is very important because it was touching the very heart of the new mission to which they were switching: the shift from direct interventionism in public and communal forest to incentive regulation of private forestry, based on the design and management of public financial incentives. The Forest Action Programme (PAF) carried out from 1986 to 1993 was the initiation to this new mission. In this programme the Forest Services, at the central level, played the major role, both in the design of the programme, as well as in the review and approval of all the applications for funds. The public agency in charge of making the payments of the grants under the EU co-funded programmes for agriculture, forest and fisheries (IFADAP), in the case of PAF, was limited to this role of paying agency, the review and approval of applications being the responsibility of the Forest Services. However, gradually, in the EU co-funded programmes for forestry, happened the same thing as for the agricultural programmes: the role of IFADAP in the review and approval of the applications increased and substituted the Forest Services.

Finally a word about three other domains with important and increasing intersectoral connections to forest policy where the Forest Services had almost no say:

a) taxation policy under the direct responsibility of the Ministry of Finances: a kind of policy which was becoming more and more necessary as a complement to the grants in the EU co-funded programmes for forestry;

b) industrial policy under the direct responsibility of the Ministry of Economy: a kind of policy whose importance is obvious given the fact that a major pulp and paper group was still

under public control, and the needed modernization of the other segments of forest industries were dependent on regulations and incentives schemes designed and managed by that Ministry;

c) environmental and land planning policies under the responsibilities of the Ministry of Environment, the Ministry of Planning and Territorial Administration and the more than three hundred local city councils around the country.

This last point deserves a special note. In the end of the 1980s and beginning of the 1990s some legislation was produced setting environmental constraints on the plantations of fast growing species. At the same time there was a process of extending the network of areas to be protected for environmental reasons. In this process the Forest Services had no major participation.

A simple General Directorate, in the middle of a large Ministry of Agriculture, where agricultural issues normally had more priority, cut off from a vertical connection and hierarchical control over the public foresters at the local level, and with effective control over only very few of the major instruments of forest policy, the Forest Services were in a very weak situation to carry on their missions.

The forest industries

In the mid of the 1990s, besides the Forest Services, the forest industries were probably the other major stakeholder with effective influence in policy making. They also were in a mood of crisis, claiming for urgent changes in forest policy. Their main claim was that their competitiveness was at risk and that a major public commitment was needed, together with private investment, in order to reduce the costs and increase the supply of timber. In spite of the EU co-funded programmes supporting afforestation, the forest industries claimed that they were not enough.

A common factor unrelated to the conditions in the forest sector was affecting the competitiveness of these industries in the end of the 1980s and in the beginning of the 1990s. That factor was the orientation of the macroeconomic policy dominated by the convergence towards the economic and monetary union in the EU. This orientation led to a tight monetary policy and to the end of the variations in the exchange rates as a mean to gain competitiveness. Such policies had an initial negative impact in many export oriented activities such as the forest industries. The rates of self-sufficiency for all the products of these industries were declining since the end if the 1980s.

Coming now to the specific conditions of the forest sector, the segment with more problems in timber supply was the one based on pine. Since the end of the 1960s, due to the increasing risk of forest fires, the area of maritime pine was declining:

1293040 ha in 1968/78;

1252300 ha in 1980/85;

976069 ha in 1995.

The risk of forest fires was getting worse every year, destroying previous investments (public and private) made in pine forests and making almost unacceptable for rational forest owners any new investment. Throughout the 1980s and until mid 1990s the forestland burnt had almost always been far above the area afforested and reforested.

Cork production was not affected by the same problems as pine, but was suffering from a long period of low investment in the renewal of the existing stands and the creation of new stands. The last period of active public support to cork oak forests, besides the recent Forest

Action Programme co-funded by the EU, dated back to the 1950s. Therefore, many of the existing cork oak stands were old and dying. Another problem which was putting increasing pressure on the cork industries, leading them to pay more attention than before to cork oak silviculture, was the competition from cork substitutes in the manufacturing of wine stoppers. The main issue in this competition was the accusation that cork could generate chemical reactions likely to damage the quality of the wine. To fight against this type of attack the quality of raw material and the quality control throughout the entire productive chain of cork stoppers was of utmost importance. So it was the time for cork industries to seriously care about what was happening upstream, in cork oak silviculture: problems in the quality of cork had to be avoided, as well as shortages in the supply of cork leading to increasing prices which would put an additional burden in the competitiveness of the industry.

Even for eucalyptus whose area was growing steadily, there were some problems:

- the growth in pulpwood production was considered by the pulp and paper companies not to be enough to supply their demand in terms of quantities and prices needed to keep them competitive;

- some of the plantations made since the 1960s had low productivity and some had health problems due to their inadequate location;

- part of those plantations were reaching the end of their lifetime and needed to be replaced;

- faced with insufficient timber supply, there were situations of overcutting which should be prevented;

- having rested for many years without significative competition from abroad, in the beginning of the 1990s, the pulp and paper industry was facing, for the first time, serious competition from Latin American countries;

- the pulp and paper industry was also uneasy with the role given to the local city councils in the process of licensing the eucalyptus plantations, a situation created by some legislation from the end of the 1980s putting some restrictions in the expansion of fast growing species.

A sign of the conjunctural problems of the pulp and paper companies was that, for the time, they were importing significative amounts of eucalyptus pulpwood.

The forest contractors

Forest contractors were new players in the field of forest policy. They were almost non existent until the beginning of the 1980s when the first major programme of afforestation of private lands came up funded by the World Bank. They developed with the next programme (Forest Action Programme) which was the first co-funded by the EU. Driven by the possibilities open by these programmes, especially the second one, new firms of forest contractors appeared. Many of them overinvested in heavy equipment and did not always had a wise management. To make things worse, they often played the role of providing short term credit to the forest owners, since they only got paid of their work when the forest owner received the public financial incentives, that is, after the plantations and other silvicultural operations were done. Since the payments of the grants to the forest owners were often subject to long delays, forest contractors were in financial trouble and some got bankrupt.

Private forest owners

For many years, private forest owners were not collectively organized, but since the beginning of the 1990s, this organisation finally got started. So they were becoming a new player in the forest policy debate. In spite of the gradual shift in forest policy, since mid 1980s, from a position centred on direct interventionism in public and communal towards a position of incentive regulator of private forestry, there was still a long way to go for changing secular habits and for filling in missing policy instruments needed to promote private forestry.

The international context

When the Forest Policy Law was approved and the NFP process was launched Portugal was in charge of the Liaison Unit of the Ministerial Conferences on the Protection of Forests in Europe, leading to the organisation of the Lisbon Conference in 1998. This international context was certainly a supporting factor for a new forest policy law and for the start of a NFP process, which is explicitly acknowledged in the introductory chapter of the final version of PDSFP. In this context of change of forest legislation in Europe and in other parts of the world, Portugal could not show, as its last comprehensive forest law, something dating back to the beginning of the XXth century, patched with several layers of partial, and not always consistent, legislation.

Another important feature of the international context with an influence in forest policy is the fact that the country had (and still has) access to the EU structural funds that were being allocated to the forest sector. That was happening since the beginning of the accession to the EU, and there was hope in the government that such source of funds could continue. The utilization of these funds required the definition of targets, measures funded and policy instruments. The Forest Policy Law and the NFP provided a definition of such kind of policy elements.

Main initiatives

A sign of the feeling of crisis and urgency for changes in forest policy is the appearance of several initiatives commissioning proposals for new policies to groups of independent experts and persons who had responsibilities in major public and private institutions related to forests. The reference list at the end of the text includes four reports prepared in this period:

a) the first one, in order of appearance, was commissioned by the Secretary of State of Agriculture, in 1992, to a group of persons who had high responsibilities in the Forest Services, in the forest owners' associations and in forest industries (Mota *et al.*, 1993);

b) the reports produced by the Monitor Company of Michael Porter and the working groups organized within the framework of the Forum for Competitiveness;

c) a report commissioned by an investment bank in 1996 (BFE, 1996);

d) a report commissioned to another bank by the main companies in the panel and in the pulp and paper industries also in 1996 (BPI *et al.*, 1996);

d) the fifth report in the list came from a working group related to the Ministry of Education in charge of making proposals for improving the linkages between higher education and enterprises in the forest sector, but went beyond this mission by providing a more comprehensive coverage of the sector than the other reports, in terms of economic importance of its different activities (forestry, forest industries, education and research) and products (wood and non wood forest products and services), as well as the main problems they were facing, with possible solutions to cope with them (CESE, 1996).

The Forest Policy Law of 1996

The mid 1990s were a time when a movement for forest policy reform seemed to be starting with the approval, by unanimity, in the Parliament, of a new Forest Policy Law, on August 17, 1996. This was a comprehensive frame law covering all types of forests, in the following domains:

a) definition of policy objectives in line with the concepts of sustainable forest management and a National Forest Programme;

b) specification of the types of actions to be supported by public policy (forest planning at the regional and the forest management unit levels; improvement in forest land ownership structure and support for associations of private forest owners; support for afforestation and improvement of existing stands; prevention, detection, and fighting of forest fires; protection against other risks to forest resources);

c) definition of the types of policy instruments to support those actions (regulations, participatory mechanisms, financial incentives, technical assistance and support to forest owners' organisations, support for research and training).

The last pieces of legislation of equivalent scope dated back to the beginning of the XXth century (decrees of the Forest Regime of 1901, 1903 and 1905 and the Decree N.º 13658, of 1927).

Legal nature of the law

The Forest Policy Law of August 17, 1996 (Law N.º 33/96) is a frame law. This means that it is a piece of legislation approved by the Parliament containing, in general terms, guiding principles and goals for policy, actions for public regulation and support consistent with those principles and goals and types of policy instruments to carry on those actions. The implementation of such kind of law is pending on decrees to be approved by the Government specifying, with appropriate detail, the measures and policy instruments. The law established a horizon of one year for the accomplishment of these complementary pieces of legislation which was not respected.

Principles and goals

One way to summarise the first four articles of the Forest Policy which make up its first chapter dealing with the principles and objectives of forest policy is as follows:

- the objective is sustainable forest management;

- who establishes the norms defining what is sustainable forest management and how it is regulated is the State;

- those responsible for forest management in accordance with those norms are the forest owners;

- the State has to play its regulatory role with the participation of forest owners and other relevant stakeholders, as well as with the contributions of science and in harmony with the international commitments of the country in the domain of forest policy.

The explicit reference to sustainable forest management and to the public goods provide by forestry as a case for public regulatory intervention pays tribute to the terminology and issues in fashion in the modern forest policy debates. However, they are not a fundamental

innovation in Portuguese forest legislation. In fact, without using the term "sustainability", but with expressions leading to the same meaning, the forest laws of the beginning of the XXth century made exactly the same case for public intervention in forestry. Those laws did not put the same emphasis on participation, but they did not forget to mention the important role that should be played by forest owners' associations and the duty of the State to strengthen their capacities.

Actions for public intervention

In its chapter II, the law defines five major areas for public intervention in forestry:

- forest planning at regional level (PROFs-*Planos Regionais de Ordenamento Florestal*) and at the forest management unit level (PGFs-*Planos de Gestão Florestal*) under the supervision of Forest Services;

- improvement in forestland ownership and management structures, especially through associative organisation of forest owners;

- afforestation, reforestation and improvement of existing stands;

- protection and promotion of non wood forest products and services;

- protection of the forest resources, especially against the risk of forest fires, but also against other types of risks.

Again, there is not here any major innovation compared with the forest laws of the beginning of the XXth century, with possibly one exception: mandatory forest planning at the forest management unit level for private forest holdings beyond a certain size. The law of 1996 maintains the principle of making this planning mandatory for all public and communal forests, as was the case for the laws of 1901, 1903 and 1905. Where these old laws had a more loose control and actually failed to impose that kind of regulatory role of Forest Services was on private forestry. This forest policy law is another attempt to cope with this failure.

The writing of the law is not well organised in terms of putting together, in the same chapters, principles and objectives, actions for public intervention and policy instruments. For this reason there is mention of actions for public intervention scattered throughout the remaining chapters of the law. For its importance, we will pick up one of them included in the last chapter referring to the actions deserving priority in forest policy. It is a set of measures aiming at protecting the forest against the risk of forest fires:

- improvements in the system of prevention, detection and support to forest fire fighting;

- increase in the number of brigades of forest sappers (professionals specialised in doing preventive silvicultural works and operations of detection and first intervention in forest fire extinguishing).

Brought to the top of the list of actions deserving priority in forest policy, together with other actions in the area of protection of forest resources, one may see here an inflexion point in the priorities of Portuguese forest policy dominated until that time by the expansion of forest land, with very few resources allocated to fire prevention.

Policy instruments

Command and control instruments

The forest planning instruments mentioned above are the main types of regulatory instruments the law put in the hands of the Forest Services (or "National Forest Authority" as stated in the law):

- this agency is responsible for the preparation of the regional plans;

- the Forest Services are also responsible for the approval and monitoring of the plans at the forest management unit level.

Thinking about the Forest Services, but not mentioning them yet explicitly, the law establishes the principle of unity of command in forest policy, by using the expression of a "National Forest Authority". This authority is also responsible for the management of public forests.

To reassert the weakened authority of the Forest Services on the ground, the law, in its last chapter dealing with prioritary actions, makes reference to the enforcement of the forest police.

Intersectoral coordination mechanisms

In order to promote intersectoral coordination of public policies related to forestry, the law established a Interministerial Commission for Forest Affairs presided by the Minister of Agriculture, Rural Development and Fisheries.

This is certainly an innovation, but its effectiveness was dependent on the capacity of the Minister presiding this commission to bring in his colleagues of the other concerned ministries and get them effectively committed in really intersectoral policies. That was an enormous challenge to which this law, by itself, was not able to respond effectively.

Participatory mechanisms

In order to create a space for organised participation of the different public and private stakeholders concerned by forest policy the law established a Forest Advisory Council presided by the Minister of Agriculture, Rural Development and Fisheries.

This is another institutional innovation, but its effectiveness was limited by two factors:

a) it was not appropriately complemented by effective participatory mechanisms at other levels (regional and local);

b) being a council at the national level and the only one of this nature in forest policy making, there were two risks:

- a long list of stakeholders claiming a seat in the council, some of them being irrelevant for forest policy making;

- fight between different organisations competing for the national representation of a group of stakeholders.

Support for research

In terms of research, the law defined three orientations:

a) research capable of promoting sustainable forest management;

b) decentralisation of research in order to improve the linkages with forest education, and end users;

c) participation of end users in the definition of research needs.

Technical assistance and financial incentives for forest owners' associations

The law sets the principle of participation of forest owners' associations in forest policy making, and elects them for public support through different means to be specified in future legislation.

These organisations were not forgotten in the forest legislation of the beginning of the XXth century. However, this was a statement which was not effectively followed through until the 1990s. So, it is fair to say that we have here an important innovation in Portuguese forest policy, certainly conditional on the specification and effective implementation of the corresponding policy instruments.

A sign that the public support to these organisations was considered of high importance by the legislators is that it is included in the list of prioritary actions defined in the last chapter of the law.

Financial instruments

The chapter on financial instruments is the main innovation brought about by this law. This innovation happened in two domains:

a) in the area of the public sources of funds for forest development;

b) in the area of types of financial incentives to forestry.

Starting from this second issue, the law broadened the set of financial incentives to forestry which, in the existing EU co-funded programmes, was limited to grants. The types considered in the law are the following:

- financial incentives of unspecified nature for (re)afforestation and stand improvement;

- soft loans for improvements in land ownership structure;

- compensations for constraints imposed on private forest owners for environmental protection purposes;

- tax incentives;

- insurance.

The explicit mention of compensations for environmental services provided by forests and the inclusion of tax incentives especially tailored to promote private investment in forestry are important innovations in Portuguese forest policy, again conditional on the specification and effective implementation of the corresponding instruments.

Coming now to the sources of public funds for the set of incentives mentioned above, the law introduced another very important innovation at a time where public finance of forestry was very heavily dependent on foreign resources. The innovation is the creation of a "permanent" Forest Fund. The law put off to its implementation decrees the specification of the sources of funds for this new policy instrument, as well as its mode of governance. In spite of this limitation, the fact is that, for the first time in Portuguese forest policy, the principle was set for the existence of a national mechanism, with permanent nature, to finance a broad range of actions fundamental for forest development:

- afforestation and reforestation;

- improvement of existing stands;

- protection of forests against the risk of forest fires;
- payment of forest environmental services;
- financial and technical assistance to forest owners' associations;
- improvements in forestland ownership structure;
- research.

Implementation of the law

Command and control instruments and intersectoral coordination mechanisms

Almost all the policy instruments established by the Forest Policy Law were implemented behind schedule, that is, more than one year after August 17, 1996. However, looking at the six groups of instruments presented above, the command and control instruments are those where the Forest Services felt easier to push ahead.

On April 30, 1997, still within the one year delay for the approval of the implementation decrees of the Forest Policy, it was published the decree (Regulatory Decree 11/97, of April 30, 1997) awarding the status of "National Forest Authority" to the Forest Services (DGF-*Direcção Geral das Florestas*). This status was reasserted by another decree of the same year (Decree N.º 256/97, of September 27, 1997). Some days later, came up the decree establishing the Interministerial Commission for Forest Affairs (Decree N.º 276/97, of October 8, 1997).

The Forest Services (DGF) also had the internal capacities and will to push forward the legislation regulating the regional forest plans (PROFs) and the forest management plans (PGFs), which finally was published in 1999 (Decrees N.º 204/99 and 205/99, of June 9, 1999).

These pieces of legislation did not make substantial changes in the effectiveness of the "command and control" capacities of the Forest Services. Their status of "National Forest Authority" did not restore the old situation of vertical control of the Forest Services over the foresters working at the local level, within the regional services of the Ministry of Agriculture. Concerning the capacities for control and coordination other public agencies relevant for forestry and forest industries, the status of "National Forest Authority" and the existence of the Interministerial Commission for Forest Affairs left things very much as they were before, that is, the Forest Services continue to have almost no capacities for doing that intersectoral coordination. The other Ministries sent low rank representatives to the Interministerial Commission. Even in the management of the public incentives to forestry which were the main type of forest policy instrument of the time, the player with increasing power was IFADAP, and not the Forest Services.

Coming back to the regional forest plans and the forest management plans, the capacities of the Forest Services to push forward these instruments were almost used up with the approval of the corresponding legislation in 1999. The Forest Services were lack the resources needed to implement this legislation, that is, to do the technical work for the preparation of the regional plans and to set up the corresponding participatory mechanisms. So, without further resources, they were dependent on the initiative of the regional directorates of agriculture. Two of them made some steps to get those plans done (Algarve and Entre-Douro-e-Minho), but the others didn't. Since without regional plans, there is no legal frame for forest managements plans, these plans are still waiting for implementation.

Participatory mechanisms

With the Forest Advisory Council happened what was expected:

- a long delay to established the composition of the council due to conflicts among organisations conflicting for the representation of some stakeholders (private forest owner's, for example);

- some organisations suddenly trying to build up a representativeness in the sector which they did not have before, in order to claim for a seat in the council (agricultural cooperatives, for example).

When finally the composition was established, the Council was in conditions to hold meetings, but the few that took place until the Summer of 2003 did not discuss in depth any substantial piece of legislation, or forest policy.

Support for research

No major new incentive or institutional reform followed from the Forest Policy Law of 1996, in terms of research.

Technical assistance and financial incentives for forest owners' associations

During the Second Common Support Framework regulating the transfers of structural funds from the EU to Portugal for the period 1994-99, there was no specific incentive scheme for forest owners' associations. Also there was no major effort from the Forest Services to push for an alternative source of support, or for intensively assisting the efforts of private forest owners to set up their associations and get support from elsewhere. What was happening on the ground in terms of creation of forest owners' associations was being driven by organisations external to the Forest Services. The incentive schemes to which those organisations were applying were the existing ones for agricultural associations, or even incentive schemes managed by other ministries.

Some changes happened with the Third Common Support Framework (2000-2006) where the Secretary of State for Rural Development who ruled over the Forest Services made a serious effort to get included in the incentives schemes co-funded by the EU some specific ones for forest owners' associations, namely the funding of new local offices of existing associations to help them to have a better coverage of their territory and get closer to their members.

Another important event in this matter was a decree of 1999 (Decree N.º 179/99, of May 21) providing financial incentives, technical assistance and assistance in kind to forest owners' associations for the creation of brigades of forest sappers. This programme is nationally funded, and initially its management was the responsibility of the Forest Services. Later on, that responsibility was shifted to the Ministry of Internal Affairs where there were some funds available in the programmes related to forest fires. This incentive scheme is the accomplishment of one of the actions defined as prioritary in the Forest Policy Law. It was welcomed by all the stakeholders in the sector, in spite of the bureaucratic problems and delays in the channelling of the public incentives. It is certainly one of the major contributions of this period of forest legislation, for the following reasons:

a) with these incentives, many of the forest owners' associations were able to move on from the initial step of their existence where they were limited to technical assistance to their members in preparing the forest management plans and filling out the applications for financial incentives to forestry;

b) with these brigades, the forest owners' associations were able to have a visible and useful presence on the ground, taking care of the major threat to forest resources, with positive effects in terms of attracting new members and building up credibility among the population of private forest owners;

c) gradually a network of qualified professionals working in permanence in the forests to prevent the risk of forest fires was developing, filling in this important missing link in the system of prevention, detection and fighting of forest fires.

Financial instruments

Financial instruments are the area where the Forest Policy had been more innovative, but it also where the implementation gaps are more important. The door was open for the diversification of the existing types of financial instruments limited to the grants for (re)afforestation and stand improvements co-funded by the EU, but nothing happened in this area since the approval of the law. The Forest Services lack internal capacities to advance technical work in this matter needed to prepare the basis for new legislation. Also they were not sufficiently active in mobilizing external consultancy to fill in this gap. The openness of the Ministry of Finances to study and discuss these issues does not exist. The main technical work about the design of new tax incentives came from the report commissioned by the forest industries as a contribution for the National Forest Programme (BPI *et al.*, 1996). Elements of another report commissioned by the Forest Services to one university were included in the final document of the NFP approved by the government in 1999, but no implementation decree followed up from there.

The other major innovation of the Forest Policy Law in terms of financial incentives was the creation of a permanent Forest Fund. The final version of the NFP approved by the government in 1999 made an important step to advance the implementation of this fund by defining the principle that it was to be fed by the earmarking of taxes related to the environmental services provide by forests. Until the Summer of 2003 this principle was not put into practice.

The National Forest Programme of 1998

Main steps of the NFP process

The NFP process launched after the approval of the Forest Policy Law of 1996 represented the first major recognition by the Forest Services, since their creation in the 19th century, of the irreplaceable role of private forest owners and forest industries in forest policy making and implementation, as well as the need to update and consolidate the scattered and sometimes incoherent pieces of forest legislation, some of which dated from the beginning of the 19th century.

This process was perceived by the main private stakeholders as an opportunity to proceed to some kind of social contract with the public authorities on the concerted development of the forest sector. In the initial stages of the process there was a willingness on behalf of all the major public and private stakeholders to reconcile timber production and environmental protection, and agreement that there should be less direct intervention by public authorities, more capacity building in the forest owners organisations, less command and control regulation and more economic instruments, if possible with innovative incentives to

stimulate private forestry which is often of a small scale. In the initial stages of the process private stakeholders (forest owners organisations and forest industries) showed a willingness to accept new duties derived from the commitment to sustainable forest management and a willingness to pay part of their costs (BPI *et al.* 1996; BPI & Agro.Ges, 1997; Mendes 1997a, 1997b, 1998a). The hope was that a long-term commitment by the public authorities would follow not only with respect to general goals and operational targets, but also on the corresponding economic instruments.

This crucial phase of the NFP process took place between March 1998, when the Forest Services issued for public discussion a draft version (DGF, 1998a) of what was called the "Plan for the Sustainable Development of Portuguese Forests" (*"Plano de Desenvolvimento Sustentável da Floresta Portuguesa"* - PDSFP), and July 1998, when a workshop was organised by the Forest Services to discuss the compilation of the various contributions produced by interested stakeholders and to agree a final version of the plan (DGF, 1998b).

This phase of the NFP concluded with approval by the government, in April 1999, of the final version of the PDSFP prepared after the July 1998 workshop (DGF 1998d). The document contains the consensus reached on policy goals and operational targets and an indication of policy instruments, including some innovative economic instruments (Forest Fund and forest taxation), but it failed in one significant respect: there was no credible long term commitment from the public authorities about the public contribution to the increased costs that forest owners would incur in order to achieve the agreed targets. In fact, the document approved by the Council of Ministers, despite proposals from some major private stakeholders, had no budget, this issue being deferred to negotiation with the EU authorities on the Regional Development Programme. So instead of a national and long-term social contract between the major forest stakeholders (forest owners, forest contractors and forest industries) and the rest of the society represented by the public authorities, where each side agreed to share the costs of increased social benefits from improved forest management, the discussion on funding was transferred to the negotiation of a short-term contract between the national public authorities and the EU public authorities. This fact killed the continued participation of private stakeholders in the process. We can say that after the spring of 1999 the process did not continue as a true NFP process by breakdown of trust between private stakeholders and public authorities.

Policy goals, operational targets and policy instruments

The general policy goals proposed in this draft of the NFP are picked from the 1996 Forest Policy Law. The derived strategic goals listed in the proposal are 33. We are not going to give here a exhaustive presentation of all of them, but simply pick some of the most relevant or innovative ones, in the light of what has been the forest policy in Portugal so far.

Improving the productivity of the existing stands

The Plan sets the following productivity improvement targets to be reached through the provision of new and reinforced financial incentives:

- improvement of 70000 ha of pine forests per year;

- raising the annual increment of the eucalyptus in 1 m3/ha/year until 2003, compared to the increment in 1983 and in another 1 m3/ha/year until 2008 compared to the 2003 increment;

- improvement of 20000 ha of cork oak forests per year;

- improvement of 5000 ha of holm oak forests per year;

- improvement of 2000 ha per year of other broad-leaved species;

- until the year 2005, conversion of all the degraded and badly located stands (15000 ha/year of eucalyptus, 1000 ha/year of Pinus pinea, 50 ha/year of chestnut trees and 3000 ha/year of maritime pine).

Expanding the forest area

To be reach through the provision of new and reinforced financial incentives, the Plan sets a target of 2% annual growth in the forest area for the next 10 years broken down as follows:

- 15000 ha/year of maritime pine;

- 2500 ha/year of Pinus pinea;

- 5000 ha/year of other conifers;

- 10000 ha/year of cork oak;

- 3000 ha/year of holm oak;

- 3000 ha/year of other oaks;

- 2000 ha/year of chestnut;

- 2000 ha/year of high quality broad-leaved species.

Improving the protection against forest fires

The plan sets the following fire protection target to be achieved through better forest management and improved co-ordination among all the services involved in fire prevention and fighting: a 20% reduction in the burnt forest lands in the period 1998-2003, and a 50% reduction in the period 2003-2008 compared to the period 1992-97.

Building forest management capacity

The plan sets the following targets to be reached by the year 2003 through the provision of new and reinforced financial incentives the regional forest management plans:

- a 200% growth in the number of members of the forest owners´ associations;

- the forest owners´ associations cover 25% of the counties;

- 10% of the timber and cork sales go through the forest owners´ associations;

- a 20 to 30% increase in the timber sales due to direct negotiation between the forest owners´ associations and the logging companies;

- 10 teams of firemen in the forest owners´ associations;

- a 100% growth in the turnover of private and co-operative forest companies;

- 100 extensionists assisting the forest owners´ associations and the set up of grouped forest management units;

- 10 communal forests with at least one permanent forester in charge of forest management;

- 300 forest management plans at the forest management unit level covering an area of 250000 ha;

- 500000 ha managed by the public forest management company under forest management plans;

- all the subsidised forest investment above a certain area is carried out under forest management plans.

Building capacity in the forest related services

The plan sets the following targets to be reached by the year 2003 through the provision of new and reinforced financial incentives, training, technical assistance, certification, competitive bidding and improved public information:

- 10% of the forestry contractors have a level III technician;

- 30% of the forestry contractors attend training courses;

- 30% of the timber harvesting is done by using new equipment;

- there are tests and appropriate information available on all the new logging equipment on sale in the market;

- 20% of the forestry contractors are certified;

- the forestry contractors follow the 1997 ILO occupational safety and health code for forest workers;

- forest works are paid at the same level as farm workers;

- only roundwood non suitable for sawmilling is delivered to the pulp paper and panel companies;

- 20% decrease in the forest investment costs due to improved public information on these costs and competitive bidding;

- 50% of the forest projectors attended specific training courses;

- prize awards to the 10 best forest projects;

- 50% of the forest investment projects getting public subsidies are inspected by special audits.

The Plan expects 20% productivity gains in the forestry contractors' work by the year 2008.

Creating a Sustainable Forest Management certification system

By the end of 1999 the Pan European Indicators of Sustainable Forest Management at the Forest Management Level are tested and adapted to the Portuguese conditions.

By the year 2000 a national certification system is in place.

The regional forest management plans incorporate the monitoring systems needed for certification.

Protecting biodiversity

The plan sets the following targets to be reached by the year 2003 through the provision of new and reinforced financial incentives, training, and norm setting:

- 20% of the forest projects include mixed stands;

- 100% of the forest projects protect biodiversity;

- 10000 ha/year of private forest projects protecting habitats with high environmental value;

- all the forest contractors follow a code of environmentally friendly practices.

Innovating financing

Following up on the statement of the 1996 Forest Policy Law for the creation of a permanent forest fund to finance forest investment and management and compensate forest owners for positive externalities, the Plan proposes the following sources of financial resources for this fund:

- a new tax or a share on the corporate income tax paid by the water and electricity power companies;

- a new tax on the carbon emissions by polluting companies;

- 1% of the proceeds from the tax on fuel and gas;

- bonds;

- philanthropic contributions.

The Plan also announces tax incentives for forest owners not yet fully specified.

Consolidating forest legislation

The Plan announces for 1999 a Forest Code updating and consolidating all the scattered forest legislation.

Other goals and targets

The plan also sets an extensive list of goals and operational targets regarding the enhancement of the protective role of forests in terms of soil and water conservation, the contribution of forests to the global carbon cycles, the protection of forest resources against airborne pollution and biotic agents, the integration of forest planning with the wider land use planning, interdisciplinarity and improved co-ordination of forest research, development of the forest industries, commercial promotion of forest products, enhancement of the recreation use of forests and improved management of non timber forest production, including gaming and fishing.

Implementation of the NFP

Current status of the NFP process

As a NFP, the forest policy process, since 1999, has seen virtually no public participation and intersectoral coordination. For example:

- the Forest Consultative Council met only twice and discussed no substantial matters;

- the Interministerial Commission for Forest Affairs met only a few times, with all ministries, except the Ministry of Agriculture, nominally represented by low rank officials;

- only the command and control instruments (PROFs) have made some move ahead, but very slowly (no PROF is ready yet, but some are in preparation) and with insufficient public participation and intersectoral coordination;

- innovative economic instruments (such as the Forest Fund) remained at "ground zero" in terms of practical implementation, and even in terms of public discussion until the aftermath of Summer 2003 forest fires.

Supporting Factors

Political culture

After almost 50 years of an authoritative political regime and a longer tradition of highly centralised government, the political culture in the country is not the best environment for a NFP process. However, the arrival of democracy in 1974 made possible free speech and free association, which are indispensable pre-requisites for a NFP.

Private institutions

With increasing reason in a country where only 1.2% of the forest area is fully public, and where there is an important economic base of export-oriented forest industries, the collective organisation of private forest owners and forest industries is an important pre-requisite for a NFP process. Partly due to the nature of the political regime that was in place for almost 50 years, together with the heterogeneous structure of the forest sector – there are three major species, each very different in terms of the economic organisation of its production, manufacturing and trade – such an organisation has taken some time to build up.

However, the first half of the 1990s happened to be a fructuous time in this matter for three reasons:

a) Forest owners' organisations (associations and cooperatives) finally start to grow in numbers, in membership and in technical capacity, in spite of a lack of unified representation at the national and international level;

b) Private forest contractors animated by the afforestation programmes co-funded by the EU structural funds also became a voice in the forest policy arena, unified in an active national association;

c) The associations of the pulp and paper industries merged into one, as did the associations for the woodworking industries.

Public institutions

In the mid-1990s the public agencies most directly involved with forests were in a situation of "identity crisis", not necessarily unfavourable to a NFP process. What happened was a governmental decision of June 1996 which transferred most of the human and material resources of the General Directorate of Forests (DGF) at the local and regional level to the Regional Directorates of the Ministry of Agriculture. The intention was to promote an integrated action of foresters, agricultural engineers and veterinarians of the Ministry of Agriculture, working on the field to assist farmers and forest owners, who often are the same persons. The major change for the DGF was to loose its centralised and hierarchical control over the local and regional offices, which for many years had been in charge of managing the public forests and most of the communal forests.

The DGF, with much less direct and operational responsibilities on the ground and while painfully adjusting to its new responsibilities, had to turn more to forest policy making and to building bridges with the private stakeholders. The NFP process launched in 1998 was an outcome of this situation.

The foresters remaining in the Regional Directorates of Agriculture had to undergo an adjustment process to the new chains of command while the regional directors of agriculture had to adjust to new responsibilities in forest management to which they were not accustomed. It is fair to say that this merger of the two agencies at the regional and local levels is still not fully completed everywhere. The preparation of the PROFs is the process through which that integration process may finally progress, providing foresters in the regional services with new missions and possibly new motivations.

Laws and regulations

The approval of the Forest Policy Law in the summer of 1996 was a major pre-condition for the launching of the NFP process. Article 3 of this law clearly adopted some core principles of a NFP:

- multiple use and sustainable management of forests as the main goal of forest policy;
- participation;
- intersectoral coordination and conflict resolution schemes;
- commitment to the international forest policy dialogue.

As a frame law, the Forest Policy Law should be followed by the translation of its principles into operational targets and policy instruments. The NFP process could deliver that.

The NFP process could also respond to the criticism made so many times to the public authorities about a “lack forest policy”, and it could provide a coherent and updated code of forest legislation for a country with a "forest vocation" and an active presence in international markets and institutions related to forests.

International context

When the Forest Policy Law was approved and the NFP process was launched Portugal was in charge of the Liaison Unit of the Ministerial Conferences on the Protection of Forests in Europe, leading to the organisation of the Lisbon Conference in 1998. This international context was certainly an important supporting factor for the NFP process which is explicitly acknowledged in the introductory chapter of the final version of PDSFP.

Financial incentives

Another supporting factor for the NFP process, also explicitly acknowledged in the introductory chapter of the final version of PDSFP, was the fact that the government had to negotiate with the EU authorities a Regional Development Programme for 2000-2006 which included forest development incentives. To engage in such negotiations it was clearly preferable to have a coherent set of goals and operational targets, if possible backed by a consensus built with the major stakeholders in the forest sector.

Trends in forest resources

Trends in forest resources were an important supporting factor in the pre-NFP period. Considering the three major species, the main facts relevant for this matter are the following:

a) In the period 1987-93 the average forest area burnt was 55602 hectares per year, which is more than twice the area of afforestation supported by public incentive schemes.

b) The species most affected by forest fires was pine, with a sharp drop in its area from 1252300 hectares in 1980 to 976069 hectares in 1995.

c) Cork production was not affected by the same problems as pine, but was suffering from a long period of low investment in the renewal of the existing stands and the creation of new stands, as the following figures on cork extraction clearly show:

1959/67: 221111 ton/year

1968/76: 198111 ton/year

1977/85: 155756 ton/year

1986/94: 152044 ton/year

d) Even with eucalyptus, the most dynamic species in the Portuguese forest sector, there were some problems on the horizon (the need to renew about one third of the existing plantations, as well as the need to relocate some plantations installed in inappropriate places), together with claims by the industry of a short supply of pulpwood requiring an unprecedented resort to imports.

Impeding factors

Political culture

The instauration of a democratic regime in 1974 with all its benefits in terms of conditions for participation in policy making is not in itself enough to eliminate the consequences of decades, even centuries, of authoritarian regimes and centralised modes of governance. Furthermore, within the central government and at the local levels of the public administration there is no tradition of effective intersectoral coordination of public policies.

The internal structure of the ministries usually changes when the minister changes. The areas of responsibilities of different ministries sometimes overlap. Often the regional divisions of different ministries do not match. Also an increasing number of public authorities at the central and local levels want to have a say on forest related issues, in an often incoherent way. This is further complicated by the fact that there have been no spaces where these conflicting claims at the local, regional and national levels can be stated, discussed and harmonised.

Private institutions

In spite the important steps towards the collective organisation of the major private stakeholders in the forest sector accomplished in the pre-NFP period, the capacity of these organisations when the NFP process was launched was still fledgling. The technical capacity of most of private institutions in terms of forest policy formulation was poor and in some cases like the forest owners' associations it was impossible to build up a strong and unified voice at the national level.

Hence it is no surprise that the NFP process initiated in Portugal in 1998 was essentially a central agency-driven process with moderate levels of participation and intersectoral coordination.

Public institutions

For many decades the Forest Services focused most of their activities in the direct management of public and communal forests. Until they lost most of those responsibilities in 1996, they did not build sufficient technical capacities to gradually switch their activities to forest policy making and to the support of private forestry, very much needed especially in regions with small scale forestry. So when the NFP process was launched the staff in the central office of the Forest Services were just beginning to learn and adjust to these new roles, without great difficulties to leave aside the "command and control" approach of the authoritarian political culture.

The same happened with respect to the foresters left at the local and regional levels within the Regional Directorates of Agriculture. Here an additional complicating factor was that these professionals were often put under the supervision of non-foresters. This situation of "identity crisis" often worked against the motivation of foresters in the public administration to contribute to the NFP process.

Financial incentives

The possibility of Portugal having access to substantial transfers of EU structural funds, including for the support of forest development, is having a perverse effect as far as a NFP process is concerned. If such funding sources did not exist, private and public stakeholders would have to rely on a social contract within the national borders to share the costs of achieving sustainable forest management. Since, for the moment, the country has access to substantial amounts of EU structural funds the pressure to move towards such a social contract is lower. The government has used the possibility of access to EU money within the III Common Support Framework to fund some of the actions proposed in the. The big problem here is that the private stakeholders don't what is going to happen to these incentive schemes after 2006. This sent a bad signal to the private stakeholders who understand this to mean a lack of long term commitment by the public authorities to share the costs of sustainable forest management.

Heterogeneity of the forest sector components

The forest sector (forestry, forest industries and related industries and services) has a great importance in the Portuguese economy:

- with 2.9 % of the GDP in 1998 and 4.3 % of the workforce in 1995, it is one of the top three clusters in terms of value added and employment, together with textile and clothing industries, agriculture and food industries;

- with 11 % of the exports, it is the fourth major exporting sector.

Although important in the aggregate, the forest sector has a heterogeneous structure which makes it difficult to co-ordinate public policy and to achieve strong and unified representations of private stakeholders, especially of forest owners. In fact the sector is split into three key forest products that are very different from each other in terms of forest production and market structures: pine wood and the woodworking industries (sawmilling, carpentry, panels and furniture); pulpwood and the related pulp, paper and board industries; and cork production and the cork industries. There are important differences between these three components in terms of ownership structure and forest management:

- in pine, communal forests represent 11.9% of the total area, while non- industrial private forest owners often with small holdings represent 84.2%;

- in eucalyptus, non-industrial private forest owners represent 69.9% of the total area, and pulp and paper industries 28%;

- in cork oak, non-industrial private forest owners often with large holdings represent 96.8% of the total area.

Finally, within each segment of the forest industries there are substantial differences in terms of business structure:

- small and medium-sized firms dominate in sawmilling, carpentry, furniture, preparation and transformation of cork, manufacturing of paper and board products;

- big firms dominate in the pulp, paper and panel industries.

Participatory Mechanisms

Stakeholder participation during the planning and evolution of the NFP

During the preparation of PDSFP, that is from January 1997 until November 1998 when the Forest Services handed to the government the final version of this document, the mechanisms for stakeholder participation put in place by that public agency were the following:

a) Organisation of workshops open to a wide audience of all concerned stakeholders;

b) Smaller informal meetings at DGF offices with experts and some stakeholders at the request of the Forest Services, or at the request of the concerned stakeholders to discuss specific proposals to be included in PDSFP;

c) Circulation of a draft version of the PDSF in March 1998 in written and electronic formats to collect contributions from interested stakeholders.

Concerning the workshops mentioned in a), there were two. The first was held in Tróia (30 January to 1 February 1997) focused on the steps to be taken to establish the implementation decrees for the 1996 Forest Policy Law (DGF, 1997a). The second workshop held in Tomar, in July 1998, analysed the draft version of PDSFP which incorporated contributions from the earlier public discussion phase of that document (DGF, 1998b).

The first workshop involved presentations from keynote speakers invited by the Forest Services about each of the specific chapters of the Forest Policy Law. The second workshop was organised with plenary sessions and smaller working group discussions on thematic areas. It focused on the contents of the PDSFP and aimed to come to a consensus among concerned stakeholders on conflicting issues included in this plan.

This stage of the NFP process proved that such a process, which had not been undertaken before in Portugal, could not only be initiated, but could also count on the interested participation of all the main stakeholders concerned about forestry. Even though this participation did not go very much beyond the groups of stakeholders traditionally more concerned with forestry – such as forest owners associations, forest contractors, forest industries, foresters and other forest professionals, forest researchers– it nonetheless proved that some constructive steps could be undertaken to bring in other relevant groups, such as environmentalists.

The process proved that some consensus could be reached among major concerned stakeholders. Finally the process proved that participation could be an effective way to introduce new ideas to forest policy and forest legislation.

One example of how this happened relates to innovative financial instruments, namely the Forest Fund defined in the Forest Policy Law of 1996.. Some proposals were made during and right after the discussion and approval of that law (Mendes, 1996, 1997a, 1997b) about what resources should feed in this fund. Basically these proposals advocated the earmarking of existing taxes related to forest environmental services. These proposals were supported by technical advice provided to the Forest Services by a World Bank expert who had good knowledge of the Coast Rica case. However, other expertise commissioned by the Forest Services to the Economics Department of the New University of Lisbon (Baganha, 1998) was critical of those proposals. The discussions during the July 1998 meeting in Tomar were crucial in turning the tide in favour of either the earmarking of the resources for the Forest Funds or some other stable connection between the Forest Fund and existing taxes related to the environmental services provided by forests. So it was this type of proposal that finally was built in the version of PDSFP approved by the government in April 1999. Unfortunately this new policy orientation was left in the laws of the country without effective implementation until the aftermath of Summer 2003 forest fires. The public discussions on this subject (Mendes, 2003b, 2003d, 2003e) and the reforms promised by the government after that tragic event finally brought about concrete decisions to implement the Forest Fund. We will turn to the specifics of those reforms later on in this chapter.

Stakeholder participation since the start of the implementation process

Article 3 of the 1996 Forest Policy Law defines seven guiding principles, three of which concern participation, negotiation and conflict resolution:

- "strategic cooperation: the participation of the different social, professional and socio-economic groups in the definition and implementation of forest policy should be promoted and animated by the competent bodies of the central, regional and local administration;

- social responsibility: citizens should participate in the establishment of the goals of the forest development policy, in the respect of the economic, social, environmental and cultural values of forest and the associated natural systems;

- intervention and mediation: the authority responsible for the implementation of forest policy should standardize, monitor and provide information for the activity of the stakeholders, as well as reconcile the different interests in presence, arbitrating the conflicts resulting from that implementation".

The institutional framework to organise participation at the national level according to that law is the Forest Consultative Council, a new body to be created under the presidency of the Minister of Agriculture, Rural Development and Fisheries and made up of representatives of the different stakeholders in the forest sector. The 1996 Forest Policy Law only determined the creation of this body as an advisory council assisting the government in forest policy matters. It did not specify important issues for its establishment, namely its composition. This aspect was the first stumbling block to establishing this council. Lack of unified representation at the national level of some key stakeholders such as the forest owners' associations made it difficult to quickly reach a politically accepted compromise about that composition. That compromise was finally reached, but when the council met for the first time the government in place did not last for much longer. So no substantial discussions and political commitments actually took place in the initial meeting. Since then the council has met only one more time, in 2003, with a new government in power, but still with no substantial items on the agenda.

At the regional level organised participation in forest policy making can take place within the Regional Agrarian Councils, which are advisory bodies of the Regional Directors of

the Ministry of Agriculture where private stakeholders in the agricultural and forest sectors are invited to participate. In some regions these councils are broken into specialised sections, one of which is concerned with forestry.

At the sub-regional level organised participation in forest policy making can take place within the Follow Up Commissions accompanying the preparation of the Regional Forest Management Plans by the Regional Directorates of Agriculture and where the stakeholders concerned by the geographical area covered by each of these plans have a seat.

Participation at the local level can take place within the Specialised Commissions for Forest Fires presided over by the mayor of each municipality and where firemen associations, forest owners associations, police authorities and other stakeholders concerned with issues related to forest fires prevention and fighting have a seat.

One can conclude from this short presentation that there is a lack of articulation between those four levels of organised participation. At the local level the leading authority in promoting participation is the municipality. At the sub-regional and regional levels the Regional Director of the Minister of Agriculture has this responsibility. At the level national it is the Minister of Agriculture with the close assistance of the General Director of Forestry.

At all four levels participation is impeded by the fact that forestry is an activity competing with many other issues in the busy agendas of the minister of agriculture, the regional directors of agriculture and the mayors. So these participatory bodies do not meet regularly and with sufficient political commitment.

Furthermore the authorities with a direct leading role at each level are different and there are no formal and effective channels of communication among them.

Finally participation tends to be very much centred on narrow forestry and silvicultural related issues, and on technical and command and control instruments, not reaching out enough to socio-economic, environmental and broader intersectoral coordination matters and to economic instruments.

Another implementation failure concerns the relationship between participation and science. In the participatory bodies public and private stakeholders often reduce their contribution to making political statements without enough supporting body of scientific knowledge and technical expertise.

In short, the participatory bodies have not yet been able to deliver enough substantial and innovative policy measures and a forest policy strategy with sufficient coherence, intersectoral coordination, sound scientific basis and strong political commitment. Instead they have been no more than fledgling first steps in a country and a public policy where participation was absent for many decades. More has to be done to progress towards effective and substantial participation.

Intersectoral Approaches

In its guiding principles the 1996 Forest Policy Law recognises forests as a resource to be managed in a "multiple use" way, with the support of public policies that should be "articulated with the sectoral policies for agriculture, industry, environment, taxation, and land use planning", and which should be fed by contributions from participatory mechanisms at the national, regional, sub-regional and local levels involving all concerned public and private stakeholders.

Intersectoral coordination encompassing private stakeholders has been dealt with in the previous section. Here we examine intersectoral coordination encompassing inter-ministry coordination.

For this purpose the 1996 Forest Policy Law established an Interministerial Commission for Forest Affairs to be presided by the Minister of Agriculture, Rural Development and Fisheries and including representatives of the different ministries concerned with forests. The commission was created and the ministries nominated their representatives, but the experience showed that, with the exception of the Ministry of Agriculture, Rural Development and Fisheries, other ministries sent low ranking officials and did not commit to serious inter-ministry coordination on forest affairs. The commission has met only a few times and has been ineffective in fulfilling its mission.

Many important opportunities and needs for this kind of coordination have remained unanswered since 1996. We will stress four of them concerning some of the major social benefits provided by forests.

One is the preparation and implementation of the National Plan for Climatic Change within the Framework Convention on Climatic Change. This process has been the responsibility of the Ministry of Environment, with some inputs requested from and provided by the Forest Services. However, the Forest Services' contribution has had some serious limitations, including a lack of scientific research that could have been prevented if demands from the public authorities had been made well in advance and matched with appropriate resources. The result is still unresolved doubts on the crucial point of whether or not Portuguese forests are a carbon sink. Furthermore an opportunity has been lost to link this process with innovations in the financing of forest development and concrete steps towards the implementation of the Forest Fund determined by the 1996 Forest Policy Law and the 1999 PDSFP.

Another outcome of insufficient inter-ministry coordination is the fact that public affairs related to the forest industries – including the preparation of the privatisation of the Portuguese pulp and paper industries, the provision of public incentives to support the modernisation of forest industries, capacity building in the forest industries' association and research projects for these economic activities – are channelled mostly through the Ministry of Economy, with no major steps to articulate the necessary improvement in the management of private forests with the necessary improvement in the competitiveness of forest industries.

Another area where there has been insufficient inter-ministry coordination concerns non-forest activities that are heavily dependent on forest resources, namely water supply and rural tourism. Water is a major source of electrical power generation in Portugal and is crucial for domestic and industrial uses. Electricity markets are undergoing major structural changes in the Iberian Peninsula. The same applies to water supply, not only in terms of new infrastructure building, but also in terms of water pricing, water quality improvement and entrepreneurial structures for water management and supply. Even though in Portugal the quality and quantity of water resources are heavily dependent on forest management, the links between water management and forest management have only rarely been made.

A further activity crucial for the economy and increasingly dependent on proper forest management is tourism. It is well known that Portugal has a comparative advantage here due its attractive coastal areas, but also because of the demand for rural tourism. Landscape quality, including forest landscape, is a crucial resource to be managed and improved. Many times tourist business interests claim supportive public polices, and many times governments have responded to those calls. However, appropriate links to forest management improvements have

almost never been made, hence no practical concerted actions have been implemented in this area.

Finally intersectoral coordination concerns an issue of rising importance for Portuguese forests, namely the protection against the risk of forest fires. In the predominantly Mediterranean type of weather existing in most of the country, the more appropriate way to deal with this risk is through prevention because, once a fire starts, it spreads very quickly, making fighting largely ineffective, except for the protection of human lives and houses. Fire prevention is essentially a matter of improved forest management, namely through preventative silvicultural works reducing the accumulation of combustible materials to proportions with low probability of fire ignition. With rural emigration these types of works are more and more expensive for private forest owners. Therefore a major axis of forest policy to deal with forest fires should be to promote forms of collective organisation of private forest owners to carry out those works with some economies of scale and proper technical guidance and to provide to these owners some co-funding in order to lower the private costs of those works to levels compatible with their willingness to pay for the remaining part.

One positive step in this direction was taken in 1999 with a decree providing some financial assistance to forest owners' associations for the creation of brigades to carry out fire surveillance and preventative silvicultural works. The problem is that the status and future of these financial incentives have been uncertain, and many associations participating in this programme had insufficient capacities and resources to sustain the brigades, and opted out. The inadequacies of inter-ministry coordination concern the fact that the management of this programme has shifted between the Ministry of Agriculture, Rural Development and Fisheries, which was responsible for its conception but did not have the money to fund it, and the Ministry of Internal Affairs, which was responsible for the funding. Recently the bodies dependent on the Ministry of Internal Affairs and related to the coordination of fire fighting and civil protection (including fire prevention) were merged, with much criticism from the interests involved (firemen's associations and other stakeholders in this area), which added to the problems in the management of the programme.

Negotiation and Conflict Resolution

Instances for organised negotiation and conflict resolution of forest policy law making are the same as for participation. So the same analysis applies here as for section 4 on participatory mechanisms.

Long term iterative processes

The 1996 Forest Policy Law set a duration of one year after its approval for the necessary implementation decrees to be in place. That deadline was not respected. It was only in 1997 that the decrees were approved about the new roles and internal organisation of the General Directorate of Forests, as well as the establishment of the Interministerial Commission for Forest Affairs. In 1999 the PDSFP was issued as were decrees about the Regional Forest Managements Plans, but the preparation of these plans dragged on for three years, with the first being expected at the end of 2003.

1999 was also the year that decree was approved providing financial support to forest owners' associations to create brigades for preventative silvicultural works. The implementation of the Forest Fund had to wait until the aftermath of the huge forest fires of Summer 2003.

The PDSFP states in its final chapter that a monitoring and on going evaluation system would be established and a participation-driven revision of the plan within the framework of the Forest Consultative Council would be undertaken within two years. However neither monitoring and evaluation nor a revision of the plan has occurred.

This inertia can be explained due to a change in the political composition of the government and parliament responsible for the 1996 Forest Policy Law and the PDSFP. The current government and parliament have not scrapped the Forest Policy Law, which was approved with unanimity, and they continue to refer to the 1999 PDSFP which, in spite of incomplete implementation, has the strength of having been generated through participation and consensus-building among the major stakeholders in the forest sector.

However with respect to the implementation of the Forest Policy Law and the PDSFP the current government has adopted a "pragmatic" approach: instead of reinitiating and deepening the participatory process which led to the 1999 PDFSP, the Minister of Agriculture preferred to call a one day brain storming in his office with a reduced number of invited experts with no institutional representation in order to draw up an action plan for forest policy that would be financially and politically feasible in the short run. From that meeting, which was held in September 2002, and after some work done by the General Directorate General of Forests, the government approved in February 2003 the **"Action Programme for the Forest Sector"** (DGF, 2003). This document was the guiding plan for forest policy adopted by the government and the General Directorate of Forests until the big forest fires of Summer 2003 broke out. Because its preparation was not a participatory process, it is not surprising that the Action Programme did not gain the same commitment from private stakeholders as the 1999 PDSFP, even though it was intended as a follow up to the PDFSP. One clear sign and outcome of this lack of participation is that nowhere in the list of actors responsible for the eleven groups of actions around which the Action Programme is organised can one find private stakeholders. All the committed actions involve the public administration, mostly the Directorate General of Forests, followed by the Regional Directorates of Agriculture.

Synergies and Innovations

The main innovations brought about by the NFP process in Portugal between 1996 and 1999 are the following:

a) The NFP proved that when the public forest authorities make a serious and credible call to the private stakeholders for forest policy making they have enough institutions throughout the sector and beyond to listen to them and respond in a constructive way.

b) The process also showed that it is possible to introduce into the forest legislation some innovative financial mechanisms for forest development, something that has proved difficult in other countries undergoing processes of forest legislation reforms (Spain, for example)

c) Participatory and intersectoral coordination mechanisms have been created at the national level, even though they have been weak.

d) The NFP process also created a regional level of forest planning with accompanying participatory mechanisms.

e) A further relevant innovation to emerge from the process was the public financial support for forest owners associations, with the possibility of obtaining co-funding for technical capacity building and creation of brigades to carry out preventative silvicultural works.

The problem with these innovations is that they are only first steps. In some cases they have not been sufficient to result in implemented actions. In other cases they have been implemented, but in a very weak manner that risks reversal, as was illustrated in previous sections.

The Summer 2003 forest fires and their effects of forest policy reform

In the Summer of 2003, 423949 ha of forests and shrub lands burnt in Portugal which is 3,4 times the already high average of burnt area during the period 1998-2002. To partially compensate for the immense losses caused by this calamity, one positive result was to raise awareness among the population and public decision makers about the economic, social, and environmental importance of forests. The government in place was naturally responsive to these changing perceptions and, after the most immediate actions concerning the operations of fire fighting and relief to affected populations, announced a "structural reform" of forest policy going beyond the February 2003 "Action Programme for the Forest Sector". The main axis of this reform approved by a resolution of the Council of Ministers of the 31 of October of 2003 is the following:

a) raising the political profile of forest affairs in the structure of the government through the creation of a Secretary of State for Forestry, in the Ministry of Agriculture, with interministerial coordinating capacities in the area of forest fires prevention;

b) providing new financial incentives to improve private forest management through the following measures:

- implementation of the Forest Fund created by the Forest Policy Law of 1996 to be fed by resources coming from an additional tax on fuels, and proceeds from the management of public forests;

- tax deductions for forest investments;

c) raising the profile of command and control instruments acting on private forestry through the following measures:

- regulations for mandatory reinvestment of forest income of private owners in improved forest management;

- sanctions to private forest owners who leave their forests unmanaged or have incorrect forest management practices;

- mandatory unification of management of forest areas to be submitted to prioritary intervention due to high risk of forest fires.

It is too early to make a fair judgement of this set of announced measures. However, some tentative remarks can be made based at this early stage. First, concerning the long awaited implementation of the Forest Fund, its creation has been welcomed by the main stakeholders in the forest sector, especially the forest owners' associations. Some cautionary notes can be made at this point concerning some weaknesses in the solution chosen by the government:

- the solution raised some opposition because it consists in creating and new tax, instead of earmarking an existing one, in a context where the electoral promises of the government were to cut on taxes;

- by restricting the new tax to fuels instead of extending it to other activities concerned by forest environmental services, the government became exposed to the opposition of the strong lobby of transportation related activities.

Other alternatives for the implementation of the Forest Fund not suffering from this weakness had been proposed in the years and weeks before these decisions taken by the government (Mendes, 1996, 1997a, 1997b, 2003e), but they were not considered.

Now concerning the "command and control" orientations to improve forest management, they also may be confronted to high risks of implementation failures in a country where 93,4% of the forest area are privately owned and where the public administration has not a good track record and making its decisions to be fully respected. Probably the arenas where these orientations will be mostly discussed and attempted for effective implementation are the PROFs. Based on the examples of these plans that are available for public discussion at this point (the plans for the North-western region) they suffer from the following weaknesses:

- they go too much in detail and in mandatory impositions to forest owners in terms of the management options they have to make on their forests;

- they propose, but they cannot guarantee appropriate compensations for the increasing duties they attempt to impose on private forest owners;

- they set unrealistic targets and timetables in terms of forest area to be engaged in improved forest management.

Instead of this kind of posture by the public administration, what is advisable at this stage is to go for an experimental period of forest planning where high priority is given to capacity building and participation through the following actions:

a) increase the support the current process of collective organisation of private forest owners;

b) increase the support to develop bridges between these organisations and the institutions with training and research capacities;

c) take the PROFs essentially as arenas to create and develop concerted action at the regional and sub regional level between forest owners' associations, municipalities, fire fighting associations, regional forest services and other stakeholders, through mutual understanding, persuasion and cooperation, instead of bodies of implementation of "top down" mandatory regulations.

Certainly there might be some need for mandatory regulations and sanctions on some actions by careless for owners, but they are not, by far, the most needed axis of forest policy at this stage. The experience available on the ground with some existing forest owners' associations which are doing their job well is that private forest owners', large or small, are responsive to technical support services provided by institutions they can trust, capable to reach out to their goals and constraints, and based on this advice, they are willing to match appropriate public incentives with their own funds for sustainable forest management.

Annexes

Matrices for Social Cost-Benefit Analysis

Maintenance costs and benefits of wood, cork and pine nuts (without risk)

Years	Maritime pine		Stone pine		Other conifers		Cork oak		Eucalyptus		Chestnut		Total	
	Costs	Benefits	Costs	Benefits	Costs	Benefits	Costs	Benefits	Costs	Benefits	Costs	Benefits	Costs	Benefits
1987	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0	119000	0	0	0	119000	0
1990	0	0	0	0	0	0	0	0	344360	0	0	0	344360	0
1991	3526500	0	68500	0	14750	0	757200	0	671583	0	301800	0	5340333	0
1992	2298750	0	195750	0	15000	0	1071000	0	709364	0	195900	0	4485764	0
1993	1404750	0	164500	0	1371500	0	1566000	0	537806	0	628200	0	5672756	0
1994	1383625	0	79850	0	1071475	0	1495890	0	384757	0	605610	0	5021207	0
1995	1392975	0	70700	0	1153900	0	2092095	0	343867	0	997050	0	6050587	0
1996	3817775	0	127800	0	741325	0	1717440	0	433535	0	1078050	0	7915925	0
1997	3817048	0	1633105	0	494728	0	4619874	0	235850	0	1518150	0	12318754	0
1998	11373363	0	2567710	143850	2462808	0	8366681	0	87515	0	2227092	0	27085168	143850
1999	5758203	0	1620200	575475	1203398	0	7054847	0	82438	0	2077332	0	17796417	575475
2000	5051840	0	2246340	1000200	3620445	0	10434554	0	353985	5656784	3182130	0	24889294	6656984
2001	7337123	0	1549315	1296510	2743645	0	7308398	0	555549	8223728	3159216	0	22653246	9520238
2002	6632543	0	3102697	1597560	2788152	0	9250683	0	677384	11031323	3452919	0	25904378	12628883
2003	11251674	0	2190294	1910265	3504252	0	5739621	0	655795	4677245	3420204	1061330	26761840	7648840
2004	8012035	0	4979616	5163453	1948855	0	9766780	0	775067	1179784	3582921	688915	29065272	7032152
2005	11762534	0	7849557	10598713	5235164	0	11092260	0	871079	56449	3514371	1147840	40324964	11803002
2006	8259308	0	4116413	14181181	2837386	0	4787265	0	388359	1219150	3434979	379484	23823709	15779814
2007	8758693	0	6404108	19189271	3127898	0	7868300	0	341379	1112521	2989101	608208	29489478	20909999
2008	8377693	24685500	3617225	23671798	3915216	103250	7954295	0	431536	175081	2095881	513574	26391845	49149203
2009	5662634	16091250	4525430	29415707	2624101	105000	9249486	0	243140	240324	1963107	1453052	24267897	47305333
2010	8902546	9833250	59535	32302622	3074092	9600500	5979758	0	120123	2297177	2080333	6370110	20216388	60403659
2011	2981395	9685375	1434537	37819861	1281032	7500325	3794753	0	76639	16992885	1220533	3359643	10788888	75358089
2012	4429540	9750825	2357424	41063146	1421431	8077300	4833972	0	329073	10357856	1111478	5082459	14482918	74331585
2013	9111785	4507475	1196312	39556930	1602718	5096350	4387241	0	555549	13894046	1331635	2483689	18185240	65538490
2014	3886495	12237208	1693629	42442807	900494	3368593	5294300	0	677384	5891031	869983	2933017	13322284	66872654
2015	2659781	31266813	1266840	42803595	1583132	8434003	2096430	6350384	655795	1485948	880862	1421456	9142840	91762199
2016	2478209	5844580	1614870	44936208	1289016	1505490	6321410	8982120	775067	71098	1437499	4021716	13916070	65361212
2017	1939075	10853938	2798649	44481199	1484287	2712745	10860869	8370732	871079	1535530	1395665	12584019	19349624	80538162
2018	579533	41666624	4158198	44253924	655245	2659521	5806274	5808941	388359	1401229	763992	6022694	12351600	101812933
2019	1573355	26240298	1872288	40412358	433105	3603593	9077943	11267654	341379	220516	759552	8608707	14057622	90353125
2020	4020019	12777606	3163428	40883585	1084372	12475164	9155291	10046891	431536	302690	610351	5069709	18464997	81555646
2021	751446	12585453	2338695	38674846	193563	9746137	8079446	30294602	243140	2893314	284278	5225683	11890567	99420036

2022	1395506	12670501	4179537	39250540	348782	10495874	2351160	52049423	139163	18085762	0	1492042	8414148	134044142

Maintenance costs and benefits of wood, cork and pine nuts (without risk) – cont.

Years	Maritime pine		Stone pine		Other conifers		Cork oak		Eucalyptus		Chestnut		Total	
	Costs	Benefits	Costs	Benefits	Costs	Benefits	Costs	Benefits	Costs	Benefits	Costs	Benefits	Costs	Benefits
2023	4406796	5857142	2005074	34870977	337964	6622343	2096430	21475494	85279	8223728	0	4221425	8931543	81271108
2024	2754272	15901377	900212	32220513	459277	4377245	6321410	43932313	338523	11031323	0	12688607	10773693	120151378
2025	1264275	40628990	1549899	32863612	1234350	10959384	10860869	48813871	534162	4677245	0	5984034	15443555	143927136
2026	1245263	7594614	1262880	31511097	964328	1956277	4481174	45313896	665612	1179784	0	8473480	8619256	96029148
2027	1253678	14103917	1786500	31327528	1038510	3525018	7203693	8607206	652014	56449	0	5135422	11934395	62755540
2028	579533	41265426	296100	28488052	655245	3401996	8165816	16695475	778980	1219150	0	5187012	10475674	96257111
2029	1573355	25703272	143730	29119544	433105	4627837	7938326	14886650	870720	1112521	0	1314360	10959236	76764183
2030	4020019	11473998	127260	30026240	1084372	11202412	998100	44888028	385203	175081	0	3718710	6614954	101484469
2031	751446	11301449	119070	31138046	193563	8751808	692640	77122515	341598	240324	0	8784828	2098317	137338971
2032	1395506	11377820	2622474	33778585	348782	9425055	1343520	31820605	438459	2297177	0	3718278	6148741	92417520
2033	1232946	155544903	4010148	33250913	324689	6575298	1841580	59386369	268622	13849381	0	27280252	7677985	295887117
2034	685397	112242603	1862073	29353554	445777	4569906	4522584	64253571	86909	5787888	0	18210638	7602740	234418161
2035	0	96348730	3275973	29871889	0	68289120	7054596	59617225	57599	7763883	0	27427883	10388168	289318730
2036	0	65784353	2427210	28579356	0	47418670	3149415	7531306	301393	3291861	0	8010519	5878018	160616066
2037	0	72028017	2940165	28934565	0	52339988	5258388	14608541	413699	830336	0	12838655	8612252	181580102
2038	0	38631178	63630	27215351	0	33973307	5251761	13025818	338041	39729	0	10841036	5653432	123726419
2039	0	80720480	59535	30202884	0	24553663	6994585	39277024	8089	858042	0	30672471	7062209	206284564
2040	0	190352355	1311237	33675900	0	51346207	5275279	67482201	77320	782996	0	72458563	6663836	416098222
2041	0	35581803	2005074	37141484	0	9165423	2176570	27843029	332148	123223	0	30668908	4513792	140523870
2042	0	66078772	900212	40614500	0	16515192	3498937	57108878	0	169141	0	40223183	4399148	220709665
2043	0	58381363	1645799	44080083	0	15374361	3598471	63500212	0	1616761	0	30256913	5244270	213209694
2044	0	32454321	1413630	47553099	0	21108024	3335558	58947993	0	6945215	0	26378592	4749188	193387246
2045			1664450	51018683			0	11296958					1664450	62315641
2046			111790	54491699			0	21912811					111790	76404510
2047			98980	57957282			0	19538728					98980	77496010
2048			92610	61430298			0	58915537					92610	120345835
2049			2039702	64895882			0	101223301					2039702	166119183
2050			3119004	68368898			0	41764544					3119004	110133442
2051			1461979	71834481			0	79488351					1461979	151322832
2052			2587129	75307497			0	86516313					2587129	161823811
2053			1920730	78773081			1325100	80282485					3245830	159055566
2054			2302765	82246097			1874250	11296958					4177015	93543055
2055			63630	85711680			1746675	21912811					1810305	107624492
2056			59535	89184696			1212120	19538728					1271655	108723424
2057			1311237	92650280			2351160	58915537					3662397	151565816

2058			2005074	96123296			2096430	101223301					4101504	197346597

Maintenance costs and benefits of wood, cork and pine nuts (without risk) – cont.

Years	Maritime pine		Stone pine		Other conifers		Cork oak		Eucalyptus		Chestnut		Total	
	Costs	Benefits	Costs	Benefits	Costs	Benefits	Costs	Benefits	Costs	Benefits	Costs	Benefits	Costs	Benefits
2059			961862	99588879			6321410	41764544					7283271	141353423
2060			1726074	103061895			10860869	77724075					12586943	180785970
2061			1287630	106527479			4481174	84020883					5768804	190548362
2062			1506015	110000495			7203693	77956912					8709708	187957407
2063			63630	113466078			7408616	9683107					7472246	123149186
2064			59535	116939094			6867326	18782410					6926861	135721504
2065			1311237	120407966			0	16747481					1311237	137155447
2066			2005074	123866540			0	50499031					2005074	174365571
2067			900212	127247786			0	86762830					900212	214010616
2068			1549899	157125247			0	35798181					1549899	192923428
2069			1139580	208710899			0	68132872					1139580	276843772
2070			1434150	196935642			0	74156840					1434150	271092482
2071			0	164967487			0	68813558					0	233781045
2072			0	163070155			0	9683107					0	172753262
2073			0	162245703			567900	18782410					567900	181028113
2074			0	702010175			803250	16747481					803250	718757656
2075			0	980029711			748575	50499031					748575	1030528742
2076			0	471421761			519480	86762830					519480	558184591
2077			0	736216986			1007640	35798181					1007640	772015167
2078			0	533674620			1655670	66368596					1655670	600043216
2079			0	641543100			3780176	71661410					3780176	713204510
2080							5652758	66487985					5652758	66487985
2081							2613143	8069256					2613143	8069256
2082							4430817	15652008					4430817	15652008
2083							4373081	13956234					4373081	13956234
2084							6555374	42082526					6555374	42082526
2085							6206211	72302358					6206211	72302358
2086							2560671	29831817					2560671	29831817
2087							4116396	56777393					4116396	56777393
2088							4233495	61797367					4233495	61797367
2089							3924186	57344632					3924186	57344632
2090							0	8069256					0	8069256
2091							0	15652008					0	15652008
2092							0	13956234					0	13956234
2093							567900	42082526					567900	42082526

2094							803250	72302358					803250	72302358

Maintenance costs and benefits of wood, cork and pine nuts (without risk) – cont.

Years	Maritime pine		Stone pine		Other conifers		Cork oak		Eucalyptus		Chestnut		Total	
	Costs	Benefits	Costs	Benefits	Costs	Benefits	Costs	Benefits	Costs	Benefits	Costs	Benefits	Costs	Benefits
2095							748575	29831817					748575	29831817
2096							519480	54571417					519480	54571417
2097							1007640	58677187					1007640	58677187
2098							898470	54436834					898470	54436834
2099							2709176	6051365					2709176	6051365
2100							4654658	11737886					4654658	11737886
2101							1920503	10466177					1920503	10466177
2102							3087297	31558884					3087297	31558884
2103							3932321	54221597					3932321	54221597
2104							4014140	22371729					4014140	22371729
2105							998100	42578984					998100	42578984
2106							692640	46343605					692640	46343605
2107							1343520	43004372					1343520	43004372
2108							1197960	6051365					1197960	6051365
2109							3612234	11737886					3612234	11737886
2110							6206211	10466177					6206211	10466177
2111							2560671	31558884					2560671	31558884
2112							4116396	54221597					4116396	54221597
2113							4801395	22371729					4801395	22371729
2114							4727436	42578984					4727436	42578984
2115							748575	46343605					748575	46343605
2116							519480	43004372					519480	43004372
2117							1007640	6051365					1007640	6051365
2118							898470	11737886					898470	11737886
2119							2709176	10466177					2709176	10466177
2120							4654658	31558884					4654658	31558884
2121							1920503	54221597					1920503	54221597
2122							3087297	22371729					3087297	22371729
2123							3175121	35963580					3175121	35963580
2124							2943140	36986635					2943140	36986635
2125							0	34284305					0	34284305

Maintenance costs and benefits of wood, cork and pine nuts (with risk)

Years	Maritime pine		Stone pine		Other conifers		Cork oak		Eucalyptus		Chestnut		Total	
	Costs	Benefits	Costs	Benefits	Costs	Benefits	Costs	Benefits	Costs	Benefits	Costs	Benefits	Costs	Benefits
1987	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0	119000	0	0	0	119000	0
1990	0	0	0	0	0	0	0	0	344360	0	0	0	344360	0
1991	3526500	0	68500	0	14750	0	757200	0	671583	0	301800	0	5340333	0
1992	2298750	0	195750	0	15000	0	1071000	0	709364	0	195900	0	4485764	0
1993	1404750	0	164500	0	1371500	0	1566000	0	537806	0	628200	0	5672756	0
1994	1383625	0	79850	0	1071475	0	1495890	0	384757	0	605610	0	5021207	0
1995	1392975	0	70700	0	1153900	0	2092095	0	343867	0	997050	0	6050587	0
1996	3817775	0	127800	0	741325	0	1717440	0	433535	0	1078050	0	7915925	0
1997	3817048	0	1633105	0	494728	0	4619874	0	235850	0	1518150	0	12318754	0
1998	11373363	0	2567710	143850	2462808	0	8366681	0	87515	0	2227092	0	27085168	143850
1999	5758203	0	1620200	575475	1203398	0	7054847	0	82438	0	2077332	0	17796417	575475
2000	5051840	0	2246340	1000200	3620445	0	10434554	0	353985	5656784	3182130	0	24889294	6656984
2001	7337123	0	1549315	1296510	2743645	0	7308398	0	555549	8223728	3159216	0	22653246	9520238
2002	6632543	0	3102697	1597560	2788152	0	9250683	0	677384	11031323	3452919	0	25904378	12628883
2003	11251674	0	2190294	1910265	3504252	0	5739621	0	655795	4677245	3420204	1061330	26761840	7648840
2004	8012035	0	4979616	5163453	1948855	0	9766780	0	775067	1179784	3582921	688915	29065272	7032152
2005	11762534	0	7849557	10598713	5235164	0	11092260	0	871079	56449	3514371	1147840	40324964	11803002
2006	8259308	0	4116413	14181181	2837386	0	4787265	0	388359	1219150	3434979	379484	23823709	15779814
2007	8758693	0	6404108	19189271	3127898	0	7868300	0	341379	1112521	2989101	608208	29489478	20909999
2008	8377693	24685500	3617225	23671798	3915216	103250	7954295	0	431536	175081	2095881	513574	26391845	49149203
2009	5662634	16091250	4525430	29415707	2624101	105000	9249486	0	243140	240324	1963107	1453052	24267897	47305333
2010	8902546	9833250	59535	32302622	3074092	9600500	5979758	0	120123	2297177	2080333	6370110	20216388	60403659
2011	2981395	9685375	1434537	37819861	1281032	7500325	3794753	0	76639	16992885	1220533	3359643	10788888	75358089
2012	4429540	9750825	2357424	41063146	1421431	8077300	4833972	0	329073	10357856	1111478	5082459	14482918	74331585
2013	9111785	4507475	1196312	39556930	1602718	5096350	4387241	0	555549	13894046	1331635	2483689	18185240	65538490
2014	3886495	12237208	1693629	42442807	900494	3368593	5294300	0	677384	5891031	869983	2933017	13322284	66872654
2015	2659781	31266813	1266840	42803595	1583132	8434003	2096430	6350384	655795	1485948	880862	1421456	9142840	91762199
2016	2478209	5844580	1614870	44936208	1289016	1505490	6321410	8982120	775067	71098	1437499	4021716	13916070	65361212
2017	1939075	10853938	2798649	44481199	1484287	2712745	10860869	8370732	871079	1535530	1395665	12584019	19349624	80538162
2018	579533	41666624	4158198	44253924	655245	2659521	5806274	5808941	388359	1401229	763992	6022694	12351600	101812933
2019	1573355	26240298	1872288	40412358	433105	3603593	9077943	11267654	341379	220516	759552	8608707	14057622	90353125
2020	4020019	12777606	3163428	40883585	1084372	12475164	9155291	10046891	431536	302690	610351	5069709	18464997	81555646
2021	751446	12585453	2338695	38674846	193563	9746137	8079446	30294602	243140	2893314	284278	5225683	11890567	99420036

2022	1395506	12670501	4179537	39250540	348782	10495874	2351160	52049423	139163	18085762	0	1492042	8414148	134044142

Maintenance costs and benefits of wood, cork and pine nuts (with risk) – cont.

Years	Maritime pine		Stone pine		Other conifers		Cork oak		Eucalyptus		Chestnut		Total	
	Costs	Benefits	Costs	Benefits	Costs	Benefits	Costs	Benefits	Costs	Benefits	Costs	Benefits	Costs	Benefits
2023	4406796	5857142	2005074	34870977	337964	6622343	2096430	21475494	85279	8223728	0	4221425	8931543	81271108
2024	2754272	15901377	900212	32220513	459277	4377245	6321410	43932313	338523	11031323	0	12688607	10773693	120151378
2025	1264275	40628990	1549899	32863612	1234350	10959384	10860869	48813871	534162	4677245	0	5984034	15443555	143927136
2026	1245263	7594614	1262880	31511097	964328	1956277	4481174	45313896	665612	1179784	0	8473480	8619256	96029148
2027	1253678	14103917	1786500	31327528	1038510	3525018	7203693	8607206	652014	56449	0	5135422	11934395	62755540
2028	579533	41265426	296100	28488052	655245	3401996	8165816	16695475	778980	1219150	0	5187012	10475674	96257111
2029	1573355	25703272	143730	29119544	433105	4627837	7938326	14886650	870720	1112521	0	1314360	10959236	76764183
2030	4020019	11473998	127260	30026240	1084372	11202412	998100	44888028	385203	175081	0	3718710	6614954	101484469
2031	751446	11301449	119070	31138046	193563	8751808	692640	77122515	341598	240324	0	8784828	2098317	137338971
2032	1395506	11377820	2622474	33778585	348782	9425055	1343520	31820605	438459	2297177	0	3718278	6148741	92417520
2033	1232946	155544903	4010148	33250913	324689	6575298	1841580	59386369	268622	13849381	0	27280252	7677985	295887117
2034	685397	112242603	1862073	29353554	445777	4569906	4522584	64253571	86909	5787888	0	18210638	7602740	234418161
2035	0	96348730	3275973	29871889	0	68289120	7054596	59617225	57599	7763883	0	27427883	10388168	289318730
2036	0	65784353	2427210	28579356	0	47418670	3149415	7531306	301393	3291861	0	8010519	5878018	160616066
2037	0	72028017	2940165	28934565	0	52339988	5258388	14608541	413699	830336	0	12838655	8612252	181580102
2038	0	38631178	63630	27215351	0	33973307	5251761	13025818	338041	39729	0	10841036	5653432	123726419
2039	0	80720480	59535	30202884	0	24553663	6994585	39277024	8089	858042	0	30672471	7062209	206284564
2040	0	190352355	1311237	33675900	0	51346207	5275279	67482201	77320	782996	0	72458563	6663836	416098222
2041	0	35581803	2005074	37141484	0	9165423	2176570	27843029	332148	123223	0	30668908	4513792	140523870
2042	0	66078772	900212	40614500	0	16515192	3498937	57108878	0	169141	0	40223183	4399148	220709665
2043	0	58381363	1645799	44080083	0	15374361	3598471	63500212	0	1616761	0	30256913	5244270	213209694
2044	0	32454321	1413630	47553099	0	21108024	3335558	58947993	0	6945215	0	26378592	4749188	193387246
2045			1664450	51018683			0	11296958						
2046			111790	54491699			0	21912811						
2047			98980	57957282			0	19538728						
2048			92610	61430298			0	58915537						
2049			2039702	64895882			0	101223301						
2050			3119004	68368898			0	41764544						
2051			1461979	71834481			0	79488351						
2052			2587129	75307497			0	86516313						
2053			1920730	78773081			1325100	80282485						
2054			2302765	82246097			1874250	11296958						
2055			63630	85711680			1746675	21912811						
2056			59535	89184696			1212120	19538728						
2057			1311237	92650280			2351160	58915537						

2058			2005074	96123296			2096430	101223301						

Maintenance costs and benefits of wood, cork and pine nuts (with risk) – cont.

Years	Maritime pine		Stone pine		Other conifers		Cork oak		Eucalyptus		Chestnut		Total	
	Costs	Benefits	Costs	Benefits	Costs	Benefits	Costs	Benefits	Costs	Benefits	Costs	Benefits	Costs	Benefits
2059			961862	99588879			6321410	41764544						
2060			1726074	103061895			10860869	77724075						
2061			1287630	106527479			4481174	84020883						
2062			1506015	110000495			7203693	77956912						
2063			63630	113466078			7408616	9683107						
2064			59535	116939094			6867326	18782410						
2065			1311237	120407966			0	16747481						
2066			2005074	123866540			0	50499031						
2067			900212	127247786			0	86762830						
2068			1549899	157125247			0	35798181						
2069			1139580	208710899			0	68132872						
2070			1434150	196935642			0	74156840						
2071			0	164967487			0	68813558						
2072			0	163070155			0	9683107						
2073			0	162245703			567900	18782410						
2074			0	702010175			803250	16747481						
2075			0	980029711			748575	50499031						
2076			0	471421761			519480	86762830						
2077			0	736216986			1007640	35798181						
2078			0	533674620			1655670	66368596						
2079			0	641543100			3780176	71661410						
2080							5652758	66487985						
2081							2613143	8069256						
2082							4430817	15652008						
2083							4373081	13956234						
2084							6555374	42082526						
2085							6206211	72302358						
2086							2560671	29831817						
2087							4116396	56777393						
2088							4233495	61797367						
2089							3924186	57344632						
2090							0	8069256						
2091							0	15652008						
2092							0	13956234						
2093							567900	42082526						

2094							803250	72302358						

Maintenance costs and benefits of wood, cork and pine nuts (with risk) – cont.

Years	Maritime pine		Stone pine		Other conifers		Cork oak		Eucalyptus		Chestnut		Total	
	Costs	Benefits	Costs	Benefits	Costs	Benefits	Costs	Benefits	Costs	Benefits	Costs	Benefits	Costs	Benefits
2095							748575	29831817						
2096							519480	54571417						
2097							1007640	58677187						
2098							898470	54436834						
2099							2709176	6051365						
2100							4654658	11737886						
2101							1920503	10466177						
2102							3087297	31558884						
2103							3932321	54221597						
2104							4014140	22371729						
2105							998100	42578984						
2106							692640	46343605						
2107							1343520	43004372						
2108							1197960	6051365						
2109							3612234	11737886						
2110							6206211	10466177						
2111							2560671	31558884						
2112							4116396	54221597						
2113							4801395	22371729						
2114							4727436	42578984						
2115							748575	46343605						
2116							519480	43004372						
2117							1007640	6051365						
2118							898470	11737886						
2119							2709176	10466177						
2120							4654658	31558884						
2121							1920503	54221597						
2122							3087297	22371729						
2123							3175121	35963580						
2124							2943140	36986635						
2125							0	34284305						

Social Cost-Benefit Analysis Matrix (without risk)

Years	Initial investment costs	Administrative costs	Private costs and benefits		Social benefits of carbon storage	Benefits of other NWFP and positive externalities	Costs of fire prevention and fighting	Total			
			Maintenance costs	Benefits of wood, cork and pine nuts				Costs	Benefits	Net benefits with all costs and benefits	Net benefits without other NWFP and externalities
1987	25647886	206904	0	0	0	0	0	25854790	0	-25854790	-25854790
1988	24300639	729808	0	0	430128	23780	0	25030447	453908	-24576539	-25030447
1989	16521150	461907	119000	0	860257	71339	0	17102057	931596	-16170461	-17102057
1990	16638800	336412	344360	0	1549774	162011	0	17319572	1711785	-15607787	-17319572
1991	13748890	316731	5340333	0	2392663	303453	0	19405954	2696116	-16709838	-19405954
1992	15334519	271106	4485764	0	3012867	482184	380000	20471389	3495051	-16976338	-20471389
1993	12769266	141405	5672756	0	3657708	705792	770000	19353427	4363500	-14989927	-19353427
1994	28605796	101867	5021207	0	4056848	962267	1160000	34888869	5019115	-29869754	-34888869
1995	47892048	403234	6050587	0	5109323	1327392	1550000	55895869	6436715	-49459154	-55895869
1996	36632797	277896	7915925	0	7327319	1909130	1940000	46766619	9236449	-37530170	-46766619
1997	46494576	226069	12318754	0	8040183	2573221	2330000	61369398	10613404	-50755994	-61369398
1998	36165846	230099	27085168	143850	9162714	3368809	2720000	66201113	12675373	-53525740	-66057263
1999	46444912	211318	17796417	575475	10255972	4283879	3110000	67562647	15115326	-52447321	-66987172
2000	10387440	113202	24889294	6656984	11203180	5303888	3500000	38889936	23164052	-15725884	-32232952
2001	4643207	52666	22653246	9520238	11203180	6323897	3890000	31239119	27047315	-4191804	-21718881
2002	2238548	25391	25904378	12628883	11203180	7343907	4280000	32448317	31175970	-1272347	-19819434
2003			26761840	7648840	11203180	8363916	4670000	31431840	27215936	-4215903	-23782999
2004			29065272	7032152	11203180	9383925	5060000	34125272	27619257	-6506014	-27093119
2005			40324964	11803002	11203180	10403934	5450000	45774964	33410116	-12364848	-33971962
2006			23823709	15779814	11203180	11423943	5450000	29273709	38406937	9133228	-13493895
2007			29489478	20909999	11203180	12443952	5450000	34939478	44557131	9617654	-14029478
2008			26391845	49149203	11203180	13463962	5450000	31841845	73816345	41974499	17307357
2009			24267897	47305333	11203180	14483971	5450000	29717897	72992484	43274587	17587436
2010			20216388	60403659	11203180	15503980	5450000	25666388	87110819	61444432	34737272
2011			10788888	75358089	11203180	16523989	5450000	16238888	103085258	86846370	59119201
2012			14482918	74331585	11203180	17543998	5450000	19932918	103078763	83145845	54398667
2013			18185240	65538490	11203180	18564007	5450000	23635240	95305677	71670438	41903251
2014			13322284	66872654	11203180	19584017	5450000	18772284	97659851	78887568	48100371
2015			9142840	91762199	11203180	20604026	5450000	14592840	123569405	108976564	77169358
2016			13916070	65361212	11203180	21624035	5450000	19366070	98188427	78822358	45995143
2017			19349624	80538162	11203180	22644044	5450000	24799624	114385386	89585762	55738538
2018			12351600	101812933	11203180	23640274	5450000	17801600	136656387	118854787	84011333
2019			14057622	90353125	11203180	24612724	5450000	19507622	126169029	106661408	70845504
2020			18464997	81555646	11203180	25542061	5450000	23914997	118300887	94385890	57640649

2021			11890567	99420036	11203180	26420628	5450000	17340567	137043844	119703277	82079469
2022			8414148	134044142	11203180	27261906	5450000	13864148	172509228	158645079	120179993

Social Cost-Benefit Analysis Matrix (without risk) – cont.

Years	Initial investment costs	Administrative costs	Private costs and benefits		Social benefits of carbon storage	Benefits of other NWFP and positive externalities	Costs of fire prevention and fighting	Total			
			Maintenance costs	Benefits of wood, cork and pine nuts				Costs	Benefits	Net benefits with all costs and benefits	Net benefits without other NWFP and externalities
2023			8931543	81271108	11203180	28058307	5450000	14381543	120532595	106151052	66889565
2024			10773693	120151378	11203180	28821841	5450000	16223693	160176399	143952706	103927685
2025			15443555	143927136	11203180	29476726	5450000	20893555	184607042	163713487	123033581
2026			8619256	96029148	11203180	29914997	5450000	14069256	137147325	123078069	81959892
2027			11934395	62755540	11203180	30270915	5450000	17384395	104229635	86845240	45371145
2028			10475674	96257111	11203180	30495336	5450000	15925674	137955627	122029953	80331437
2029			10959236	76764183	11203180	30600275	5450000	16409236	118567638	102158402	60354947
2030			6614954	101484469	11203180	30600275	5450000	12064954	143287924	131222970	89419515
2031			2098317	137338971	11203180	30600275	5450000	7548317	179142426	171594109	129790654
2032			6148741	92417520	11203180	30600275	5450000	11598741	134220975	122622235	80818780
2033			7677985	295887117	10813870	30088025	5450000	13127985	336789012	323661027	282759132
2034			7602740	234418161	10424560	29575775	5450000	13052740	274418496	261365756	221365421
2035			10388168	289318730	9846534	28815215	5450000	15838168	327980479	312142311	273480562
2036			5878018	160616066	9121221	27860855	5450000	11328018	197598142	186270123	149288047
2037			8612252	181580102	8585220	27155591	5450000	14062252	217320913	203258661	167517850
2038			5653432	123726419	8076274	26485925	5450000	11103432	158288618	147185186	112622987
2039			7062209	206284564	7802961	26126303	5450000	12512209	240213828	227701620	193772356
2040			6663836	416098222	7313616	25482428	5450000	12113836	448894266	436780429	403984385
2041			4513792	140523870	6147096	23947533	5450000	9963792	170618499	160654706	130560077
2042			4399148	220709665	5886375	23604480	5450000	9849148	250200520	240351372	210860517
2043			5244270	213209694	5496731	23091790	5450000	10694270	241798215	231103945	202515424
2044			4749188	193387246	5030765	22478677	5450000	10199188	220896688	210697500	183188058
2045			1664450	62315641	4659846	21990626	5450000	7114450	88966113	81851663	55201191
2046			111790	76404510	4659846	21990626	5450000	5561790	103054982	97493192	70842720
2047			98980	77496010	4659846	21990626	5450000	5548980	104146482	98597502	71947030
2048			92610	120345835	4659846	21990626	5450000	5542610	146996307	141453697	114803225
2049			2039702	166119183	4659846	21990626	5450000	7489702	192769655	185279953	158629481
2050			3119004	110133442	4659846	21990626	5450000	8569004	136783914	128214910	101564438
2051			1461979	151322832	4659846	21990626	5450000	6911979	177973304	171061325	144410853
2052			2587129	161823811	4659846	21990626	5450000	8037129	188474283	180437154	153786682
2053			3245830	159055566	4659846	21990626	5450000	8695830	185706038	177010208	150359736
2054			4177015	93543055	4659846	21990626	5450000	9627015	120193527	110566512	83916040
2055			1810305	107624492	4659846	21990626	5450000	7260305	134274964	127014659	100364187
2056			1271655	108723424	4659846	21990626	5450000	6721655	135373896	128652241	102001769

2057			3662397	151565816	4659846	21990626	5450000	9112397	178216288	169103891	142453419
2058			4101504	197346597	4659846	21990626	5450000	9551504	223997069	214445565	187795093

Social Cost-Benefit Analysis Matrix (without risk) – cont.

Years	Initial investment costs	Administrative costs	Private costs and benefits		Social benefits of carbon storage	Benefits of other NWFP and positive externalities	Costs of fire prevention and fighting	Total			
			Maintenance costs	Benefits of wood, cork and pine nuts				Costs	Benefits	Net benefits with all costs and benefits	Net benefits without other NWFP and externalities
2059			7283271	141353423	4659846	21990626	5450000	12733271	168003895	155270624	128620152
2060			12586943	180785970	4659846	21990626	5450000	18036943	207436442	189399499	162749027
2061			5768804	190548362	4659846	21990626	5450000	11218804	217198834	205980030	179329558
2062			8709708	187957407	4659846	21990626	5450000	14159708	214607879	200448171	173797699
2063			7472246	123149186	4659846	21990626	5450000	12922246	149799658	136877411	110226939
2064			6926861	135721504	4659846	21990626	5450000	12376861	162371976	149995116	123344644
2065			1311237	137155447	4659846	21990626	5450000	6761237	163805919	157044682	130394210
2066			2005074	174365571	4659846	21990626	5450000	7455074	201016043	193560969	166910497
2067			900212	214010616	4659846	21990626	5450000	6350212	240661088	234310877	207660405
2068			1549899	192923428	4656722	21980351	5450000	6999899	219560501	212560602	185923529
2069			1139580	276843772	4653599	21970076	5450000	6589580	303467447	296877867	270254192
2070			1434150	271092482	4635746	21911351	5450000	6884150	297639579	290755429	264208332
2071			0	233781045	4620744	21862001	5450000	5450000	260263790	254813790	228331045
2072			0	172753262	4613462	21838046	5450000	5450000	199204770	193754770	167303262
2073			567900	181028113	4607014	21816836	5450000	6017900	207451963	201434063	175010213
2074			803250	718757656	4600981	21796991	5450000	6253250	745155628	738902378	712504406
2075			748575	1030528742	4468109	21359912	5450000	6198575	1056356763	1050158188	1024330167
2076			519480	558184591	4264928	21359912	5450000	5969480	583809431	577839951	552215111
2077			1007640	772015167	4173707	20691554	5450000	6457640	796880428	790422788	765557527
2078			1655670	600043216	4016650	20391483	5450000	7105670	624451349	617345679	592937546
2079			3780176	713204510	3901173	19874850	5450000	9230176	736980533	727750358	703974335
2080			5652758	66487985	3755846	19494990	5450000	11102758	89738821	78636063	55385227
2081			2613143	8069256	3755846	19016940	5450000	8063143	30842042	22778899	6113
2082			4430817	15652008	3755846	19016940	5450000	9880817	38424794	28543977	5771191
2083			4373081	13956234	3755846	19016940	5450000	9823081	36729020	26905939	4133153
2084			6555374	42082526	3755846	19016940	5450000	12005374	64855312	52849939	30077153
2085			6206211	72302358	3755846	19016940	5450000	11656211	95075144	83418933	60646147
2086			2560671	29831817	3755846	19016940	5450000	8010671	52604603	44593932	21821146
2087			4116396	56777393	3755846	19016940	5450000	9566396	79550179	69983783	47210997
2088			4233495	61797367	3755846	19016940	5450000	9683495	84570153	74886658	52113872
2089			3924186	57344632	3755846	19016940	5450000	9374186	80117418	70743232	47970446
2090			0	8069256	3755846	19016940	5450000	5450000	30842042	25392042	2619256
2091			0	15652008	3755846	19016940	5450000	5450000	38424794	32974794	10202008
2092			0	13956234	3755846	19016940	5450000	5450000	36729020	31279020	8506234

2093			567900	42082526	3755846	19016940	5450000	6017900	64855312	58837412	36064626
2094			803250	72302358	3755846	19016940	5450000	6253250	95075144	88821894	66049108

Social Cost-Benefit Analysis Matrix (without risk) – cont.

Years	Initial investment costs	Administrative costs	Private costs and benefits		Social benefits of carbon storage	Benefits of other NWFP and positive externalities	Costs of fire prevention and fighting	Total			
			Maintenance costs	Benefits of wood, cork and pine nuts				Costs	Benefits	Net benefits with all costs and benefits	Net benefits without other NWFP and externalities
2095			748575	29831817	3755846	19016940	5450000	6198575	52604603	46406028	23633242
2096			519480	54571417	3755846	19016940	5450000	5969480	77344203	71374723	48601937
2097			1007640	58677187	3755846	19016940	5450000	6457640	81449973	74992333	52219547
2098			898470	54436834	3755846	19016940	5450000	6348470	77209620	70861150	48088364
2099			2709176	6051365	3755846	19016940	5450000	8159176	28824151	20664975	-2107811
2100			4654658	11737886	3755846	19016940	5450000	10104658	34510672	24406014	1633228
2101			1920503	10466177	3755846	19016940	5450000	7370503	33238963	25868460	3095674
2102			3087297	31558884	3755846	19016940	5450000	8537297	54331670	45794373	23021587
2103			3932321	54221597	3755846	19016940	5450000	9382321	76994383	67612062	44839276
2104			4014140	22371729	3755846	19016940	5450000	9464140	45144515	35680375	12907589
2105			998100	42578984	3755846	19016940	5450000	6448100	65351770	58903670	36130884
2106			692640	46343605	3755846	19016940	5450000	6142640	69116391	62973751	40200965
2107			1343520	43004372	3755846	19016940	5450000	6793520	65777158	58983638	36210852
2108			1197960	6051365	3755846	19016940	5450000	6647960	28824151	22176191	-596595
2109			3612234	11737886	3755846	19016940	5450000	9062234	34510672	25448438	2675652
2110			6206211	10466177	3755846	19016940	5450000	11656211	33238963	21582752	-1190034
2111			2560671	31558884	3755846	19016940	5450000	8010671	54331670	46320999	23548213
2112			4116396	54221597	3755846	19016940	5450000	9566396	76994383	67427987	44655201
2113			4801395	22371729	3755846	19016940	5450000	10251395	45144515	34893120	12120334
2114			4727436	42578984	3718151	18826080	5450000	10177436	65123215	54945779	32401548
2115			748575	46343605	3680456	18635220	5450000	6198575	68659281	62460706	40145030
2116			519480	43004372	3586817	18161100	5450000	5969480	64752289	58782809	37034892
2117			1007640	6051365	3484244	17641740	5450000	6457640	27177349	20719709	-406275
2118			898470	11737886	3407323	17252268	5450000	6348470	32397477	26049007	5389416
2119			2709176	10466177	3277876	16596840	5450000	8159176	30340893	22181718	2307002
2120			4654658	31558884	3158082	15990288	5450000	10104658	50707254	40602596	21454226
2121			1920503	54221597	2727824	13811765	5450000	7370503	70761186	63390683	46851094
2122			3087297	22371729	1879529	9516601	5450000	8537297	33767859	25230562	13834432
2123			3175121	35963580	1518606	7689145	5450000	8625121	45171331	36546209	27338458
2124			2943140	36986635	942776	4773551	5450000	8393140	42702962	34309822	28593495
2125			0	34284305	430962	2182084	5450000	5450000	36897351	31447351	28834305
INTERNAL RATES OF RETURN										8.6%	6.5%

Social Cost-Benefit Analysis Matrix (with risk)

Years	Initial investment costs	Administrative costs	Private costs and benefits		Social benefits of carbon storage	Benefits of other NWFP and positive externalities	Costs of fire prevention and fighting	Total			
			Maintenance costs	Benefits of wood, cork and pine nuts				Costs	Benefits	Net benefits with all costs and benefits	Net benefits without other NWFP and externalities
1987	25647886	206904	0	0	0	0	0	25854790	0	-25854790	-25854790
1988	24300639	729808	0	0	430128	23780	0	25030447	453908	-24576539	-25030447
1989	16521150	461907	119000	0	860257	71339	0	17102057	931596	-16170461	-17102057
1990	16638800	336412	344360	0	1549774	162011	0	17319572	1711785	-15607787	-17319572
1991	13748890	316731	5340333	0	2392663	303453	0	19405954	2696116	-16709838	-19405954
1992	15334519	271106	4485764	0	3012867	482184	380000	20471389	3495051	-16976338	-20471389
1993	12769266	141405	5672756	0	3657708	705792	770000	19353427	4363500	-14989927	-19353427
1994	28605796	101867	5021207	0	4056848	962267	1160000	34888869	5019115	-29869754	-34888869
1995	47892048	403234	6050587	0	5109323	1327392	1550000	55895869	6436715	-49459154	-55895869
1996	36632797	277896	7915925	0	7327319	1909130	1940000	46766619	9236449	-37530170	-46766619
1997	46494576	226069	12318754	0	8040183	2573221	2330000	61369398	10613404	-50755994	-61369398
1998	36165846	230099	27085168	143850	9162714	3368809	2720000	66201113	12675373	-53525740	-66057263
1999	46444912	211318	17796417	575475	10255972	4283879	3110000	67562647	15115326	-52447321	-66987172
2000	10387440	113202	24889294	6656984	11203180	5303888	3500000	38889936	23164052	-15725884	-32232952
2001	4643207	52666	22653246	9520238	11203180	6323897	3890000	31239119	27047315	-4191804	-21718881
2002	2238548	25391	25904378	12628883	11203180	7343907	4280000	32448317	31175970	-1272347	-19819434
2003			26761840	7648840	11203180	8363916	4670000	31431840	27215936	-4215903	-23782999
2004			29065272	7032152	11203180	9383925	5060000	34125272	27619257	-6506014	-27093119
2005			40324964	11803002	11203180	10403934	5450000	45774964	33410116	-12364848	-33971962
2006			23823709	15779814	11203180	11423943	5450000	29273709	38406937	9133228	-13493895
2007			29489478	20909999	11203180	12443952	5450000	34939478	44557131	9617654	-14029478
2008			26391845	49149203	11203180	13463962	5450000	31841845	73816345	41974499	17307357
2009			24267897	47305333	11203180	14483971	5450000	29717897	72992484	43274587	17587436
2010			20216388	60403659	11203180	15503980	5450000	25666388	87110819	61444432	34737272
2011			10788888	75358089	11203180	16523989	5450000	16238888	103085258	86846370	59119201
2012			14482918	74331585	11203180	17543998	5450000	19932918	103078763	83145845	54398667
2013			18185240	65538490	11203180	18564007	5450000	23635240	95305677	71670438	41903251
2014			13322284	66872654	11203180	19584017	5450000	18772284	97659851	78887568	48100371
2015			9142840	91762199	11203180	20604026	5450000	14592840	123569405	108976564	77169358
2016			13916070	65361212	11203180	21624035	5450000	19366070	98188427	78822358	45995143
2017			19349624	80538162	11203180	22644044	5450000	24799624	114385386	89585762	55738538
2018			12351600	101812933	11203180	23640274	5450000	17801600	136656387	118854787	84011333
2019			14057622	90353125	11203180	24612724	5450000	19507622	126169029	106661408	70845504
2020			18464997	81555646	11203180	25542061	5450000	23914997	118300887	94385890	57640649

2021			11890567	99420036	11203180	26420628	5450000	17340567	137043844	119703277	82079469
2022			8414148	134044142	11203180	27261906	5450000	13864148	172509228	158645079	120179993

Social Cost-Benefit Analysis Matrix (with risk) – cont.

Years	Initial investment costs	Administrative costs	Private costs and benefits		Social benefits of carbon storage	Benefits of other NWFP and positive externalities	Costs of fire prevention and fighting	Total			
			Maintenance costs	Benefits of wood, cork and pine nuts				Costs	Benefits	Net benefits with all costs and benefits	Net benefits without other NWFP and externalities
2023			8931543	81271108	11203180	28058307	5450000	14381543	120532595	106151052	66889565
2024			10773693	120151378	11203180	28821841	5450000	16223693	160176399	143952706	103927685
2025			15443555	143927136	11203180	29476726	5450000	20893555	184607042	163713487	123033581
2026			8619256	96029148	11203180	29914997	5450000	14069256	137147325	123078069	81959892
2027			11934395	62755540	11203180	30270915	5450000	17384395	104229635	86845240	45371145
2028			10475674	96257111	11203180	30495336	5450000	15925674	137955627	122029953	80331437
2029			10959236	76764183	11203180	30600275	5450000	16409236	118567638	102158402	60354947
2030			6614954	101484469	11203180	30600275	5450000	12064954	143287924	131222970	89419515
2031			2098317	137338971	11203180	30600275	5450000	7548317	179142426	171594109	129790654
2032			6148741	92417520	11203180	30600275	5450000	11598741	134220975	122622235	80818780
2033			7677985	295887117	10813870	30088025	5450000	13127985	336789012	323661027	282759132
2034			7602740	234418161	10424560	29575775	5450000	13052740	274418496	261365756	221365421
2035			10388168	289318730	9846534	28815215	5450000	15838168	327980479	312142311	273480562
2036			5878018	160616066	9121221	27860855	5450000	11328018	197598142	186270123	149288047
2037			8612252	181580102	8585220	27155591	5450000	14062252	217320913	203258661	167517850
2038			5653432	123726419	8076274	26485925	5450000	11103432	158288618	147185186	112622987
2039			7062209	206284564	7802961	26126303	5450000	12512209	240213828	227701620	193772356
2040			6663836	416098222	7313616	25482428	5450000	12113836	448894266	436780429	403984385
2041			4513792	140523870	6147096	23947533	5450000	9963792	170618499	160654706	130560077
2042			4399148	220709665	5886375	23604480	5450000	9849148	250200520	240351372	210860517
2043			5244270	213209694	5496731	23091790	5450000	10694270	241798215	231103945	202515424
2044			4749188	193387246	5030765	22478677	5450000	10199188	220896688	210697500	183188058
2045					4659846	21990626	5450000	5450000	26650472	21200472	-5450000
2046					4659846	21990626	5450000	5450000	26650472	21200472	-5450000
2047					4659846	21990626	5450000	5450000	26650472	21200472	-5450000
2048					4659846	21990626	5450000	5450000	26650472	21200472	-5450000
2049					4659846	21990626	5450000	5450000	26650472	21200472	-5450000
2050					4659846	21990626	5450000	5450000	26650472	21200472	-5450000
2051					4659846	21990626	5450000	5450000	26650472	21200472	-5450000
2052					4659846	21990626	5450000	5450000	26650472	21200472	-5450000
2053					4659846	21990626	5450000	5450000	26650472	21200472	-5450000
2054					4659846	21990626	5450000	5450000	26650472	21200472	-5450000
2055					4659846	21990626	5450000	5450000	26650472	21200472	-5450000
2056					4659846	21990626	5450000	5450000	26650472	21200472	-5450000

2057					4659846	21990626	5450000	5450000	26650472	21200472	-5450000
2058					4659846	21990626	5450000	5450000	26650472	21200472	-5450000

Social Cost-Benefit Analysis Matrix (with risk) – cont.

Years	Initial investment costs	Administrative costs	Private costs and benefits		Social benefits of carbon storage	Benefits of other NWFP and positive externalities	Costs of fire prevention and fighting	Total			
			Maintenance costs	Benefits of wood, cork and pine nuts				Costs	Benefits	Net benefits with all costs and benefits	Net benefits without other NWFP and externalities
2059					4659846	21990626	5450000	5450000	26650472	21200472	-5450000
2060					4659846	21990626	5450000	5450000	26650472	21200472	-5450000
2061					4659846	21990626	5450000	5450000	26650472	21200472	-5450000
2062					4659846	21990626	5450000	5450000	26650472	21200472	-5450000
2063					4659846	21990626	5450000	5450000	26650472	21200472	-5450000
2064					4659846	21990626	5450000	5450000	26650472	21200472	-5450000
2065					4659846	21990626	5450000	5450000	26650472	21200472	-5450000
2066					4659846	21990626	5450000	5450000	26650472	21200472	-5450000
2067					4659846	21990626	5450000	5450000	26650472	21200472	-5450000
2068					4656722	21980351	5450000	5450000	26637073	21187073	-5450000
2069					4653599	21970076	5450000	5450000	26623675	21173675	-5450000
2070					4635746	21911351	5450000	5450000	26547097	21097097	-5450000
2071					4620744	21862001	5450000	5450000	26482745	21032745	-5450000
2072					4613462	21838046	5450000	5450000	26451508	21001508	-5450000
2073					4607014	21816836	5450000	5450000	26423850	20973850	-5450000
2074					4600981	21796991	5450000	5450000	26397972	20947972	-5450000
2075					4468109	21359912	5450000	5450000	25828021	20378021	-5450000
2076					4264928	21359912	5450000	5450000	25624840	20174840	-5450000
2077					4173707	20691554	5450000	5450000	24865261	19415261	-5450000
2078					4016650	20391483	5450000	5450000	24408133	18958133	-5450000
2079					3901173	19874850	5450000	5450000	23776023	18326023	-5450000
2080					3755846	19494990	5450000	5450000	23250836	17800836	-5450000
2081					3755846	19016940	5450000	5450000	22772786	17322786	-5450000
2082					3755846	19016940	5450000	5450000	22772786	17322786	-5450000
2083					3755846	19016940	5450000	5450000	22772786	17322786	-5450000
2084					3755846	19016940	5450000	5450000	22772786	17322786	-5450000
2085					3755846	19016940	5450000	5450000	22772786	17322786	-5450000
2086					3755846	19016940	5450000	5450000	22772786	17322786	-5450000
2087					3755846	19016940	5450000	5450000	22772786	17322786	-5450000
2088					3755846	19016940	5450000	5450000	22772786	17322786	-5450000
2089					3755846	19016940	5450000	5450000	22772786	17322786	-5450000
2090					3755846	19016940	5450000	5450000	22772786	17322786	-5450000
2091					3755846	19016940	5450000	5450000	22772786	17322786	-5450000
2092					3755846	19016940	5450000	5450000	22772786	17322786	-5450000

2093					3755846	19016940	5450000	5450000	22772786	17322786	-5450000
2094					3755846	19016940	5450000	5450000	22772786	17322786	-5450000

Social Cost-Benefit Analysis Matrix (with risk) – cont.

Years	Initial investment costs	Administrative costs	Private costs and benefits		Social benefits of carbon storage	Benefits of other NWFP and positive externalities	Costs of fire prevention and fighting	Total			
			Maintenance costs	Benefits of wood, cork and pine nuts				Costs	Benefits	Net benefits with all costs and benefits	Net benefits without NWFP and externalities
2095					3755846	19016940	5450000	5450000	22772786	17322786	-5450000
2096					3755846	19016940	5450000	5450000	22772786	17322786	-5450000
2097					3755846	19016940	5450000	5450000	22772786	17322786	-5450000
2098					3755846	19016940	5450000	5450000	22772786	17322786	-5450000
2099					3755846	19016940	5450000	5450000	22772786	17322786	-5450000
2100					3755846	19016940	5450000	5450000	22772786	17322786	-5450000
2101					3755846	19016940	5450000	5450000	22772786	17322786	-5450000
2102					3755846	19016940	5450000	5450000	22772786	17322786	-5450000
2103					3755846	19016940	5450000	5450000	22772786	17322786	-5450000
2104					3755846	19016940	5450000	5450000	22772786	17322786	-5450000
2105					3755846	19016940	5450000	5450000	22772786	17322786	-5450000
2106					3755846	19016940	5450000	5450000	22772786	17322786	-5450000
2107					3755846	19016940	5450000	5450000	22772786	17322786	-5450000
2108					3755846	19016940	5450000	5450000	22772786	17322786	-5450000
2109					3755846	19016940	5450000	5450000	22772786	17322786	-5450000
2110					3755846	19016940	5450000	5450000	22772786	17322786	-5450000
2111					3755846	19016940	5450000	5450000	22772786	17322786	-5450000
2112					3755846	19016940	5450000	5450000	22772786	17322786	-5450000
2113					3755846	19016940	5450000	5450000	22772786	17322786	-5450000
2114					3718151	18826080	5450000	5450000	22544231	17094231	-5450000
2115					3680456	18635220	5450000	5450000	22315676	16865676	-5450000
2116					3586817	18161100	5450000	5450000	21747917	16297917	-5450000
2117					3484244	17641740	5450000	5450000	21125984	15675984	-5450000
2118					3407323	17252268	5450000	5450000	20659591	15209591	-5450000
2119					3277876	16596840	5450000	5450000	19874716	14424716	-5450000
2120					3158082	15990288	5450000	5450000	19148370	13698370	-5450000
2121					2727824	13811765	5450000	5450000	16539589	11089589	-5450000
2122					1879529	9516601	5450000	5450000	11396130	5946130	-5450000
2123					1518606	7689145	5450000	5450000	9207751	3757751	-5450000
2124					942776	4773551	5450000	5450000	5716327	266327	-5450000
2125					430962	2182084	5450000	5450000	2613046	-2836954	-5450000
INTERNAL RATES OF RETURN										7.9%	6.1%

Organisations related to the forest sector

Universities with Forest Education

Instituto Superior de Agronomia
Departamento de Engenharia Florestal
Tapada da Ajuda, 1349-017 Lisboa - Portugal
Website: www.isa.utl.pt/def/
E-mail (department director): presidentedef@isa.utl.pt
Phone:(+351) 213 653 371
Fax: (+351) 213 645 000

Universidade de Trás-os-Montes e Alto Douro
Departamento Florestal
Quinta dos Prados – Apartado 1013
5000-911 Vila Real – Portugal
Head of the Department: Prof. Hermínio da Silva Botelho
Website: home.utad.pt/~floresta/
E-mail (head of the department): hbotelho@utad.pt
Phone: (+351) 259 350 856
Fax: (+351) 259 350 480

Universities with Environemental Sciences Education

Universidade de Aveiro
Departamento de Ambiente e Ordenamento
Campus de Santa Apolónia - Apartado 172
5301-854 Bragança – Portugal
Head of the Department: Prof. Dr. Carlos Alberto Borrego
Website : http://www.dao.ua.pt
E-mail (head of the department): borrego@ua.pt
Tel : (+351) 234 370 200

Faculdade de Ciências e Tecnologia
Departamento de Ciências e Engenharia do Ambiente
Quinta da Torre
2829-516 Monte da Caparica – Portugal
Website : http://www.fct.unl.pt/faculdade/dcea.html
Phone: (+351) 212 948 300
Fax: (+351) 212 954 461

Universidade de Évora
Área Departamental de Ciências da Natureza e Ambiente
Rua Romão Ramalho, 59
7000-671 Évora – Portugal
Head of the Department: Prof. Dra. Maria Teresa Amado Pinto Correia

Website : http://www.uevora.pt
E-mail (head of the department): mtpc@uevora.pt
Phone: (+351) 266 745 361
Fax: (+351) 266 744 968

Universidade do Algarve
Faculdade de Engenharia dos Recursos Naturais
Campus de Gambelas
8005-139 Faro – Portugal
Website : http://www.ualg.pt/fern/
E-mail (board of the faculty): cdfern@ualg.pt
Phone: (+351) 289 800 957
Fax: (+351) 289 818 419

Polytechnic Schools with Forest Education

Escola Superior Agrária de Bragança
Campus de Santa Apolónia - Apartado 172
5301-854 Bragança – Portugal
Website : http://www.esa.ipb.pt
E-mail (Foreign Relations Service): grei@ipb.pt
Tel : (+351) 273 303 200
Fax : (+351) 273 325 405

Escola Superior Agrária de Coimbra
Departamento Florestal
Bencanta
3040-316 Coimbra – Portugal
Head of the Department: Prof. Adj. José de Jesus Gaspar
Website: http://www.esac.pt/Departamentos/prinflor.htm
E-mail (head of the department): jgaspar@mail.esac.pt
Phone: (+351) 239 802 940
Fax: (+351) 239 802 979

Escola Superior Agária de Castelo Branco
Unidade Departamental de Silvicultura e Recursos Naturais
Quinta da Senhora de Mércules
Apartado 119
6001-909 Castelo Branco
Head of the Departament: Prof. Dr. José Pedro Fragoso de Almeida
Website: http://www.esa.ipcb.pt
E-mail (head of the department): falmeida@esa.ipcb.pt
Phone: (+351) 272 339900
Fax: (+351) 272 339901

Escola Superior de Tecnologia de Viseu
Departamento de Engenharia de Madeiras
Campus Politécnico – Repeses
3504-510 Viseu – Portugal

Website: http://www.demad.estv.ipv.pt/dep/demad/
E-mail: demad@estv.ipv.pt
Phone: (+351) 232 480 500
Fax: (+351) 232 424 651

Escola Superior Agrária de Beja
Rua Pedro Soares
Apartado 158
7801-902 Beja – Portugal
Website: http://www.esab.ipbeja.pt/
E-mail (board of the school): conselhodirectivo@esab.ipbeja.pt
Phone: (+351) 284 314 300
Fax: (+351) 284 388 207

Other institutions related to forests and environmental education

Associação Portuguesa de Educação Ambiental
Apartado 4021
1501 Lisboa – Portugal
Website : http://www.aspea.pt
Phone: (+351) 217 724 827
Fax: (+351) 217 724 827

Associação de Professores de Geografia
Bairro da Liberdade, Impasse à Rua C, Lote 9, loja 13,
1070-023 Lisboa – Portugal
Web site: http://www.aprofgeo.pt
Phone/Fax: (+351) 213 861 490

Forest Scientific Societies

Sociedade Portuguesa de Ciências Florestais
Instituto Superior de Agronomia
Departamento de Engenharia Florestal
Tapada da Ajuda
1349-017 - Lisboa – Portugal
Website : http://www.spcf.pt
E-mail: spcf@spcf.pt
Phone: (+351) 213 634 667
Fax: (+351) 213 645 000

Research institutions and networks (besides universities and polytechnic schools already metioned)

Estação Florestal Nacional
Avenida da República
Quinta do Marquês

2784-159 Oeiras – Portugal
Website: http://www.efn.com.pt
E-mail: direcção@efn.com.pt
Phone: (351) 214 463 700
Fax: (+351) 214 463 701

Publishes SILVA LUSITANA, the only scientific forest journal in Portugal

RAIZ- Instituto de Investigação da Floresta e do Papel

Quinta de S. Francisco
Apartado 15
3801-501 Eixo – Portugal
Website: http://www.raiz-iifp.pt
E-mail: raiz-mfc@raiz-iifp.pt
Phone: (+351) 234 920 130
Fax: (+351) 234 931 359

Núcleo de Investigação Científica de Incêndios Florestais
Faculdade de Letras da Universidade de Coimbra

Praça da Porta Férrea
3000-447 Coimbra – Portugal
Website: http://www.nicif.pt/nicif.htm
E-mail: nicif@nicif.pt
Phone: (+351) 239 859 931
Fax: (+351) 239 836 733

Instituto Ambiente e Vida
Departamento de Zoologia
Universidade de Coimbra

Largo Marquês de Pombal
3004-517 Coimbra – Portugal
Director: Prof. Dra. Isabel Abrantes
Website: http://www.uc.pt/iav
E-mail: nicif@nicif.pt
Phone (director): (+351) 239 834 729
Fax (director): (+351) 239 826 798

Faculdade de Ciências de Lisboa
Centro de Biologia Ambiental

Campo Grande, Edifício C2
1749-016 Lisboa – Portugal
Website : http://cba.fc.ul.pt/
E-mail: cba@fc.ul.pt
Phone: (+351) 217 500 000
Fax: (+351) 217 500 028

CEABN- Centro de Ecologia Aplicada Prof. Baeta Neves

Instituto Superior de Agronomia
Tapada da Ajuda
1349-017 Lisboa
Website: www.isa.utl.pt/ceabn/
E-mail: ceabn@ip.pt
Phone: (+351) 213 616 080
Fax: (+351) 213 623 483

Public Administration related to forests

Direcção Geral dos Recursos Florestais
Avenida João Crisóstomo, 28
1069-040 Lisboa – Portugal
Web site: http://www.dgrf.min-agricultura.pt
Phone: (+351) 213 124 800
Fax: (+351) 213 124 988

IFADAP- Instituto de Financiamento e Apoio ao Desenvolvimento da Agricultura e Pescas
Rua Castilho, 45/51
1269-344 Lisboa
Website: www.ifadap.min-agricultura.pt
Phone: (+351) 213 846 000
Fax: (+351) 213 846 170

CAOF- Comissão de Acompanhamento de Operações Florestais
Av. Afonso Costa, 3
1949-002 Lisboa
Website: http://www.idrha.pt/caof/apontadores.htm
E-mail: idrha@idrha.min-agricultura.pt
Pnone:(+351)218 442 200
Fax: (+351) 218 442 202

Gabinete de Planeamento e Política Agro-Alimentar
Rua Padre António Vieira, 1 – 8.º
1099 – 073 Lisboa – Portugal
Web site: http://www.gppaa.min-agricultura.pt
Phone: (+351) 213 819 300
Fax: (+351) 213 876 635

Instituto do Ambiente
Rua da Murgueira, 9/9A
2610-124 Amadora – Portugal
Web site: http://www.iambiente.pt
Phone: (+351) 214 728 200
Fax: (+351) 214 719 074

Instituto de Conservação da Natureza
Rua de Santa Marta, 55
1150 - 294 Lisboa
Web site: http://www.icn.pt
Phone: (+351) 213 507 900
Fax: (+351) 213 507 984

Serviço Nacional de Bombeiros e Protecção Civil
Av do Forte em Carnaxide
2795 - 112 Carnaxide
Web site: http://www2.snbpc.pt
Phone: (+351) 214 247 100
Fax: (+351) 214 247 180

National federations of forest owners' associations

FORESTIS – Associação Florestal de Portugal
Rua de Santa Catarina, 753
4000 - 454 Porto – Portugal
Website: www.forestis.pt
E-mail: forestis@mail.telepac.pt
Phone: (+351) 222 073 130
Fax: (+351) 222 073 139

Fenafloresta- Federação Nacional das Cooperativas de Produtores e Florestais, FCRL
Rua Maria Andrade, 13
1199-013 Lisboa – Portugal
Website: www.confragri.pt
E-mail: fenafloresta@confragri.pt
Phone: (+351) 218 118 065
Fax: (+351)218 118 008

FPFP- Federação dos Produtores Florestais de Portugal
Av. Colégio Militar, Lote 1786
1549-012 Lisboa - Portugal
E-mail: www.fpfp.pt
Phone: (+351) 217122290

National associations of forest contractors and forest industries

ANEFA- Associação Nacional de Empresas Florestais, Agrícolas e do Ambiente
Apartado 2006
2605 Belas – Portugal
Website: http://www.anefa.pt
Phone: (+351) 214 315 270

Fax: (+351) 214 315 271

CELPA- Associação da Indústria Papeleira
Rua Marquês Sá da Bandeira, 74, 1.º Esq.
1069-076, Lisboa - Portugal
Website: http://www.celpa.pt
Phone: (+351) 217 611 510
Fax: (+351) 217 611 529

AIMMP – Associação das Indústrias da Madeira e do Mobiliário de Portugal
Rua de Álvares Cabral, 281
4050-041 Porto – Portugal
Website: http://www.aimmp.pt
Phone: (+351) 223394200
Fax: (+351) 223394210

APCOR – Associação Portuguesa de Cortiça
Av. Comendador Henrique Amorim, 580
Apartado 100
4535 Santa Maria de Lamas - Portugal
Phone: (+351) 227442176
Fax: (+351) 227449768

Major web sites related to forests, agriculture and environmental issues

PORTAL FLORESTAL: http://www.portalflorestal.com

Confederação dos Agricultores de Portugal
Portal Florestal
Avenida do Colégio Militar, Lote 1786
1549-012 Lisboa – Portugal
Phone: (+351) 217 100 000
Fax: (+351) 217 166 123

NATURLINK: http://www.naturlink.pt

AGROPORTAL: http://www.agroportal.pt

Main environmentalist groups of with national audience

QUERCUS – Associação Nacional de Conservação da Natureza
Apartado 4333
1503-003 Lisboa – Portugal
Web site: http://www.quercus.pt
Phone: (+351) 217 788 474
Fax: (+351) 217 787 749

Liga para a Protecção da Natureza
Estrada do Calhariz de Benfica, 187
1500-124 Lisboa – Portugal
Web site: http://www.lpn.pt
Phone: (+351) 217 780 097
Fax: (+351) 217 783 208

GEOTA – Grupo de Estudos de Ordenamento do Teritório e Ambiente
Travessa do Moinho de Vento, 17, Cv. D.ta
1200-727 Lisboa – Portugal
Web site: http://www.geota.pt
Phone: (+351) 213 956 120
Fax: (+351) 213 955 316

C.P.A.D.A. – Confederação Portuguesa das Associações de Defesa do Ambiente
Rua Ferreira Lapa, 25, R/C
1150-155 Lisboa – Portugal
Web site: http://www.cpada.pt
Phone/Fax: (+351) 213 542 819

Technical assistance institutions

CINCORK - Centro de Formação Profissional da Indústria de Cortiça
Urbanização do Serrado, Rua 13, n°416
4535-334 PAÇOS DE BRANDÃO
Website : www.cincork.org
E-mail : cincork@mail.telepac.pt
Phone: (+351)227 471 200
Fax : (+351) 227 471 209

Centro PINUS – Associação para a Valorização da Floresta de Pinho
Rua do Campo Alegre, 823
4150-180 Porto – Portugal
Web site: http://www.centropinus.org
Phone/Fax: (+351) 226 067 156

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AIMMP-Associação das Indústrias da Madeira e do Mobiliário de Portugal-Departamento Técnico. 1996. A Floresta Portuguesa e a Indústria de Madeira. Porto: Associação das Indústrias da Madeira e do Mobiliário de Portugal.

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BFE-Banco de Fomento e Exterior. 1996. Plano Estratégico para o Sector Florestal - 1.ª Fase. Lisbon: Banco de Fomento e Exterior (unpublished manuscript refered as BFE, 1996).

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