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RESEARCH ARTICLE

The Portuguese forest and the Common Agricultural Policy

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Abstract
Objectives The article aims to assess the impact of support from the European Union on the prevalence of fires in Portugal. The study has a territorial dimension that identifies the support distribution pattern and the location of forest spaces.
Methods The study uses several databases on the territory and on the funds of the European Union distributed by the municipalities of the Portuguese mainland. It uses a spatial econometrics model from endogenous variables constructed from a principal component analysis.
Results The results infer that support is concentrated in the most prosperous agricultural regions. The poorest regions where the forest surface is proportionally larger receive little support. There is no correlation between European Union support for forests and the prevalence of fires.
Conclusions To reduce the risk and prevalence of fire, it is necessary to promote an active management of forest areas. To this end, it is necessary to review the way in which support from the Common Agricultural Policy is distributed so that vulnerable territories can receive more support, empowering populations and promoting rural development.

Keywords Common Agricultural Policy · Forest · Vulnerable territories

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Introduction

The forest is almost always in the news for the wrong reasons, especially in the hottest seasons. Although this phenomenon is more associated with the South European countries, fires are increasingly occurring in northern latitudes. Despite the increasing concerns, forest fires are considered part of the Mediterranean landscapes (Moreira et al. 2011) and, generally, a characteristic of the ecosystem (Pausas and Keeley 2009). The scientific evidence has shown that fire regimes are closely related to phenomena such as climatic variability and most relevant for this work, human activities (Bowman et al. 2011). The socio-economic changes and the land use changes on the urban–rural–wildland interface across large parts of the European Mediterranean territory are of particular concern as it seems to potentiate the change of their forest fire regimes to a more strength and destructive pattern (Ursino and Romano 2014).

The Portuguese territory is an interesting case study, where the path between the slight changes in its climatic regimes and the socioeconomic restructuration of local communities (in particular, across the inland territory and the associated land use changes) are pointed as relevant elements to explain the increasing risk of socioeconomic losses to local communities associated to fire events (Mateus and Fernandes 2014; Oliveira et al. 2017). In particular, the association between the extended rural decline (Wolf et al. 2020) and the abandonment of cultivated land spots (Azevedo et al. 2011), seems to contribute to explaining the increase and selective prevalence of fire occurrences on specific land use types (Nunes et al. 2016). Moreover, as climate changes provide better weather conditions to increase the number of fires and raise the probability of "mega-fires," the classical response based on the capacity of firefighting services exceeds, and alternative approaches based on prevention are required (San-Miguel-Ayanz et al. 2013).

As evidence grows on the close link between the decline of farmland, the emergence of shrubland landscapes, and the transformation of forests (change in its composition/prevalence of species), researchers have highlighted the importance of forest management. This is viewed as a fundamental step towards (a) the social and economic valuing of the forest for the community and (b) the first and most important preventive measure against fires. Despite this reality, forestry policies have not been able to reverse the increasing risk of forest fires or the efficient use of their economic, environmental, and social potential, which can be associated with the prevalence of a reactive approach adopted by policymakers, as shown by Mourao and Martinho (2019) through extensive bibliometric analysis. In the case of Portugal, the strict analysis of legislation timeframes seems to point to a similar pattern of reactiveness. Despite the results, the debate around it highlights the limited explanation power of the analysis of legislation to understand the complex nature of policies with a direct or indirect impact on forest management and its relationship with fire regimes (Fernandes et al. 2017).

In the case of Portugal, the interlinkage between forest fires and policies cannot ignore the important role of the broad European policy (Jones et al. 2011). In fact, most public funding to directly support forest management (and the development of rural areas, in general) comes from the Common Agricultural Policy (CAP) and the Rural Development Program (Pillar II). In this sense, the analysis of the distribution of CAP funds will provide an important contribution to the debate on the current state of the forests and the relationship between rural development, forest management investment, and forest fire incidence.

This article assesses the association between the spatial distribution of CAP support to Portuguese beneficiaries and the proportion of land occupied by forests (and other non-farmland natural-related land use). It will pursue an empirical approach to explore the path between the CAP fairness on the distribution of rural development funds (in general), CAP forest policy programs (in particular), and CAP forest firefighting investment (in focus) with the fire prevalence.

The paper will follow with a brief overview of forest policy within the CAP overall framework (Pillar 2) and how it has been operationalized in Portugal. In particular, the following section will provide close attention to the strategic dimensions enunciated in the legislation supporting CAP programs and shows the overall relevance of forests through the non-urban landscape. The work follows with an empirical section, divided into (a) exploratory spatial analysis of CAP investment, in particular, the program actions directly related to forests management, the fairness analysis of that distribution concerning the recognized "vulnerable territories," (b) then, exploratory factor analysis will be presented in order to analyze the relationships between socioeconomic and geomorphological attributes of the municipalities, the CAP investments (based on yearly payments data for 2019 and 2020 years) and the fire occurrences (burned area and the number of fires) across the last 10 years and (c) a spatial regression analysis will be presented to track the path between the socioeconomic and geomorphological characteristics of territories (as latent dimensions) and the number of fires occurrences. The discussion of the results in this section will provide an articulated interpretation and discussion of the different evidence encountered.

At a time when the Portuguese counterpart of the CAP Strategic Plan for the next funding cycle has been approved, the discussion on the results provided by this work will be an opportunity to provide a set of suggestions aimed at ensuring a fairer distribution of funding support, valuing the production of environmental services in territories where this provision has

been scarce in order to contribute to a more resilient forest and (rural) communities, in particular, to manage one of the most broadcasted concerns: the forest fires.

Forest policy in Europe and Portugal

The Treaties do not mention the forest explicitly. In this sense, there is no European forest policy. However, the forest has been increasingly present on the political agenda of the European Union. This is partly due to the increasingly frequent occurrence of mega fires in several member states, but also to the central role of the forest in combating climate change. The principle of subsidiarity, combined with the diversity of forests within the European area, implies that forestry policy remains within the domain of national competences. However, against the background of a growing awareness of the global nature of climate phenomena and the impossibility of segmenting this fight within the sovereignty of each individual states, the European Union established a European strategy for forests with a set of support mechanisms to encourage the sustainability of European forests.

There is no technical definition commonly adopted by all member-states on the meaning of the term "forest". The European Union, and in particular the Eurostat adopted the United Nations terminology, which considers forest as a "Land spanning more than 0.5 hectares with trees higher than 5 m and a canopy cover of more than 10 percent" (Keenan et al. 2015). The European Forest with its 158 million hectares represents 5% of the world's forest area. It covers 37.7% of the surface of the European Union. Two thirds of the forest is concentrated in 6 member states, Sweden, Finland, Spain, France, Germany, and Poland). With very different dynamics within the European space, the forest area increased by 11 million hectares between 1990 and 2010.

The European Forest presents an enormous diversity. Within the European Union, and even to a lesser extent, within some Member States, we find very different ecosystems, all classified as forest. This difference stems from the geoclimatic specificity, and in particular the soil, altitude, and topography, despite considering that only 4% of the European forest has not been subject to human intervention (Table 1).

The multifunctional character of the forest is recognized by the European Union. The forest has an environmental function, providing several key ecosystem services. It is the first line of defense against soil erosion. It represents an important carbon sink and protects biodiversity, serving as a habitat for numerous species. The forest also has an economic function. According to Eurostat, 134 million of the 161 million hectares of forest in the European Union are allocated to wood production. In the European Union, 42% of wood production is destined for the energy sector. In second place comes the sawmill with 24%. In third place follows the paper industry with 12%. In addition to wood, the forest produces other non-woody goods such as cork, resins, oils and food products (mushrooms, wild fruits). It also supports leisure activities (tourism, sports, etc.).

The factors that threaten the forest can be biotic or abiotic (Aggestam and Pülzl 2018). It is estimated that 6% of the forest surface is affected by biotic factors, among which intensive grazing and various pests stand out. Within the abiotic factors, fires emerge as the main one, especially in the Mediterranean regions. Drought, storms, and air pollution, all associated with climate change, are also referred to as potential threats to the forest.

Although forestry policy is a national competence, the EU has long contributed, through its policies, to the implementation of sustainable forest management and influences Member States' decisions on forestry matters. According to the European Commission, sustainable forest management can be defined as "The administration and use of forest lands in a way and at a rate that maintains their productivity, biodiversity, productivity, regeneration capacity, vitality and their potential to fulfil now and in the future relevant ecological, economic and social functions at local, national and global levels and that does not cause damage to other ecosystems."[1] The first European text dedicated to forests was published in 1998. The 1998 EU Forestry Strategy established a framework for sustainable forest management based on beneficial

[1] Ministerial Conference for the Protection of Forests in Europe. Helsinki, 2003.

Table 1 Baseline data on EU forests. *Source* Eurostat 2019

Member-state	Forests/other wooded lands (1000 he)	Percentage of forests in the total area (%)	GVA/forest area (EUR/hectare)	Forest ownership: % of public forests	Forest area per inhabitant	People employed in forestry (1000 UTA)
Austria	3885.6	46.40	274.00	25.80	0.47	21.70
Belgium	689.3	22.60	121.00	46.50	0.06	2.30
Bulgaria	3880.0	35.20	68.00	87.90	0.53	22.20
Croatia	1936.6	34.20	112.00	71.70	0.59	14.40
Cyprus	172.7	33.90	442.00	68.80	0.34	21.80
Czechia	2675.3	33.90	442.00	76.60	0.25	21.80
Denmark	627.5	14.60	557.00	23.70	0.12	6.00
Estonia	2438.4	53.90	98.00	41.30	1.85	5.80
Finland	22,409.0	66.20	183.00	30.40	4.23	20.80
France	17,169.6	27.10	206.00	24.70	0.27	30.00
Germany	11,419.0	32.00	275.00	52.00	0.14	39.00
Greece	3901.8	29.50	14.00	77.50	0.59	9.00
Hungary	2054.5	22.10	129.00	57.60	0.22	20.70
Ireland	778.0	11.10	24.00	53.20	0.17	2.40
Italy	9512.3	31.50	208.00	33.60	0.19	38.80
Latvia	3406.9	52.80	163.00	52.30	1.72	17.90
Lithuania	2200.0	33.70	122.00	61.40	0.77	11.90
Luxembourg	88.7	34.30	400.00	47.10	0.16	0.30
Malta	0.4	1.50	0.00	–	–	0.00
Netherlands	368.6	8.90	430.00	48.50	0.02	2.00
Poland	9471.0	30.30	165.00	81.90	0.24	73.30
Portugal	3312.0	35.90	288.00	3.00	0.47	15.30
Romania	6929.1	29.10	257.00	67.00	0.35	51.80
Slovakia	1925.9	39.30	256.00	50.20	0.36	25.50
Slovenia	1185.6	58.50	228.00	25.30	0.62	7.10
Spain	18,567.9	36.70	54.00	29.20	0.59	88.80
Sweden	27,980.0	63.80	110.00	24.30	3.18	40.00
UE-27	158,822.9	37.70	168.00	39.70	0.36	519.40

cooperation between EU and Member State policies and initiatives.[2]

This strategy led to the Forest Action Plan 2007–2011[3] which constituted an important instrument for the implementation of the strategy, addressing four objectives: competitiveness, environment and quality of life, coordination, and communication. In September 2013, the Commission communication entitled "A new EU strategy for forests and the forest sector" defined the new EU strategy and proposed a new European framework for the creation of sectoral policies with an impact on forests.[4] The communication stressed two main objectives:

- Ensuring that European forests are managed sustainably.
- Strengthen the Union's contribution to promoting sustainable forest management and combating deforestation worldwide.

[2] Council Resolution of 15 December 1998 on a forestry strategy for the European Union.

[3] COM (2006) 302.

[4] COM (2013) 0659.

In September 2015, the Commission approved the multiannual implementation plan for the EU's forestry strategy.[5] The so-called "Forest MAP" establishes a list of actions that must be taken to respond to the challenges of the European wood sector. 1 year before the expiration of the "Forest MAP", the Council invited the Commission to present a new forestry strategy for the coming years. The EU's new 2030 forestry strategy is one of the flagship initiatives of the "European Green Deal". It is based on the EU's 2030 biodiversity strategy and is expected to contribute to achieving the EU's biodiversity targets, as well as the target of reducing greenhouse gas emissions by at least 55% by 2030 and climate neutrality by 2050. The strategy recognizes the central and multifunctional role of forests and the contribution of foresters and the entire forest-based value chain to achieving a sustainable and emission-neutral economy by 2050, while preserving living and prosperous rural areas.

Around 90% of Union funds allocated to forests come from the European Agricultural Fund for Rural Development (EAFRD). For the 2015–2020 period, support for investments in the forest covered the development of forest areas and the improvement of forest viability, afforestation and creation of wooded areas, and the installation of agroforestry systems. It also covers the prevention and repair of damage caused to forests by fires, natural disasters and catastrophic events, investments in improving the resilience and environmental value of forest ecosystems and investments in forest technologies and the transformation, mobilization, and commercialization of forest products. Other non-forest-specific measures were also provided, such as payments under the Natura 2000 network and the Water Framework Directive.[6] A total of €8.2 billion has been programmed for the period 2015–2020 (27% for afforestation, 18% for improving the resilience of forests and 18% for preventing damage).

Table 2 presents the main forest support items within the 2014–2020 program contained in Regulation (EU) no. 1305/2013 of the European Parliament and of the Council of 17 December 2013 on support for rural development by the European Agricultural Fund for Rural Development (EAFRD).

However, and according to the European Commission's communication on the forestry strategy for 2030, the rate of application of forestry measures was low and decreased considerably over the programming period.[7] This is due, still according to the same document, to several factors: the lack of knowledge necessary to deal with the administrative procedures for requesting access to funds, the insufficient attractiveness of support, the lack of training of agents, limited guidance on how to implement forest adaptation activities and climate change measures to prevent and reduce risks (e.g., forest fires, soil erosion, disease, flooding). The new CAP (for the period 2023–2027) aims to offer more flexibility to design forest-related interventions according to national needs and characteristics, reducing bureaucracy and ensuring synergies between the European Green Deal, national resource policies for forests and the European Union's environmental and climate acquis.

According to the 2030 forestry strategy, the recommendations addressed to the Member States, the CAP strategic plans for the period 2023–2027 should focus on forests. The recommendations encourage sustainable forest management to improve the multifunctional role of forests. When evaluating CAP strategic plans, the Commission will pay particular attention to forest-related measures, which have strong synergies with the EU's climate and biodiversity objectives. In view of the EU's growing ambition on climate and biodiversity, Member States are particularly encouraged, depending on their national circumstances, to establish a payment scheme for ecosystem services in favor of landowners and forest managers to cover costs and revenue losses. Member States are also encouraged to accelerate the roll-out of carbon-reducing agricultural practices. This objective can be achieved through ecological schemes related to agroforestry interventions or through investment in biodiversity-oriented rural development in forestry, agroforestry, and other non-productive investments for environmental and climate related objectives.

[5] SWD (2013) 0343.

[6] Around 37.5 million hectares of forest (23% of European forest) are part of the Natura 2000 nature protection network, set up under the EU's environmental policy.

[7] Communication from The Commission to The European Parliament, The Council, The European Economic and Social Committee and The Committee of The Regions Empty, New Eu Forest Strategy For 2030.

Table 2 Rural development headings related to the forest

IV/A. Programming period 2014–2020—measures established by Title III, Chapter 1, of Regulation (EU) No. 1305/2013			
IV/A.8	[RD] art.º 21 (22–26)	Investments in the development of forest areas and in improving the viability of forests	This measure aims to promote investments in the development of wooded areas, in the protection of forests, and in innovation in the forestry sector, technologies and forest products, with the purpose of contributing to the growth potential of rural areas and increasing production of renewable energies
IV/A.9	[RD] art.º 22.º	Afforestation and creation of wooded areas	This sub-measure provides support for afforestation and forestation operations on agricultural and non-agricultural land
IV/A.10	[RD] art.º 23.º	Implementation of agro-forestry systems	This sub-measure supports the creation of agro-forestry systems and practices in which perennial woody species are combined with crops and/or animals in the same territorial unit
IV/A.11	[RD] art.º 24.º	Prevention and repair of damage to forests caused by forest fires, natural disasters and catastrophic events	This sub-measure aims to prevent and repair forestry potential, through compensation and replanting, after forest fires or other natural disasters such as pest and disease outbreaks, in addition to threats related to climate change
IV/A.12	[RD] art.º 25.º	Investments to improve the resilience and environmental value of forest ecosystems	This sub-measure supports actions that enhance the environmental value of the forest, facilitate its adaptation and mitigation of climate change, provide ecosystem services and increase the public utility value of forests. The increase in the environmental value of forests must be ensured
IV/A.13	[RD] art.º 26.º	Investments in forest technologies and in the transformation, mobilization, and commercialization of forest products	This sub-measure aims to provide support for investment in machinery and/or equipment related to harvesting, cutting, mobilizing, or processing wood prior to industrial sawing. The main objective of this sub-measure is to improve the economic value of forests

According to the 6th National Forest Inventory (IFN6), the mainland Portuguese forest is dominated by native species.[8] First come the oaks (including cork oaks and holm oaks) with 36% of the total area (Blondel 2006). In second place are pines with about 30%. Eucalyptus forests represent 26% of the forest area and the remaining area is distributed among lesser species (including chestnut, carob, acacia, strawberry tree, poplar, riverine species, and other resinous species).

The twentieth century represents a period of inflection regarding the secular trend of decline in the Portuguese forest area. According to (Nunes 2002), the forest covered only 7% of the national territory at the end of the nineteenth century. This trend was reversed throughout the twentieth century. The first major effort to reforest the so-called uncultivated areas began in 1886, with the creation of the Forest Services. Plans for afforestation began in mountainous areas. The work of afforesting the dunes on the coast started in that period as well. In 1902, the forest occupied 21% of the territory. Later, with the "*Plano de Povoamento Florestal*" in 1938 (Forest Settlement Plan) and the successive "*Planos de* Fomento",[9] the forest area continued to increase, reaching 30% of the territory in the 1970s. Maritime pine, capable of growing in very poor

[8] Available at http://www2.icnf.pt/portal/florestas/ifn/ifn6 (accessed in 20/02/2022).

[9] Development Plans implemented by the dictatorship that prevailed in Portugal between 1926 and 1974.

Table 3 Forest area (thousands of ha) by Geographic localization. *Source* INE 2019 and IFN6

	2015	2010	2005	1995
T: Total	3329.6	3269.7	3299.9	3381.4
1: Forest areas	3030	2991.1	2940.2	3233.3
11: Pine area	808.7	811.4	821.2	1060.8
111: Pinus pines area	619.5	633.4	659.5	983.1
112: Stone pine area	189.2	178	161.6	77.7
12: Cork oaks area	705.1	695.9	711.8	712.8
13: Eucalyptus area	777.8	757.7	716.5	675.1
14: Oak area	76.7	65.1	61.9	130.9
15: Chestnut area	47.8	42.7	37.5	41.6
16: Holm oak area	341.8	343.3	329.4	461.6
17: Areas of other softwoods	58.3	80	79.4	28.4
18: Other hardwood areas	213.8	194.9	182.4	122.1
2: Burnt areas of settlements	12.7	30.1	104.7	79.3
3: Clear cut areas	99	38.3	28.5	27.4
4: Regenerating areas	125.7	147.4	179.5	0
5: Other Forest areas	62.2	62.8	46.9	41.4

soils, was the privileged species (Gómez Sal 2017). In addition to its rusticity, pine had other advantages. It improved the level of organic material in the soil, allowing the use of leftovers for biomass. In addition, the wood produced fed an important industrial sector of furniture and construction. The maritime pine forest reached its maximum in the 1980s. From then on, it suffered from fires and gave part of its area to eucalyptus, considered as a species of choice for the paper industry. Between 1995 and 2015, according to Table 3, the global forest area remains practically the same. The pine forest area loses 250 thousand hectares, while the eucalyptus area increases by 150 thousand hectares. The area of cork oak (holm oak and cork oak) loses about 120 thousand hectares.

The forest ownership regime in force in Portugal is unique in the European panorama. As can be seen in Table 1, only about 3% of forest land is owned by public entities. Private landowners hold 92%, with the remainder integrated into the community property (the so-called "Baldios"). Private property is characterized by high fragmentation. In Portugal, there are 11.7 million rustic plots for forest use.

According to Portuguese Statistic Institute (INE), the total of Forestry Production and Forestry Exploitation currently represents a total of around 1.3 billion euros, employing around 100 thousand direct workers (INE 2020). Industrial products originating in the forest account for a significant proportion of exports. In these products, cork and paper pulp stand out. In addition to wood (especially pine and eucalyptus) and cork, the production of pinecone, resin and chestnut are also economically relevant. Silviculture and Forestry, with around 885 million euros, represent around 0.6% of the national GVA. If we include the associated industry, this percentage rises to 2.5%. Forest products as a whole guarantee, on average, a trade surplus of 2.5 billion euros covering a significant part of the entire Portuguese food trade deficit.

The Forest Policy Framework Law (Law no. 33/96) defines the foundations of national forestry policy. The National Strategy for Forests (ENF) was approved by the Portuguese government in September 2006. It was then updated in 2015. This law constitutes the reference element for public and private guidelines and action plans for the development of the forestry sector. This strategy is materialized through 22 PROF (regional forest management plans), of which 21 cover the mainland (they will be reduced to 7 after the ongoing review) and 1 cover the Autonomous Region of Madeira. Public and community forests, private properties above a certain size and ZIF (forest intervention zones) must, according to the law, have a PGF (forest management plan). More than 3000 PGFs have been approved on the mainland, covering 1.72 million hectares (31% of forest stands).

Faced with such a high fragmentation of forest property, it is essential to support the association of forest owners. Producers and forest owners can find advantages by creating organizations representing their interests. These enable cooperation and resource optimization. Forest producer organizations carry out a wide range of activities. These can be advisory and support tasks in forest management. Producer organizations can implement public programs for the promotion and protection of forest resources. These programs are fundamental, namely in the defense of the forest against fires and in the fight against biotic agents. They may also perform business functions, marketing and enhancing the products valorization of their members. The importance of producer organizations is recognized by Portuguese legislation. The Basic Law of Forestry Policy assumes the objective of «Promoting the management of the national forest heritage, namely through the planning of forest operations and the promotion and support of associations».

However, despite their growth, the organizations cover only around 65,000 forest owners. According to INE estimates, there are around half a million forest owners in Portugal. Currently, 135 forest producer organizations are registered within the Institute for the Conservation of Nature and Forests (ICNF).

The Forest Intervention Zones (ZIF), created through Decree-Law no. 127/2005, of 5 August, represent another form of grouping, focused on the common management of forest areas. The existence of a very fragmented land structure, in small plots, has constituted a strong obstacle to socioeconomic development and to the strengthening of the competitiveness of the forestry sector. The ZIF's fundamental objectives are the promotion of sustainable management of forest areas. With the association of small areas under the same management, the necessary scale is gained to enable a planning and forest management capable of guaranteeing a better use of the productive potential and, at the same time, preventing the risks associated with fires or pests. At the end of 2021, there were 262 ZIF constituted according to ICNF data, covering about 1856 thousand hectares. These were managed by 86 different entities and encompassed more than 29 thousand members. Figure 1 shows the distribution of ZIF on the mainland. Two observations deserve to be made. Firstly, the ZIFs cover a still small part of the territory. Moreover, they are heavily concentrated in Alentejo and Ribatejo (center and south of Portugal). A third smaller but significant spot stands out in the central-north region in the western part of Serra da Estrela.

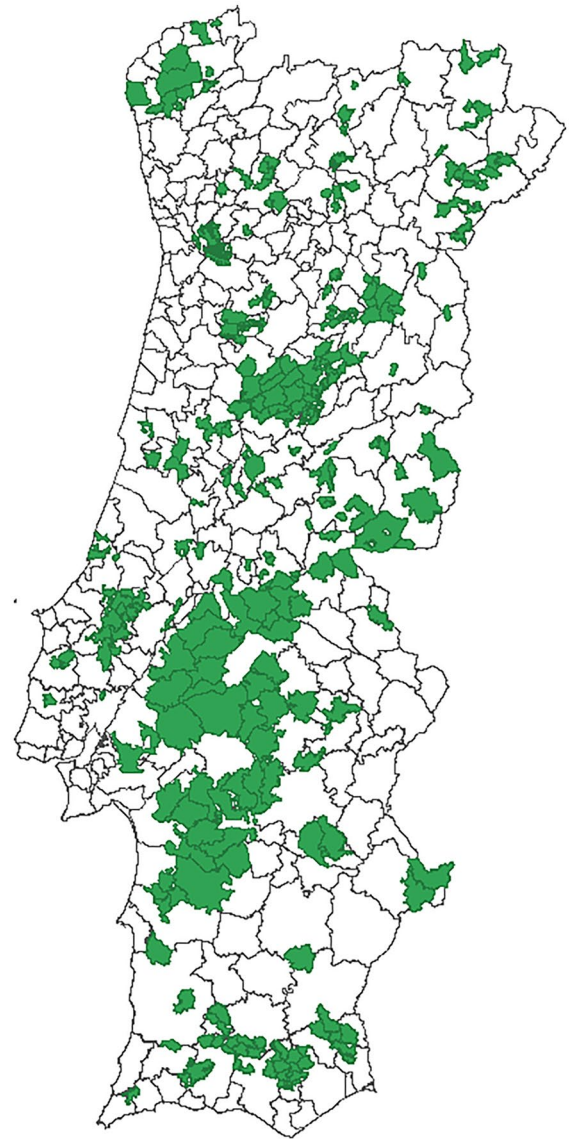

Fig. 1 Distribution of Forest Intervention Zones (ICNF, 2021)

CAP support for forestry in Portugal: an empirical analysis

The Rural Development Plan corresponding to the last Multiannual Financial Framework (PDR 2020) is divided into four areas:

- Area 1. Innovation and Knowledge
- Area 2. Competitiveness and Production Organization
- Area 3. Environment, Efficiency in the Use of Resources and Climate
- Area 4. Local development

Specific measures for the forest can be found in Area 3. In Area 2 are measures to support the valorization of forest products. These are essentially designed for industrial companies that process forest products.

Within Area 3, there are two measures targeting the forest: measures 7 ("Agriculture and Natural Resources") and 8 ("Protection and Rehabilitation of Forest Stands"). Within measure 7 we find several actions: actions 7.3 (Natura network), 7.7 (extensive pasture), 7.9 (forest mosaic), and 7.10 (Environmental measures). Measure 7 is intended to contribute to a more sustainable and fire-resistant

forest. However, its financial weight and scope are small. Measure 8 concentrates the most important resources destined to support the forest. This measure includes two main actions, each with a set of operations:

- Action 8.1. Sustainable Forestry
    - Operation 8.1.1. Afforestation of Agricultural and Non-Agricultural Lands
    - Operation 8.1.2. Installation of Agroforestry Systems
    - Operation 8.1.3. Forest Prevention against Biotic and Abiotic Agents
    - Operation 8.1.4. Restoration of the Forest Affected by Biotic and Abiotic Agents or by Catastrophic Events
    - Operation 8.1.5. Improving the Resilience and Environmental Value of Forests
    - Operation 8.1.6. Improvement of the Economic Value of Forests
- Action 8.2. Management of Game and Aquaculture Resources
    - Operation 8.2.1. Management of Hunting Resources
    - Operation 8.2.2. Aquaculture Resource Management

Data on amounts paid by beneficiary released by the Institute for Financing for Agriculture and Fisheries (IFAP) represent the most reliable source for assessing the support that really reaches the field. The disclosure of that information is a legal imperative of the regulations.

The common agricultural policy (CAP) supports almost seven million beneficiaries across the European Union. Under the transparency rules, EU countries must publish detailed data on the beneficiaries of CAP payments.

Recipients of EU funding under the CAP must appear on publicly accessible lists. These lists are intended to promote transparency and trust in EU funding measures. However, to ensure the protection of personal data, the information disclosed is limited and is only available for a specified period. Published data must include:

- the name of the beneficiary (exceptions are provided for recipients of very small payments, whose thresholds are set by EU countries);
- the municipality in which the beneficiary resides or is registered;
- the breakdown of payment amounts by specific measure, as well as the sum of the amounts received by each beneficiary during the financial year in question;
- a description of the measures financed by the funds, including their nature and purpose.

Regulation (EU) no 1306/2013 of the European Parliament and of the Council of 17 December 2013 on the financing, management, and monitoring of the common agricultural policy

CHAPTER IV: Transparency

Article 111: Publication of beneficiaries

1. Member States shall ensure annual ex-post publication of the beneficiaries of the Funds. The publication shall contain:

(a)without prejudice to the first paragraph of Article 112 of this Regulation, the name of the beneficiary, as follows:

(i) the first name and the surname where the beneficiary is a natural person

(ii) the full legal name as registered where the beneficiary is a legal person with the autonomous legal personality pursuant to the legislation of the Member State concerned

(iii) the full name of the association as registered or otherwise officially recognized where the beneficiary is an association without an own legal personality

(b) the municipality where the beneficiary is resident or is registered and, where available, the postal code or the part thereof identifying the municipality

(c) the amounts of payment corresponding to each measure financed by the Funds received by each beneficiary in the financial year concerned

(d) the nature and the description of the measures financed by either of the Funds and under which the payment referred to in point (c) is awarded

The information referred to in the first subparagraph shall be made available on a single website per Member State. It shall remain available for 2 years from the date of the initial publication

2. As regards the payments corresponding to the measures financed by the EAFRD as referred to in point (c) of the first subparagraph of paragraph 1, the amounts to be published shall correspond to the total public funding, including both the Union and the national contribution

Data and methods

The main dataset used on this work was provided by IFAP (Instituto de Financiamento agrícola e pescas),

which has the main mission of the management of payments provided by the CAP programs. Thus, this dataset has the advantage of providing a "real-yearly-view" of the (spatial) distribution of payments and a complete coverage of all different types of programs which ensures payments. Moreover, this dataset is based on payments to beneficiaries and the georeferencing data associated with that entities is more accurate rather than in other data sources.

The dataset was released for the purposes of European harmonization and, thus, is grouped according to the rubrics of the regulations and not according to the national PDR (Programa de Desenvolvimento Rural). Thus, the sample provided by this dataset will provide an overview of the (yearly) flow of money to the beneficiaries and a realistic evaluation of realization, as the payments are usually realized with a control on beneficiaries' eligibility and effective investment. Moreover, the nature of the dataset will provide a stable overview of the funding program execution, which can be expected to be more stable amounts across years since it does not depend on the cycles of the funding competitions (as in data from PDR) Despite that, the availability of data only for 2019 and 2020 do not provide a way to verify this assumption.

Table 4 presents the main items directly or indirectly related to the forest. It is necessary to interpret the data with some caution. Many actions, such as action 15 (agri-environmental measures) are transversal to many areas.[10] In this case it is not possible to isolate the part of this action that is absorbed by the forest. Actions 8 and 20, on the other hand, are aimed directly at the forest. Action 20 has an almost residual value. We will focus our study on action 8 that aggregates the fundamental part of the PDR2020 measures dedicated to the forest. In Table 4, we can see the average of the amounts paid and the number of beneficiaries between 2019 and 2020. Action 8 supported on average during the period, 5357.5 beneficiaries, in a global amount of 53 million euros. This value corresponds roughly to 10% of the total envelope allocated to Rural development (Pillar II of the CAP). It represents an aid of almost 10 thousand euros per farmer.

[10] Article 28 of Regulation (EU) No 1305/2013 of the European Parliament and of the Council of 17 December 2013 on support for rural development by the European Agricultural Fund for Rural Development (EAFRD).

Figure 2 compares the distribution of support in the Portuguese mainland with the proportion of forest area per agricultural holding according to the 2019 INE Agricultural Census (Instituto Nacional de Estatística 2021a). More particularly, the cartogram on the left shows the distribution of the amount of forest support by municipality related to with action 8 (see Table 4). The middle cartogram shows the distribution of beneficiaries also by municipalities in mainland Portugal. The two maps indicate a very uneven geographical distribution of CAP forestry support in the territory. Support and beneficiaries are mainly concentrated in the Alentejo region, and in the interior areas of the Center and North regions. As a result, a significant part of the central and northern regions receives much less support compared to other regions of the country.

Does this pattern result from a heterogeneous geographic distribution of the forest space? The cartogram on the right side of Fig. 2 gives some clues about this question. In it, we can see the proportion of forest area in agricultural holdings censused by INE. According to the data, it is precisely in the Centro region of Portugal where this concentration is higher. We can also see a darker spot on the western side of Algarve (in the south), corresponding to the Monchique Mountain, where the forest area also represents a significant part of agricultural holdings. In other words, it is the regions where the proportion of forest area in agricultural holdings is greater that receive less support. On the other hand, regions such as Alentejo, where the forest area is less important, concentrate the most important part of forest support, in detriment of other regions where this need is certainly more pressing.

Between 2000 and 2019, 2.8 million hectares of burned area were recorded in Portugal (San-Miguel-Ayanz et al. 2020). The years 2003, 2005 and 2017 were the ones with the most rural fires. These years contributed strongly to Portugal being the country with the largest burned area within Europe in the last two decades. This high incidence of fires is related to the increasing desertification of rural areas, but also to extreme weather conditions (ICNF 2019). The abandonment of a large part of the rural space by farmers makes these territories more vulnerable to fires. For this reason, Portugal is the southern European country with the highest proportion of burned area in rural territories (San-Miguel-Ayanz et al. 2020). In this

Table 4 Paid support directly or indirectly related to the forest. *Source*: IFAP

	Average 2019/2020		
	Amount	Beneficiary	Average
Action 8: Sustainable Forestry	53 377 973.01 €	5357.5	9963.22 €
Action 15: Agro-environment and climate	153 916 929.57 €	56 995.5	2700.51 €
Action 17: Natura 2000 network and the Water Framework Directive	8 457 388.93 €	6370.5	1327.59 €
Action 18: areas subject to natural constraints	169 783 431.96 €	146,863.0	1156.07 €
Action 20: Forest and climate services and forest conservation	775 739.02 €	62.5	12 411.82 €

sense, the need to support the forest in vulnerable territories should be a top priority. Not by chance, the Recovery and Resilience Plan (the main instrument of Next Generation EU plan) provides a specific line of support for the transformation of the landscape of vulnerable territories, which involves structural measures to prevent forest fires (with a primary network of fuel management lanes) and support for the recovery of the forest, making it more resilient.

Figure 3 presents 3 maps that compare the distribution of fires with the location of vulnerable territories and the distribution of CAP support. Portuguese legislation ("Portaria n. ° 301/2020") approved the delimitation of so-called vulnerable territories. Structural changes in society in recent decades have led to population migration to large urban areas. Thousands of hectares, used in agriculture or grazing, passed into the domain of forest occupation (bushes and wooded areas). In more recent decades, the loss of economic value generated by agricultural activity, associated with the reduction in the price paid for forest products, accelerated the abandonment of large portions of the territory replaced by forestry monoculture or scrubland with high vegetable fuel loads. This situation generated the need for public policies to support these regions, reversing the cycle of degradation and

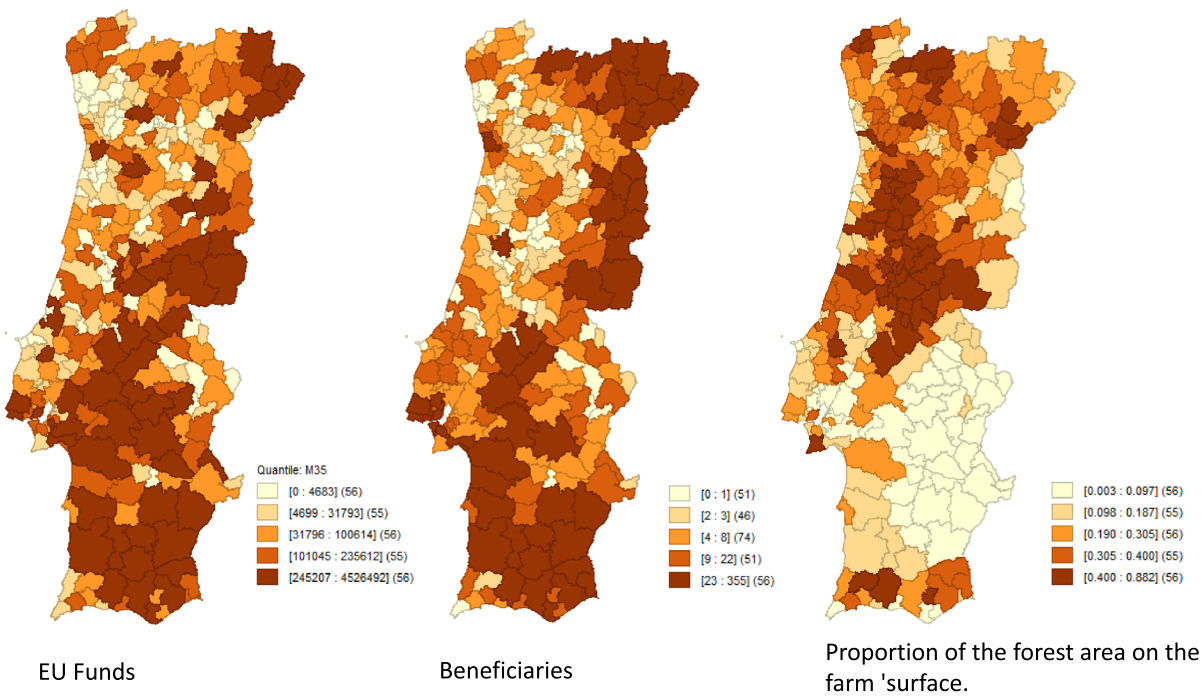

Fig. 2 Distribution of CAP support to the forest sector and forestry area. *Source* IFAP, 2019–2020 and Agricultural Census 2019, INE

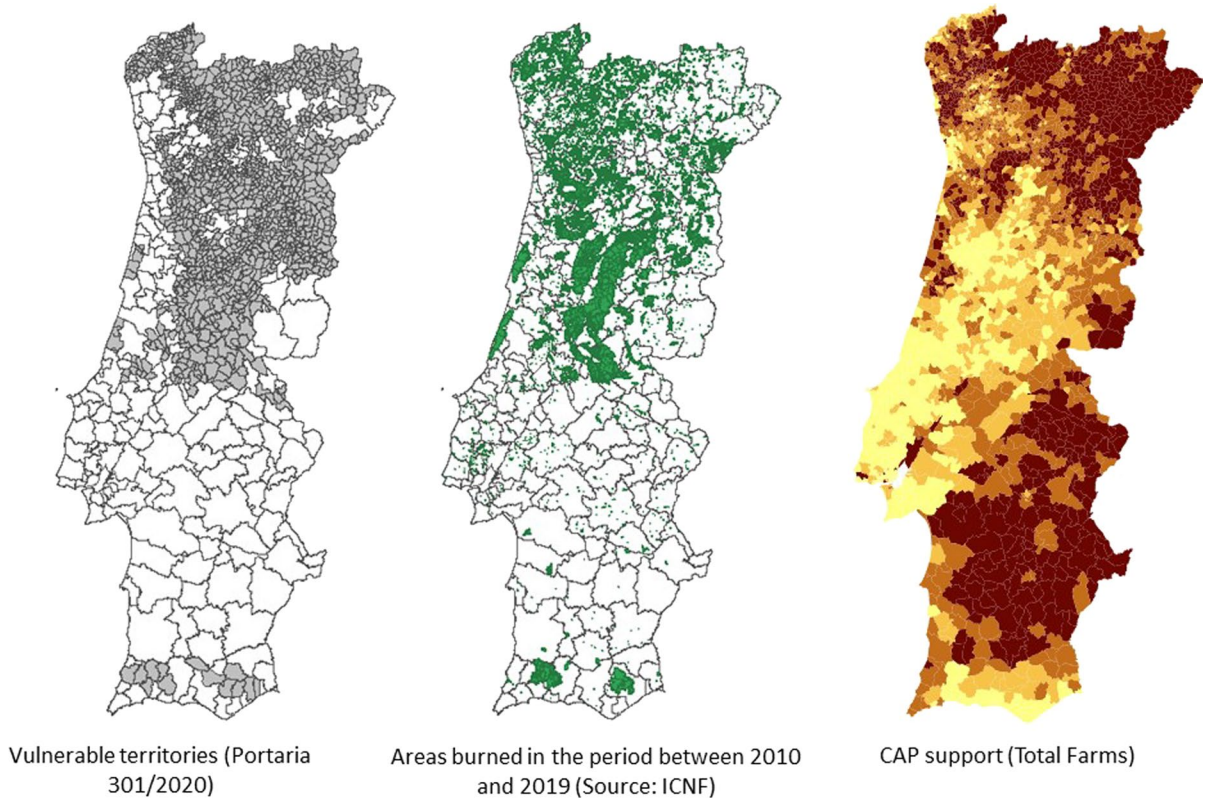

Fig. 3 Vulnerable territories, fires, and PAC support. *Source* ICNF and IFAP

impoverishment. To operationalize these policies, the legislation considers as vulnerable territories the parishes that meet the following conditions:

- The parishes on the mainland where more than 40% of the territory is at high and very high risk of rural fire.
- Parishes on the mainland that, not meeting the risk criteria established in the previous paragraph, are surrounded by parishes that meet the aforementioned criterion.

On the left map of Fig. 3, we see the continent's Vulnerable Territories. Except for a small spot in the Algarve, these territories are mainly concentrated in the Center and North regions. The middle map shows the location of fires in mainland Portugal between 2010 and 2019.[11] Finally, the cartogram on the right shows the intensity distribution of total CAP support by municipalities. Comparing the three maps, we identify the paradoxical way in which CAP funds have been distributed over the last decades. From a public policy perspective, support should be distributed to sectors that are economically unviable, but whose existence is socially beneficial, either because of the associated externalities or as an imperative in terms of territorial cohesion. The maps in Fig. 3 contradict this notion. The most significant part of CAP support is directed towards the most prosperous regions and activities in the country, leaving out the poorest and most vulnerable areas. This reality raises two questions. The first has to do with the need to revitalize abandoned rural territories in the center and north of the country as an essential condition to prevent fires and make investment in the forest feasible. The second issue has to do with the lack of equity in the distribution of support, which is heavily

[11] ICNF, Cartography of burned areas in the period between 2003 and 2019, https://www.icnf.pt/apoios/pdr2020/operacao814,reached in 23/02/2022.

concentrated in a part of the territory and in a small number of farmers.

Figure 4 represents the Lorentz curve and the Gini Index associated with payments for forest support represented in the cartogram on the left of Fig. 2. The Lorentz curve illustrates the cumulative distribution of support. An equitable distribution should correspond to the bisector of the first quadrant (dashed line in the graph). The further away from this bisector, the greater the inequality. As can be seen in the graph, there is a large concentration of supports in the last segment of the curve. The Gini index is 0.63. 50% of beneficiaries receive only 10% of support. It should be noted that support for the forest is even more concentrated than the distribution of total support. Indeed, the Gini index applied to the sum of all support is 0.50, with the 50% beneficiary receiving 17% of support.

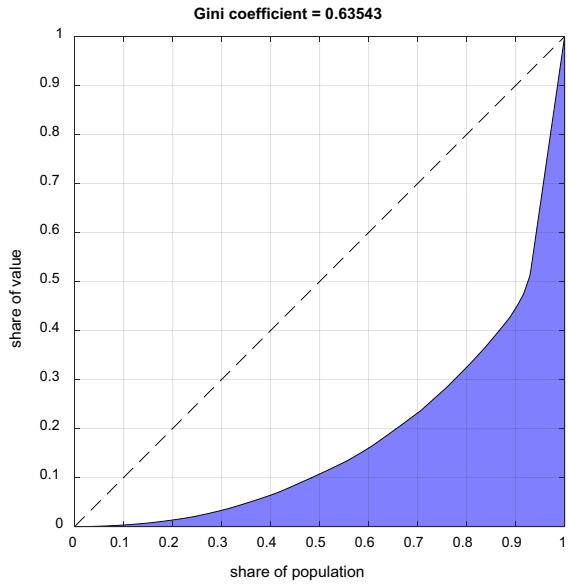

Fig. 4 Lorentz curve applied to the distribution of forest support 2019–2020 (Source IPAC and authors' calculations)

Principal component analysis

In this section, we perform a multifactor analysis with the objective of estimating the impact of CAP funds applied in rural areas on the prevalence of fires. For this, we gathered a set of variables related to each of the municipalities (see Table 5). Part of the variables were taken from INE and from the last agricultural census of 2010 as well (Instituto Nacional de Estatística 2021b). Land use data were taken from the General Directorate of Territory database from the COS2019 land use map.[12] The climatological data are from the Portuguese Institute of the Sea and the Atmosphere (IPMA).[13]

Based on these 34 variables, a Principal Component Analysis was carried out to explore correlations between variables and possible profiles among the 278 municipalities on the Portuguese mainland. The variables were previously centered and normalized.

The determinant of the correlation matrix turned out to be non-null. The KMO test gave a measurement of 0.639. As for Bartlett's Sphericity Test, the null hypothesis of non-correlation between the variables was rejected. We also verified that, in the commonality table, all variables have an extraction index greater than 0.5. We conclude that our database, with its 34 variables, is suitable for a Principal Component Analysis.

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy		0.639
Bartlett's Test of Sphericity	Approx. Chi-Square	8044.478
	Df	561
	Sig	0.000

Using eigenvalues greater than 1.5 as a criterion, we retained six components explaining 64.6% of the variance. We use the matrix of weights obtained after a Varimax rotation to interpret the components. Table 6 shows only weights greater than 0.5. The first component is clearly associated with the type of crops existing in each geographic unit. At one extreme we have agricultural fields at low altitude. At the opposite pole the forest in higher altitude zones. The second component represents a gradient relative to the number and size of farms and the amount of labor used. It also reflects the correlation between the size of farms and the number of beneficiaries. The third component aggregates the variables representing CAP support to farmers. The fourth component represents

[12] Available in SNIG, https://www.dgterritorio.gov.pt/Carta-de-Uso-e-Ocupacao-do-Solo-para-2018?language=en

[13] Available in http://portaldoclima.pt/en/.

Table 5 List of variables included in the principal components analysis

Variables	Unit	N
Number of beneficiaries A8		278
A8 amounts	euros	278
Total beneficiaries		278
Total support amount	euros	278
Exclusion rate from supports	%	278
Forest area ratio	%	278
Number of fires		278
Burned area	Ha	278
Equivalent unit of work		278
Value of standardized Production	euros	278
Used agricultural surface	Ha	278
Unused agricultural surface	Ha	278
Permanent cultures	Ha	278
Permanent meadows	Ha	278
Average surface per holding	Ha	278
Number of normal livestock units		278
Number of farms		278
Investment in biodiversity (extra. CAP)	euros	278
investment in fire prevention (extra. CAP)	euros	278
Investments in special protection zones (extra. CAP)	euros	278
Protected area	Ha	278
Altitude	m	278
Average temperature	ºC	278
Maximum temperature	ºC	278
Precipitation	mm	278
Autochthonous forest	Ha	278
Eucalyptus forest	Ha	278
Pine forest and other softwoods	Ha	278
Continuous built-up surface	Ha	278
Discontinuous built surface	Ha	278
Artificialized territories	Ha	278
Cultivated area	Ha	278
Wetlands and water surface	Ha	278
Total area	Ha	278

the climatic characteristics of each county. The fifth component combines meadows and permanent crops and native forest. And finally, the sixth component groups together the various items of national public expenditure (extra-PAC) in defense of the forest and biodiversity.

Our principal component analysis indicates that there is no association between support and fire occurrence. The average number of ignitions per board is associated with component 4 while the burned area does not appear associated with any of the 6 retained components. Both variables are thus disconnected from CAP support, whose variables are associated with factors 2 and 3. The prevalence of fires appears to be linked to maximum and average temperatures and to the rainfall regime. The lack of association between fires and CAP support is worrying and indicates that CAP may not be achieving its objectives in terms of territorial cohesion and development of rural territories. Indeed, support aimed at the forest should contribute to mitigate the risks and prevalence of fires. Total CAP support (the sum of all items per municipality) should have an indirect effect on the prevalence of fires by increasing agricultural activity in rural areas.

Regression analysis

We complement our analysis with an econometric exercise to estimate the relationship between the prevalence of fires and the set of variables in our database. For this, we will use the principal components for the predictor variables of the regression. This technique is advantageous when data suffer from multicollinearity with many explanatory variables with a high degree of correlation between them. It proceeds in two steps. In the first step, we extract the principal components from the initial variables as we did in the previous section (removing the endogenous variables). In the second step we proceed with a regression of our dependent variable (number of fires) on the factors obtained in the first step plus a dummy variable associated with vulnerable territories.

Forest fires are a phenomenon that acts at multiple spatial scales (Lanorte et al. 2013), and the adopted spatial scale (the municipality level) to the analysis of relations between fires and socioeconomic, geomorphological, and CAP funding explanation factors will possibly cause the emergence of the well-known phenomena of “spatial dependence” or “spatial autocorrelation” (Chou 2010). These phenomena can have different origins, including the modifiable aerial problem (Wong 2004) or an intrinsic characteristic of the spatial phenomena under study (an aspect translated by Tobler as the “first law of geography” (Miller 2004; Tobler 1970)). The latter is a plausible explanation of spatial dependence, as examples

Table 6 Principal component analysis attributes showing selected components and displaying only coefficients greater than 0.5 (in absolute value)

	Component					
	F1	F2	F3	F4	F5	F6
Used Agricultural Surface	0.889					
Forest area ratio	− 0.882					
Cultivated area	0.737					
Pine forest and other softwoods	− 0.691					
Eucalyptus forest	− 0.647					
Altitude	− 0.552	0.507				
Burned area						
Number of farms		0.911				
Equivalent Unit of Work		0.881				
Total beneficiaries		0.821				
Total area		0.635				
Value of Standardized Production						
Protected area						
Exclusion rate from supports			− 0.878			
A8 amounts			0.806			
Number of beneficiaries A8			0.742			
Continuous built-up surface			0.703			
Artificialized territories			0.697			
Total support amount			0.639			
Precipitation				− 0.760		
Maximum temperature				0.705		
Discontinuous built surface				− 0.654		
Number of fires				0.614		
Average temperature				0.605		
Number of normal livestock units						
Permanent Meadows					0.827	
Permanent Cultures					− 0.675	
Average surface per holding					− 0.650	
Autochthonous forest					0.543	
Unused Agricultural Surface						
Investment in biodiversity (extra. CAP)						0.693
Investments in special protection zones (extra. CAP)						0.680
investment in fire prevention (extra. CAP)						0.615

of fire occurrences (unique) affecting a wide spatial area (two or more municipalities) are increasingly common.

The following Figs. 5 and 6 show an exploratory analysis of spatial dependence through the well-established Moran I (autocorrelation measure (Moran 1950)) and LISA (local indicator of spatial association (Anselin 1995)). These statistical measures were applied to our dependent variable confirmed the presence of strong spatial dependence between the number of fires and the lagging variable.

In particular, Fig. 6, highlights the most significant spatial patterns of spatial association, showing the northwest of Portugal's mainland as a particular region where the high number of fires in each municipality is strongly associated with the high number of fires in neighborhood municipalities. This pattern is easily linked with this region's socioeconomic and

geomorphological characteristics. Crossing this map with the burned areas map presented in Fig. 3, it is possible to conclude that these is lower-scale fires (more noncontiguous burned areas). In contrast, the center and southeast of the Portuguese territory show a lower local spatial association on the number of fires, which, as similar, can be linked with the characteristics of this territory: less densely populated than the previous cluster (less complex urban–rural wildland interface), bigger land plots and, partially (mainly in the southeast part of the cluster) with a relatively high proportion of cultivated farmland or pasture activities; in contrast, this clusters of lower spatial association of the number of fires showed the largest continuous burned areas, suggesting the fires here usually occupy large extensions of territory.

Following the observation of spatial autocorrelation, the spatial lag econometric model adopted to explicitly consider and measure the spatial dependence structure on the dependent variable. Both simple LM test for lagged dependent variable and error dependence indicated presence of spatial dependence. The Robust LM (lag) test remains significant, while the Robust LM (error) tests turned to be insignificant. Therefore, we kept the spatial lag model. The model is estimated using the likelihood maximization method (LeSage and Pace 2009) and requires the specification of a spatial contiguity matrix (W), which here follows a first contiguity "queen style" geometric relationship between the polygons of the spatial (administrative) units (the Portuguese mainland municipalities). The spatial model estimations were obtained using the Geoda software (Anselin et al. 2010) and the estimation results reported in Table 7.

The regression indicates, on the other hand, a strong significance of factors 2 and 5 and of the dummy variable associated with vulnerable territories. In these, the results indicate that between 2010 and 2019, on average, there were 16.6 more fire occurrences compared to the other municipalities. Factor 2 is associated with the smallholding that prevails in regions of higher altitude and where there is more labor and a greater number of CAP beneficiaries. Factor 5 separates poor pastures and native forest at one end and permanent crops and large areas at the other (olive groves, almond groves, orchards, vineyards, etc.). The association of fires with the other factors is not significant with p-values above 10%. Factors 4 and 6 respectively represent CAP support for forestry and rural development (direct support to forest under heading A8 and general support for rural development), and public spending by the central government and municipalities in the defense of fires and in the valorization of the forest. We conclude that there is no relationship between CAP support and the prevalence of fires. This absence of statistical association reveals the ineffectiveness of public intervention, whether by the government or municipalities

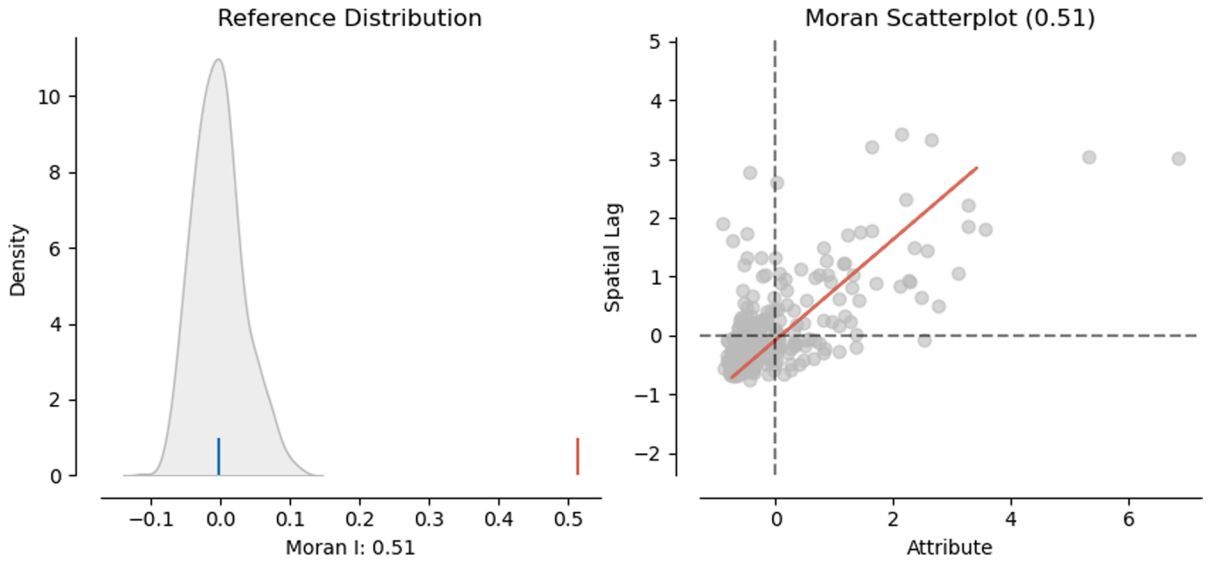

Fig. 5 Spatial correlation coefficient (Moran I) for the variable "Number of fires"

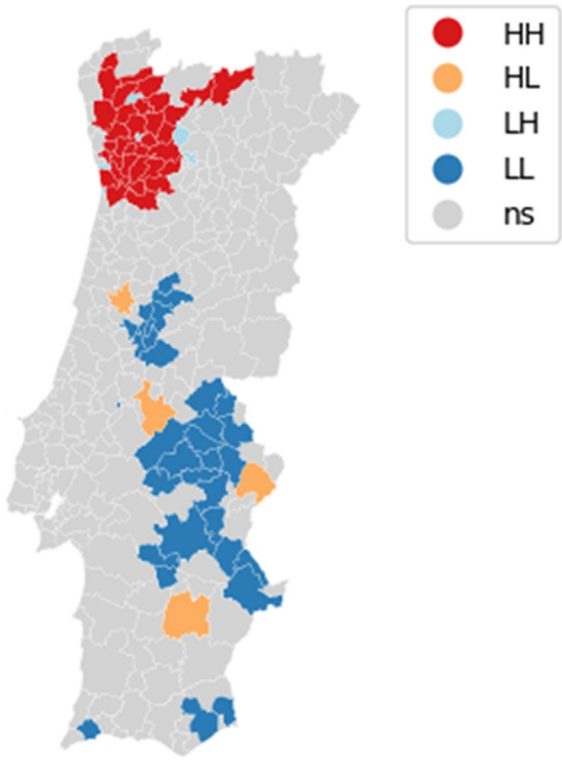

Fig. 6 Local Indicator of Spatial Association (LISA) for the variable "Number of fires"

in the defense and development of forest spaces. In summary, the prevalence of fires is higher in mountain regions and in territories where poor pastures and native forest predominate. Fires occur preferentially in smallholding areas and their prevalence is independent of public support for forestry and agriculture. *Authors' answer* The reviewer comment is relevant. We add at the end of discussion the following phrase.

The Common Agricultural Policy aims to increase the sustainability of agricultural practices and encourage the development of rural territories. In Portugal, a large part of CAP support is concentrated in the most fertile basins where irrigation prevails, leaving large areas of the country abandoned. Our results confirm this asymmetry and confirm the relationship between the prevalence of fires and mountain areas where small farms prevail and where CAP supports are scarce.

Conclusion and policy recommendations

According to our study, CAP support for forests, but also global CAP support for the agricultural sector and rural development, is excessively concentrated on a small number of farms located in regions where agriculture is most prosperous. This excessive concentration leaves a significant part of the mainland outside the scope of Community aid. Furthermore, the regions with the least support are those where smallholdings predominate and where the forest occupies the largest proportion of the area of agricultural holdings. They are those where the prevalence of fires is higher. They are also the poorest and where a significant part of the active population works in the land. This distribution has historical roots that deserve to be studied. Political science theory comprehends a wide range of perspectives and approaches to understanding the distribution of resources and the concept of fairness. Future studies will shed more light on this aspect.

The defense of the forest, and in particular the native forest, implies a solid knowledge of the characteristics of the territories. It is necessary to know the context in which the agricultural activity takes place and identify the mechanisms to be able to support these farmers or attract new generations to this activity. This implies changing a set of rules, some of a more general nature, aimed at supporting agricultural activity in vulnerable territories, and others more focused on the forest.

According to our analysis, the prevalence of fires is closely linked to the process of desertification in the rural world. In this sense, direct aid from the first pillar of the CAP is a fundamental element to boost rural territories and make investments in the forest feasible. Official statistics on direct support to Portuguese producers show a very skewed distribution (see Fig. 4). But this asymmetry is even more pronounced if we consider that there are many farmers who are excluded from CAP support. These represent, according to the most recent 2019 INE agricultural census, around 40% of farms (Cordovil 2021). In addition, these farmers are predominantly located in vulnerable territories. Its inclusion within the CAP support system is therefore an obvious necessity. In this sense, the completion of the internal convergence process, with the end of payment entitlements based on history, is a priority that should be completed as soon

Table 7 Estimation of the Spatial Lag Dependency Model

Summary of output: spatial lag model—Maximum likelihood estimation				
Dependent variable	Number of fires			
Nº obs	278			
Variable	Coefficient	SE	z-value	Probability
W	0.586831	0.0568303	10.326	0
Constant	7.73898	5.82316	1.329	0.18385
Factor 1	5.91448	3.65745	1.6171	0.10586
Factor 2	13.4039	2.97667	4.50298	0.00001
Factor 3	− 3.96855	2.42394	− 1.63723	0.10158
Factor 4	0.73489	2.47268	0.297203	0.76631
Factor 5	7.16413	2.40371	2.98045	0.00288
Factor 6	− 2.61362	2.38075	− 1.09782	0.27229
DTerrVul	16.643	8.13337	2.04626	0.04073

as possible. With a uniform payment per eligible hectare, all farmers will be able to apply equally for the basic payment, in proportion to the eligible agricultural area of their holdings.

The redistributive payment is a mechanism designed to concentrate support on farms with a smaller agricultural area. However, the formula proposed by the current version of PEPAC spreads this support across the first 20 hectares of farms up to 100 hectares. This application of the redistributive supplementary payment, which represents 10% of the total envelope of direct payments (about 350 million euros) must be reviewed and adapted to the Portuguese land structure. It is necessary to review the criteria for attributing the redistributive payment, lowering the eligible amount to the current 5 hectares, so that this instrument becomes a factor of equity between regions and between holdings.

The new green architecture of the CAP post-2022 gives a great centrality to ecological schemes. Ecological schemes to support agroforestry interventions or to cover investments made in sustainable forestry and other non-productive investments for environmental and climate purposes are strongly valued in the EU Forestry Strategy for 2030. In this sense, the creation of an eco-schemes to support farmers in the territories vulnerable, should be a priority. For this measure to be viable, it is necessary to allow farmers who are in the small farm support scheme to have access to ecological schemes, in all territory or exceptionally in vulnerable territories. In addition to these eco-schemes, and without prejudice to the incentive to promote the various modalities of grouped management (ZIF, AIGP, etc.), we highlight the need to create individual, simple and appealing support aimed at improving forest management for small producers.

Another recommendation would be the creation of an agro-environmental measure (second pillar) designed for the native forest in smallholdings, like the one that exists for the cork oak. This support would be justified by the environmental services provided, naturally requiring specific commitments from the owners, and associated with technical advice services, to be developed primarily by entities promoting aggregate (grouped) management.

Finally, considering the high bureaucracy associated with support and the difficulties that this creates, especially in vulnerable territories (but not only) where smallholdings predominate, we recommend allocating 1% of the 2nd pillar allocation to finance local technical support services with the objective of supporting small agricultural and forestry producers in applying for projects.

Author contributions All authors contributed to the study conception and design. Data collection and analysis were performed by MV and PB. The first draft of the manuscript was written by MV and all authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

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Declarations

Competing interests The authors declare no competing interests.

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