# Fire management and community restraint: the rise of forestry science and the governance of commons


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## Abstract

This paper examines the intersection of environmental history and the history of science, specifically the impact of forestry science and fire management on land use and community dynamics in rural Portuguese mountains. It further traces the evolution of fire management from an ancestral rural practice to a scientific concern and the subsequent integration of vernacular knowledge with scientific methods.

In the early twentieth century, fire was a common tool in rural Portugal for land clearance, pasture management, and soil enrichment. Rooted in local knowledge, these practices were increasingly challenged by the rise of scientific forestry, which viewed fire primarily as a threat to be controlled. By the mid-twentieth century, Portuguese forestry policies had undergone a significant shift towards aggressive fire suppression and large-scale afforestation, reflecting a broader trend of prioritizing timber production and forest protection. Notable shifts occurred in the 1970s, marked, among other factors, by the increase in rural fires, a new socio-ecological vision for the forest and the introduction of prescribed fire techniques influenced by international models.

The paper argues that the establishment of scientific fire management practices represents a merging of expert knowledge with local experience. This move represents a shift from exclusionary policies towards a more nuanced understanding of fire's role in

landscape management. An examination of these historical developments demonstrates the intricate interrelationship between science, the environment, policy, and local practices, illustrating the way knowledge systems both shape and are shaped by environmental governance.

## Keywords

forestry science, fire management, commons, land use, Portugal

## Introduction

Fire is a good servant, but a bad master.[i]

In recent years, the history of science and environmental history have become increasingly intertwined. A 2019 special issue of this journal, titled "Shared Ground: Between Environmental History and History of Science," offered a comprehensive review of the interdisciplinary research connecting the two fields, along with illustrative case studies.[ii] A key area of convergence between the two disciplines is their common focus on the relationship between place and knowledge. Scholars have explored the way the practice of science in specific locations affect those places' historical trajectories. At the same time, insights from the history of science have also enabled environmental historians to better understand how knowledge systems have shaped human-environment interactions. Conversely, the influence of specific places on scientific practice has also been a subject of investigation. In this context, Megan Raby pointed out the importance of analyzing land rather than merely place. In her words, land is "more than a unit of solid ground."[iii] It encompasses ownership, access, labor, resource management, power structures, livelihoods and identities, topics that transcend place, and which can illuminate, as well as be illuminated by, the history of science.

At the interface of the history of science and environmental history, this paper aims at relating the historical trajectories of Portuguese rural mountain communities and the development of forestry expertise on fire. Adopting a land-centered approach that links global, national and local histories, it juxtaposes knowledge and place to better understand how forestry has shaped physical and social landscapes, and how specific

tracts of land, particularly common lands, have left their imprint on the development of forest science. In this regard, it is not only a matter of highlighting, as others have, the importance of the issue of common lands and their governance for the development of forestry, but also of suggesting that the assertion of technical-scientific expertise on fire represents a fusion between local agro-pastoral practices and specialized knowledge. This contributes to the considerable bibliography that has addressed the intersection and reconciliation between academic and lay knowledge around the globe, particularly knowledge about fire.[iv] As for the importance of forestry in transforming these lands, it is worth noting from the outset that the emergence of the discipline at the turn of the 20th century coincided with ambitious plans for the state appropriation and afforestation of hundreds of thousands of hectares of common property, which were effectively carried out later. During this process, traditional uses of fire in these territories were first replaced by arson as a form of protest and then by large wildfires, extending to other places.

The history of rural fires in Portugal, to which this paper also aims to contribute, is thus not only a history of climate and land-use change, but also a history of science and knowledge production, and the emergence of a new profession, where fire assumes diverse meanings. From a fire that populates and sustains the life of the mountains, to an evil fire that must be extinguished, to a renewed and technical fire that embodies livelihoods and scientific knowledge.

## Fire is life! Fire is a scourge!

> Of all the scourges that can attack trees during their long existence, fire is the most energetic destroyer, which in a flash wipes out entire forests, devastating the work that the forces of the earth and vegetation have been engaged in for a long time.[v]

In the mountainous regions of Portugal, the role of fire as a fundamental aspect of life has been recognized since time immemorial[vi]. Fire was instrumental in fertilizing the land for the cultivation of cereals and in clearing the undergrowth to create suitable pastures for herds. Furthermore, fire was present in villages, where large bonfires were

lit in celebration of patron saints. In domestic settings, it was employed in kitchens and on stoves for the preparation of food. Fire provided warmth and illumination and was employed in the production of charcoal and in the preparation of pigs for slaughter (*matança do porco*). It was a common and daily occurrence, a pervasive feature of the environment, a fundamental aspect of livelihoods. Fire was life. By the turn of the twentieth century, in the hilltop ridges of Portugal, particularly in the North and center, an economic and social context persisted that had not been structurally transformed since previous centuries. The communities were structured around a system of agro-silvo-pastoralism, the primary economic activity being subsistence family farming, which was complemented by pastoralism. By then, a considerable proportion of this territory, which still lacked continuous patches of trees, was not privately owned. Instead, it constituted the common property of the people, who managed and used it. Common lands were used by the local population for hunting, grazing cattle in the more verdant pastures, procuring firewood for domestic use, collecting undergrowth to fertilize the land and for animal bedding, and even for the cultivation of crops.[vii]

Nevertheless, fire had also different meanings. In 1876, the Portuguese Journal of Practical Horticulture (*Jornal de Horticultura Pratica*) published an article on forest fires. Fire was regarded as a destructive force that could annihilate entire forests. Various factors were identified as causes of forest fires, including recklessness and wickedness. Shepherds were considered one main cause. They were responsible for setting fires in shrubs near forests, with the intention of improving the pasture for their flocks. They were negligent in their management, allowing fire to "jump to the trees," driven by the wind.[viii] José Carlos Sousa Pimentel, the author of this article, provides a succinct overview of what would become the central tenets of fire policy for most of the twentieth century. His perspective on forest fires in the latter half of the nineteenth century exemplifies the pervasive notion of fire as a devastating power, which persisted throughout the following decades and influenced the design of regulations that restricted the use of fire, as we shall see below.

Pimentel's concerns are indelibly linked to those of Bernardino Barros Gomes, a pivotal figure in the introduction of scientific forest management methods in Portugal in the second half of the nineteenth-century, following multiple visits to Germany and France where he was able to observe and learn from the implementation of these methods.[ix]

Although his discourse did not focus on fire, the exclusion (at least in part) of communal agropastoral practices – largely dependent on fire – from the Portuguese mountains was a sine qua non condition for ensuring the success of what he considered the necessary afforestation of the country.[x] In the mid-twentieth century, nearly a century after being written, the Direcção Geral dos Serviços Florestais e Aquícolas (DGSFA, Directorate-General for Forestry and Aquaculture Services) republished the works of Barros Gomes. At the time, they were considered "indisputably true and blatantly up to date."[xi] The following words were emphasized: "The government will be able to establish with respect for all legitimate interests a useful domain where today there is ruinous communism."[xii] This communism, referring to a communal lifestyle, included fire as a working tool. In fact, in the following decades, this communal lifestyle came into direct conflict with foresters, who would remark in the 1950s:

> These people, who have always disposed of the trees and undergrowth on their common land as they please, do not take kindly to the Forestry Service forcing them to cut down trees and firewood in accordance with the requirements of good forestry technique. The fact that they only cut down trees and undergrowth under the instructions of forestry staff makes them feel that their rights are being restricted (…) and so they take revenge by setting fire to the trees.[xiii]

Amidst this century-old conflict, foresters would come to label these lands as wastelands, despite the clear human presence and activity. This perception became their rationale for justifying the afforestation of the mountains. Yet, common lands were populated and constituted a vital part of the ecosystem. They were neither unused nor unproductive. Common lands sustained life (and were full of fire). Once an integral tool for the mountain communities, fire conflicted with the foresters' or the state's vision of a well-maintained forested landscape. What had been once a daily tool for these communities was now viewed as a scourge.

## A regime of exclusion and a culture of ignorance

> We are of the opinion that we should inquire about the character of the forest's neighbors and, in the event of dissatisfaction, increase vigilance to capture any arsonists, who would be severely punished.[xiv]

In 1852, the Instituto Agrícola (Agricultural Institute) – which became the Instituto Superior de Agronomia (ISA, Higher Institute of Agronomy) in 1911 – was established in Lisbon, embodying a strategy of modernizing the territory in accordance with the tenets of political economy. The institutionalization of agronomy as a science represented a significant milestone, leading to the appropriation of the territory by agronomists. In the same year that the Institute was founded, the post of district agronomist was created for the first time in Portugal, further acknowledging the value of their expertise. In the mid-nineteenth-century, Portugal was predominantly rural, with the wine industry representing the primary export sector. It was within this context that agronomists attained a prominent position.[xv] Foresters, in contrast, did not play a similarly significant role.

The history of higher education in forestry in Portugal can be traced back to 1864, when the Instituto Geral de Agricultura (General Institute of Agriculture) – which succeeded from the Instituto Agrícola – introduced a course on Forestry, Arboriculture and Topography.[xvi] This initiative reflected long-standing concerns about the conservation of the country's forest heritage and, more immediately, the protection of the land from floods, storms, and tides.[xvii] A "Report on the General Afforestation of the Country," published in 1868, confirms these concerns and establishes the foundation for a political economy of the forest.[xviii] In an unprecedented and extensive survey, fire (and its marginalized users) was consistently viewed as an enemy – not of the forest itself, but of afforestation, particularly in mountain ridges, which were deemed unproductive and suitable only for such use. Passages like the following, concerning the Monchique mountain range in southern Portugal, were echoed across all regions of the country:

> Abundant is the spontaneous growth of holm oak and cork oak chaparral, appearing on all slopes, even the most barren ones. However, the barbaric practices of land clearing [*roças*], slash-and-burn [*moreias*], and even the burning of bush by shepherds to obtain a small harvest of wheat or rye on some patch of better soil, or to clear large areas for grazing, destroy in moments what

> takes so long to achieve in many places. These practices completely annihilate the generous bounty of nature in this climate...[xix]

That said, forestry specialists had a limited scope of action, operating under the Administração Geral das Matas (General Forestry Administration), established in 1824, which was responsible for managing the state's forests inherited from royal hunting reserves.[xx] Technical expertise and academic specialization in forestry did not take hold until the turn of the century, following projects to expand forest areas.

In 1886, a plan for organizing forestry services was developed based on a preliminary Forest Regime, aimed at preserving and promoting the nation's forestry wealth.[xxi] In addition to addressing soil degradation, the objective was to expand the extent of public forests. The establishment of the Forest Regime in 1901 was accompanied by a reorganization of forestry services, with a particular focus on afforesting uncultivated lands, namely dunes, which had seen gradual forestation since the mid-nineteenth century. Mountain commons became a primary focus, dominating forestry activities in the following decades.[xxii] By 1910, the forestry services had developed a comprehensive plan for managing approximately 300,000 hectares of common land, representing over three percent of the national territory. However, the plan faced resistance from local communities.[xxiii] Around the same time, the field of forestry began to diverge from agronomy with the introduction of academic programs at the ISA, encompassing a range of new disciplines, including Forestry and Forest Technology, Forest Economy, Forest Engineering, and Torrential Hydraulics. The emergence of forestry, both as a discipline and as a profession, was thus inextricably linked to the state's endeavors to subdue mountain populations.

Despite existing forest legislation, most forestry initiatives in Portugal were undertaken by private organizations until the second quarter of the twentieth century.[xxiv] This situation changed with the rise of the authoritarian Estado Novo in 1933 and the subsequent publication of the *Lei do Povoamento Florestal* (Forest Settlement Law) in 1938. Foresters were then entrusted with the implementation of the new forestry policy aimed at enhancing the productivity of common land through tree planting.[xxv] The Wheat Campaign (1929), which sought to achieve self-sufficiency in production by increasing the area cultivated, had not yielded the desired outcomes. Although the 1932-

5 agricultural years resulted in a surplus, no solutions were found for the disposal of the excess production. Moreover, the production figures for 1936 were even lower than those observed in many pre-Wheat Campaign years. This encouraged the conviction that afforestation was a crucial element for the country's economic development.[xxvi]

Until that time, the study of fire held little relevance for the new engineers, despite its historical regulation since the Middle Ages and the stigma surrounding its use (or misuse) in agropastoral practices, which had developed since the late 19th century.[xxvii] In fact, during the early years of the twentieth century, fire was not a subject of study. In addition to botanical studies, analyses of sowing and other agronomic and forestry aspects, ISA's research theses might include a chapter dedicated to the prevention and control of fires, alongside plant diseases and pests.[xxviii] The primary means of preventing and fighting fires were the establishment of firebreaks, land clearance, and lookout posts, as proposed by Pimentel in 1876. Eventually, as the area of afforestation increased, the issue of fire became a significant concern for foresters. Being instrumental in addressing the pressing need for a comprehensive forest revetment project, they would also come to play a pivotal role in the protection of these resources.

In October 1945, a fire in Serra da Lousã marked the turning point, making fire a critical issue deserving a specific framework within the scientific and bureaucratic-institutional context. It was crucial to reforest the burnt area, and the ISA joined the DGSFA to plan an afforestation project.[xxix] Foresters had to venture into the field to take measurements, estimate the burnt area, calculate the volume of charred wood, and assess the overall damage. The soil and climate had to be studied, appropriate species selected, and planting methods determined. In addition, to effectively combat fires, it was essential to calculate the quantities, types, and arrangement of combustible materials. Detailed knowledge of the terrain was, thus, indispensable, to prevent fires or quickly extinguish them.[xxx]

As the Portuguese forest expanded in size, the potential for fire damage increased, prompting the creation of a new state department – the Secção de Defesa Contra Fogos (Section for Defense Against Fires) – within the DGSFA, with the express purpose of safeguarding forests from fire. Its name reflects the foresters' adversarial stance towards

it. Efforts were made to determine a "normal fire season" and identify "fire occurrence zones." It became essential to predict fire risks in order to heighten vigilance in specific areas and periods, allowing for rapid intervention to minimize damage.[xxxi] The establishment of a Fire Control Plan would have to be "traced in the light of the history of fires in the region."[xxxii] Mapping fires and their causes was crucial as was documenting the terrain's topography, roads, land use, vegetation cover, temperature, humidity, and so forth. It was of the utmost importance to monitor the conditions during periods of extreme fire risk, at times of high temperature and low humidity. It was clear that "those responsible for the forests should be aware of the potential for critical periods and the associated dangers."[xxxiii]

The implementation of afforestation projects, however, was not always straightforward. The areas designated for tree planting were sometimes private or deemed essential for the livelihoods of the local populations. According to foresters, these same populations were simultaneously responsible for the degradation of mountainous regions – which for that reason necessitated afforestation – and for the fires now threatening these projects. For instance, those who settled in the Serra da Lousã before the eighteenth-century engaged in land exploitation with "insane labor" causing an environmental problem:

> Although the area labored over by these tireless workers was only about 1/10th of the total area of the *Casal*, by fighting from sunrise to sunset, against all odds, resisting all difficulties, they managed to perform real miracles. One cannot deny them this sublime and heroic willpower in the struggle for existence, making them true slaves to the land they live on. However, it would be better if all this effort, all this constant dedication and heroism were used elsewhere to better reward human endeavor, because here it contributes to creating a situation that is extremely detrimental to the problem of the silting up of the River Mondego.[xxxiv]

While some environmental arguments were used to justify afforestation projects, the 1938 Forest Settlement Law primarily relied on economic claims[xxxv]. The vocabulary employed made this clear: "enterprise," "increased production," "export," "harnessing,"

“industrial development.” But only the state’s economy was considered. The economy of rural communities that depended on communal land for their sustenance was largely ignored.[xxxvi] In fact, these communities presented a significant challenge to foresters, particularly as fire uses – as a daily agropastoral tool – were concerned. Whether through land cultivation for survival or through negligence, everyday fires had the potential to escalate into disasters, as occurred in Serra da Lousã in 1945, where a small fire that had been inadvertently lit had started a “terrible fire:” “[A] man, with the help of his friend, was in a place more or less 500 meters from the base of the Forest Perimeter, sweeping some chestnut trees, and at one point, wanting to eat some chestnuts, he lit a fire, not thinking of the enormous danger this represented.”[xxxvii]

A regime of exclusion appeared, thus, to be an appropriate means for foresters to achieve their goals. As pointed by Murray Li, “to turn [land] to productive use requires regimes of exclusion that distinguish legitimate from illegitimate uses and users, and the inscribing of boundaries through devices such as fences, title deeds, laws, zones, regulations, landmarks and storylines.” [xxxviii] Transforming land – specifically the mountainous areas of Portugal – into a state resource meant altering not only its physical character but also, more importantly, its social character. The commons, previously benefiting local communities, were now to be managed by experts, government officials, and, in time, industrial investors. But legitimizing this intrusion into people's daily lives – and the new regime of exclusion – required a shift in discourse. A dichotomy was established, defining the right versus the wrong ways of using the land. Foresters framed their new practices as modern and enlightened, in contrast to what they saw as the backward and ignorant traditions of rural communities.[xxxix] Fire and grazing – and by extension, the local populations – became seen as “unauthorized disturbances” and “implicit threats” to the newly ordered forest system.[xl]

As a result, fire should be totally excluded from the mountains, including prescribed fire used by foresters. Although the possibility of using fire as a management tool had already been raised in the international sphere,[xli] by 1955 this approach was not recommended by Portuguese foresters, despite its potential benefits.[xlii] Disregarding international literature – which they were familiar with and even cited –, fire was dismissed as “shepherds' ancestral vice.”[xliii] Its use was considered a sign of “low

technical and social level of agricultural activity."[xliv] This rhetoric, attributing certain practices to the supposed uncivilized character of certain communities – who allegedly "burned for pleasure and by chance"[xlv] – has parallels in colonial historiography. In fact, the comparison between the African "indigenous" and the mainland "rough shepherds,"[xlvi] as the use of fire was concerned, was made by Portuguese foresters in the colonies. The same justifications used to legitimize colonialism and assert control throughout the empire were applied to the mainland, where afforestation was seen as a form of colonizing the mountains, displacing communal populations.

By the mid-twentieth century in Portugal, fire had become the "number one enemy" of the forest and was regarded as a "reality to be feared throughout the forestry world."[xlvii] Even though prescribed fire was already established in diverse countries, Portuguese foresters considered the subject to be "totally unknown" and its literature to be "always very doubtful."[xlviii] Using fire to clear the underbrush was discouraged, as prescribed burns conflicted with the goal of eradicating the use of fire in the daily practices of mountain communities, and could have a "terrible psychological effect."[xlix]

However, while "establishing a fire service that could completely exclude fire from all areas, would be desirable from a silvicultural point of view,"[l] some exceptions could be tolerated to maintain "good neighborliness."[li] Excluding populations entirely represented a high-risk strategy that should only be implemented during the most dangerous periods. As pointed out by Murray Li, where the objectives of making the land productive and profitable (for the state) justified expropriation, concerns for the well-being of rural communities, insofar as they could cause general political instability, suggested a more cautious approach to avoid conflicts.[lii] Consequently, the prohibition on burning should only be applied in specific instances.

In fact, the "utopian dream of scientific forestry" was frequently challenged by the communities living near the forest perimeters who continued to graze animals, collect firewood, and make charcoal.[liii] This "quiet resistance" prevented the full realization of the foresters' management plan.[liv] In 1955, the Section for Defense Against Fires would acknowledge the potential benefits of silvopastoralism as a suitable forestry practice. However, this recognition did not lead to tangible changes, which would be advantageous for the forest and for the neighboring peoples. This would enable the

cattle to be fed, and it would help clear firebreaks and cliffs, which would otherwise have been expensive.[lv] Furthermore, the provision of flammable combustible material for firewood to neighboring communities would facilitate the necessary clearings.[lvi] This good neighborhood policy would also allow the mobilization of essential firefighting resources and help to avoid fires caused by malicious intent.[lvii] Indeed, arson was identified as a weapon employed against the Forestry Services by mountain communities, who never considered the areas set aside for grazing to be sufficient to meet their needs.[lviii]

Despite concerns about fires, the Fire Control Plan presented by the Section for Defense, as outlined by its director, Bello Dias, in 1955, was not implemented and the teaching and research carried out by the ISA regarding fires were not aligned with it.[lix] In 1964, Carlos Baeta Neves, a forester and professor at the ISA, underscored the necessity for a comprehensive technical education campaign. There was a significant deficit in both knowledge and the availability of qualified personnel. In the context of higher education, the subject of fire was not a compulsory element of the Forestry Engineer degree program. Furthermore, there was no secondary school dedicated to the preparation of technicians to collaborate with forestry engineers. The curriculum of the Escola de Regentes Agrícolas (Agricultural Regents' Schools) was similarly deficient, with only one subject related to forestry. Similarly, practical schools of agriculture only briefly addressed the issue of forest fires. Indeed, the curricula of these educational institutions did not include any substantial content on forestry. Forest guards and fire brigade schools were deemed crucial. Research also should not be neglected by the Forestry Services and the ISA.[lx]

It can be argued that not only were people (and fire) excluded from mountain areas, but a regime of exclusion can also be identified in the ISA’s research subjects. Despite prescribed fires being a recognized territory management tool in diverse countries, this issue seems to have been deliberately neglected in Portugal, resurfacing only years later. Although foresters, including the director of the Section for Defense Against Fires, acknowledged the importance of populations, agropastoralism and even burning (under certain conditions), fire was not studied as a natural and ecological element crucial for effective land management. Instead, fire was still regarded as a purely destructive force, with studies limited to analyzing measures against fire. The potential benefits of fire

were treated as “uncomfortable knowledge”[lxi] that should remain ignored if one intended to control the land. A narrow view of mountainous areas often overlooked the value of communal land to rural communities, which had little or no potential revenue for the state. As James C. Scott notes, “from an anthropologist's perspective, nearly everything touching on human interaction with the forest was . . . missing from the state's tunnel vision.”[lxii] In fact, it was this “state's tunnel vision” that could justify a renewed political and economic project centered on monoculture.

## Vernacular knowledge and the timid assertion of a field of study

> [Traditional scrub burning and prescribed fire experiments have] somewhat different objectives, but … an identical basis and technique, particularly in terms of their dependence on climatic conditions and the combustibility of the vegetation and its debris.[lxiii]

In 1972, the Parque Nacional da Pereda-Gerês (PNPG, Peneda-Gerês National Park) – Portugal’s first national park, established in 1971 – introduced a land-use management plan that included prescribed fires on 3,500 hectares to manage pastures and establish suitable habitats for wildlife. PNPG’s technicians and populations, together, should organize these burnings on a 5-year rotation.[lxiv] This was due to José Lagrifa Mendes, the Park’s inaugural director, who had undertaken a two-month visit to the School of Natural Resources at the University of Michigan, the U.S. Department of the Interior National Park Service, and the Conservation Foundation in 1969, where he participated in a course on the Administration of National Parks and Equivalent Reserves.[lxv] Prescribed fire was already a well-established practice in the U.S., a fact that presumably encouraged him to utilize fire as a tool in Portugal. In fact, the late 20th century saw, at a global scale, significant changes in forestry attitudes towards fire, as ecological and social understandings evolved.[lxvi]Although the PNPG management plan was never fully implemented in what prescribed fire is concerned, it initiated a new era in which fire was no longer perceived as a mere villain.

By the mid-1970s, Edwin and Betty Komarek from the Tall Timbers Research Station visited Portugal, where they prompted new experiments with prescribed fires. Their goal

was to demonstrate the practicality of these techniques in both directly altering the vegetation and indirectly reducing the occurrence of so-called wildfires, thereby limiting their harmful effects.[lxvii] At about the same time, multiple uses of fire were being researched at the ISA in collaboration with state forest services. The Komareks visit explicitly inspired some of this research as they were acknowledged in some ISA's theses for their contributions and encouragement. The United States of America became a model for fire management research and studies from the Tall Timbers Research Station were cited by ISA students, some of whom have even visited the foreign Station.

By then, the forest had become a more integral part of the territory, transcending its economic value as a resource for production. Environmental protection had "finally begun to receive the attention it deserved."[lxviii] Moreover, a new generation of foresters recognized that common lands should be returned to the communities, who had the right to use and benefit from them – a shift that indeed occurred, at least in part, after the revolution of 1974 and the establishment of democracy. It was no longer justifiable to deny citizens access to the benefits that forests provide. The "errors in the afforestation" were also being considered:

> Villages that were once isolated are no longer so today, thanks to the forestry services' improvements to the roads that serve them. This improvement in access conditions does not always have a counterpart in their "modus vivendi," since as a result of errors in the afforestation, they have been deprived of common areas, grazing grounds for livestock, and subjected to fire. This shows that in large-scale afforestation of common lands, trees should never be planted right next to the villages. Instead, a social area should be reserved for collective use, even if the production of wood, resins, etc. is significantly lower. The village should be a place where the defense against fire can be organized, and never a source of concern for the agents in charge of extinguishing it. On the edges of the forest that surrounds the village, wildlife should be provided with living conditions that will delight nature lovers and sportsmen. Instead of trees entering the houses, you will see forest, and to reach it you will

> have to pass through cultivated areas that are good defenses against fire.[lxix]

In parallel, it was also recognized that in spite the efforts to mitigate fire damage – primarily through detection, prevention, and firefighting, with a notable increase in the use of modern extinguishing methods – there had been, over the years, an increase in both the frequency and size of fires.[lxx] Factors such as the structure of forest ownership, large-scale monoculture, the absence of protective afforestation, and various socioeconomic and political reasons were identified as contributing causes. As Amândio Torres, a final-year forestry student, noted, it was no longer sufficient to blame fires solely on the actions of shepherds, tourists, hunters, and arsonists. Foresters now had the responsibility of managing the land with fire prevention in mind. The establishment of forests and grazing areas should be carried out alongside the construction of firebreaks, the creation of sideways roadsides, the removal of stands and scrubland, and the implementation of fire management strategies. These measures should become integral to the prevention and control of large forest fires.[lxxi] Prescribed fire should emulate the ancestral fires used by communities. Its use aimed to replace the communal fire practices that had been lost. It could now be employed to reduce rural fires frequency and intensity[lxxii] or to improve pastures[lxxiii] and hunting habitats.[lxxiv]

Fire came to be regarded as a natural phenomenon and acknowledged for its multiple uses. Moreover, in contrast to the views held by foresters in the past, the value of people's knowledge was now recognized:

> The farmer and the shepherd used fire as a cultural technique. Although farmers do not use it much in our country, shepherds still employ it frequently. In fact, I believe that it was the shepherd who used fire most intensively. The shepherd did not and does not use fire because he was a pyromaniac or for any other futile reason. He used fire because it increases and sometimes improves the grazing area for his cattle.
>
> . . . This practical knowledge, when combined with theoretical and ecological knowledge that the old shepherd doesn't possess, could not only improve the results to be obtained, but also shorten the time it

> takes for a technician to be able to use fire in the promotion, management and improvement a given ecosystem.[lxxv]

The study of the ecology of prescribed fire and the techniques for its application was, thus, fundamental. Aspects associated with each specific fire, and its effects, should be systematically recorded on a form. These included not only temperature, humidity, rainfall, wind speed and direction, slope, exposure, vegetation cover, but also factors related to the fire itself, such as intensity, flame height, speed of spread, and effects.[lxxvi]

Building on these developments, in 1982, Portuguese forester José Moreira da Silva was tasked with implementing his proposal to establish a fire prevention scheme in public forest areas in northwestern Portugal. This initiative included the use of prescribed fires in the Porto Forestry District (and in PNPG). This systematic program of prescribed fires in the understory of Pinus pinaster and Pinus sylvestris, known as the Emergency Plan, aimed to cover strips at least 50 meters wide, along forest roads, paths and in the direction of the steepest slopes to substantially reduce the levels of fuel in the underwood and dead cover.[lxxvii] Prescribed fire became a rational and acceptable surrogate for the ancestral practice of scrub burning by communities. The new tool was not only a standardized method, but one that incorporated the everyday experiences of farmers and shepherds. A kind of creole science joining vernacular and scientific knowledge seemed the obvious solution to the problem of summer rural fires:

> . . . the ancestral cultural practice of using cold fire [*fogo frio*] to eliminate the dangerous summer wildfires set by shepherds (and hunters too) must be recovered, at the cost of exhaustive surveys among older shepherds and farmers (time is running out...), ultimately accompanied by studies on changes in floristic composition and their possible influences on improving the diet of domestic animals and the development of indigenous fauna.[lxxviii]

The invisible barrier raised at the edges of the forested commons, which marked the exclusionary regime and a culture of ignorance about fire, became a trading zone where science and lived experience converged. However, despite the recognition of rural communities' knowledge regarding fire, no comprehensive studies have been conducted

to investigate the social aspects of fire. Fire ecology continued to focus on physical aspects, largely overlooking social dimensions. The new fire, intended to serve as a surrogate for ancestral fire, was ultimately devoid of human involvement.

In practice, despite increased research and shifting attitudes toward fire management in the 1980s, prescribed burning was rarely implemented. It wasn't until 2006 that prescribed fire became part of Portugal's National Forest Fire Defense System legislation, [lxxix] and although the country now has a National Prescribed Fire Program, the total area treated remains well below recommended levels. [lxxx] More broadly, while fire in the context of landscape management began to receive attention in academic fields like physics, chemistry, and mechanical engineering, the discipline of landscape fire has received limited recognition on both national and international stages until relatively recently. The first dedicated journal, *International Journal of Wildland Fire*, was only launched in 1991, followed by *Fire Ecology* in 2005. As a core element of landscape management, fire has only recently become a research focus.

Considering this, and while Portugal has traditionally stigmatized fire, it might nonetheless be argued that the country took a pioneering role in advancing landscape fire science. Since 1990, Coimbra has hosted the International Conference on Forest Fire Research, organized by the Association for Fire Ecology and ADAI, which serves as a prominent forum where scientists, managers, and policymakers gather to address wildfire and landscape fire research. Through these efforts, Portugal has established itself as a key contributor to global fire science and management, fostering international collaboration and shaping the evolving understanding of fire as a vital element in landscape management.

## Final considerations

> The landscape has become as harsh as a desert and, unlike in the past, when there were men everywhere working the land, today you rarely see anyone digging or plowing. There are few donkeys and mules. The oxen have disappeared. There are no herds. (...) And these regular rows of calibrated, groomed trees, of an industrial monotony, identical

> in size like chickens in an aviary, foreshadow a new world, uniform and controlled, in contrast to the past that is slowly agonizing around them.[lxxxi]

At the end of the second decade of the 2000s, a new organizational structure was devised for the Instituto da Conservação da Natureza e das Florestas (ICNF, Institute of Nature Conservation and Forestry), establishing it both as the National Authority for Nature Conservation and Biodiversity and the National Forestry Authority. This reform introduced a "new model of territorial governance" that moved beyond "the urban/rural dichotomy," reinforcing the National Strategy for Nature Conservation and Biodiversity for 2030 (ENCNB 2030),[lxxxii] which posited that "the purely 'conservationist' paradigm, where protection was enforced negatively by prohibiting uses . . ., had long since been overcome"[lxxxiii]. At the same time, the ENCNB 2030 aim was to "promote Silvopastoralism as an instrument of sustainable structural prevention, enhancing effective fuel management in rural areas," and to establish new co-management model for protected areas.[lxxxiv] This approach sought to "instill a dynamic of proximity management . . . implementing participatory, collaborative and articulated management" and "to encourage the establishment of partnerships with the entities active in the territory." The "humanized character of the entire national territory," having "established a harmonious balance between human activities and nature," is seen as key to ecosystems sustainability, justifying policies that support "the presence of people and their activities."[lxxxv]

Human involvement in territory and landscape management has varied significantly over time, particularly in the context of fire in Portugal, where communal, scientific, and technical dynamics have diverged and converged. As the writer José Rentes de Carvalho notes in the epigraph to this final section, today's uniform plantations contrast sharply with the past, when rural landscapes consisted of people, herds, and farmland rather than homogenous forests. The ICNF now appears to be reclaiming the landscape that Rentes de Carvalho describes as lost, incorporating into legislation the dynamics recognized by Portuguese foresters as early as the 1970s. This trajectory is evident in the preceding pages, which aimed to illustrate how the vision of transforming Portugal into a "forest country"[lxxxvi] was shaped by economic, social, and environmental considerations, alongside scientific practices and frameworks. The history of forestry

has left a visible mark on the territory, with contemporary landscapes revealing not only natural and land use histories but also a history of science characterized by corporatism and technocracy. Here, as elsewhere, professional and state interests have shaped knowledge production, which has been critical in informing choices related to rural management.

Acknowledging the significance of fire in Portugal's contemporary history also adds another layer to the analysis of the local and socially constructed character of scientific knowledge. Place – particularly mountain areas – played a crucial role in the development of Portuguese forestry. The point is not specifically about the actual sites where trees were to be planted or how its physical attributes influenced scientific practices. In the history of Portuguese forestry, place represents a collection of sites, physically dispersed yet with the potential to be transformed into the *Portuguese Forest*. For foresters, the issue of place was fundamentally concerned with the ownership and use of land. Transforming the imagined, abstract Portuguese Forest into a tangible reality involved creating a landscape with closed borders – a shift that was key to the rise of forestry in Portugal and to foresters' professional stature.[lxxxvii] By bringing what foresters considered unproductive mountain areas into the state's sphere, forest experts cemented their kin relationship with the government. The mountain paths, once traversed by shepherds and their flocks, came to be frequented instead by foresters and forest guards.

In the context of mounting debates surrounding the increase in major fires in mountainous regions, examining the history of fire offers a lens to explore the intricate interconnections between social constructs such as nature, culture, science, and power. National politics, professional ambitions, and the territory itself, all decisively shaped forest management in Portugal, with a particular strong impact on rural dynamics. This paper sheds light on the role of science in reshaping the land. Controlling fire was key not only to successful afforestation but also to defining ownership, land access, labor, livelihoods, and, ultimately, identities. By historicizing the role and place of fire within Portugal's scientific landscapes both in the academic and bureaucratic spheres, one can better understand how professional aspirations and knowledge systems mediated human-environment interactions, shaping landscapes and sociabilities.

Indeed, by seeking to eliminate fire from mountain livelihoods and landscapes, Portuguese forestry aimed to differentiate modern forest management from ancestral methods. Economic and environmental improvements, it was argued, could only be attained with the experts' knowledge. To justify afforestation, factors extrinsic to forest management, such as "ignorant" shepherds, were often blamed. Fires that once played an integral part of human-land relations were nearly extinguished. And while it is difficult to determine the extent to which afforestation in mountainous regions influenced today's fire regime, the rise in rural fires has ultimately spurred renewed academic interest in fire as a forestry and agricultural tool, encouraged by international expertise and a new political context. Alongside the recognition of broader systems of governance, this interest contributed to the development of forester epistemologies that integrate scientific knowledge with everyday experience and local practices. Nonetheless, the introduction of alternative methods intended to replicate the effects of traditional fire practices has, however, met with limited success.

Since the 1970s, the use of technical fire – incorporating expert formal concepts and local knowledge – has been theorized to fulfil the role that shepherds and communities once played in managing mountains landscapes. For decades, researchers have argued that restoring ecosystem balance is best achieved through active land management rather than continual fire suppression. Yet, a significant portion of the public – particularly urban populations – and parts of the political elite continue to view scrub burning as a symbol of ignorance. In this context, Portugal has struggled to extinguish the recurrent and severe rural fires that have been occurring with alarming frequency. This year, as intense fires swept across much of northern and central Portugal, burning at least 135 000 ha and causing human casualties, the Agency for Integrated Rural Fire Management, despite substantial investment in prevention over fire suppression since 2017-2018, attributes these failures largely to incomplete forestry reform and the neglect of rural land, affecting sensitive operations such as forest clearing, protecting the surroundings of populated areas or intervening in landscape management.[lxxxviii] It is perhaps paradoxical, but when local community fires were lit in the past, severe rural fires with dramatic consequence hardly occurred.

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**Statements and Declarations**

*Ethical considerations*

This article does not contain any studies with human or animal participants.

*Consent to participate*

Not applicable

*Consent for publication*

Not applicable

*Declaration of conflicting interest*

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*Data availability statement*

Not applicable

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[i] Finnish saying, cited by: Francisco Castro Rego, "Efeitos Ecológicos Dos Fogos Controlados," *Notas Técnico-Científicas – Estação Florestal Nacional*, (1984/1983): 53–72.
[ii] Mark D. Hersey and Jeremy Vetter, "Shared Ground: Between Environmental History and the History of Science," *History of Science* 57, no. 4 (2019): 403–40, https://doi.org/10.1177/0073275319851013.
[iii] Megan Raby, "'Slash-and-Burn Ecology': Field Science as Land Use," *History of Science* 57, no. 4 (2019): 441–468, 441, https://doi.org/10.1177/0073275318819656.
[iv] Fred Cahir et al., "Aboriginal Fire-Management Practices in Colonial Victoria," *Aboriginal History*, no. 45 (January 1, 2021): 109–30; Albert G. Way, "Burned to Be Wild: Herbert Stoddard and the Roots of Ecological Conservation in the Southern Longleaf Pine Forest," *Environmental History* 11, no. 3 (2006): 500–526; Amos Atkinson and Cristina Montiel-Molina, "Reconnecting Fire Culture of Aboriginal Communities with Contemporary Wildfire Risk Management," *Fire* 6, no. 8 (2023), https://doi.org/10.3390/fire6080296; Bibiana Bilbao et al., "Sharing Multiple Perspectives on Burning: Towards a Participatory and Intercultural Fire Management Policy in Venezuela, Brazil, and Guyana," *Fire* 2, no. 3 (2019), https://doi.org/10.3390/fire2030039.
[v] C. A. de Sousa Pimentel, "Os Incêndios Nas Florestas. Meios de Os Prevenir e Atalhar.," *Jornal de Horticultura Prática* VII (1876): 146–149 and 164–66, 146.
[vi] Emanuel de Oliveira et al., "Remains of Traditional Fire Use in Portugal: A Historical Analysis," *Trees, Forests and People* 14 (2023): 100458, https://doi.org/10.1016/j.tfp.2023.100458.
[vii] Rocha Peixoto, "Survivance Du Régime Communautaire En Portugal (Abrégé d'une Monographie Inédite)," in *Rocha Peixoto, Etnografia Portuguesa: Obra Etnográfica Completa* (Lisboa: Dom Quixote, 1990), pp.330–47; Albert Silbert, "O Colectivismo Agrário Em Portugal – História de Um Problema," in *Do Portugal de Antigo Regime Ao Portugal Oitocentista* (Lisboa: Livros Horizonte, 1977), pp. 199–281; Marília Abel, "Os Baldios Portuguses Em Período de Transição," *Revista de História* 8 (1988): 339–44; Dulce Freire, "Os Baldios Da Discórdia: As Comunidades Locais e o Estado.," in D. Freire, I. Fonseca, and P. Godinho (eds.) *Mundo Rural: Transformação e Resistência Na Península Ibérica (Século XX)* (Lisboa: Edições Colibri, 2004), pp.191–224.
[viii] Sousa Pimentel, "Os Incêndios Nas Florestas," p.146.
[ix] Ignacio García Pereda, "Experts Florestais. Os Primeiros Silvicultores Em Portugal" (PhD thesis, Universidade de Évora, 2018), pp.32–54.
[x] For exemple: Bernardino Barros Gomes, *Plano de Arborização Da Serra d'Aire* (Lisboa: Direcção Geral dos Serviços Florestais e Aquícolas, 1948).
[xi] Barros Gomes, *Plano de Arborização*, p.7.
[xii] Barros Gomes, *Plano de Arborização*, p.7.
[xiii] Zeferino Manuel Morgado Alves da Silva, "O Problema Dos Fogos Nos Maciços Florestais (Subsídios Para o Seu Estudo)." (Relatório final do curso de Engenheiro Silvicultor, Lisboa, Instituto Superior de Agronomia, 1955), 115..
[xiv] Alves da Silva, "O Problema Dos Fogos," p.114.
[xv] Marta Macedo, *Projectar e Construir a Nação: Engenheiros, Ciência e Território Em Portugal No Século XIX* (Lisboa: Imprensa de Ciências Sociais, 2012), pp. 247–50.
[xvi] García Pereda, "Experts Florestais. Os Primeiros Silvicultores Em Portugal," pp.32–3.

[xvii] Cristina Joanaz Melo, *Arborizar Contra Cheias, Tempestades e Marés (1834-1886). Políticas de Águas e Florestas Em Portugal* (Lisboa: Instituto de História Contemporânea, Instituto de Arqueologia e Paleociências, Universidade Nova de Lisboa, 2017).
[xviii] J. F. Nery Delgado and Carlos Ribeiro, *Relatório Acerca Da Arborisação Geral Do Paiz* (Lisboa: Academia Real das Ciências, 1868).
[xix] Nery Delgado and Ribeiro, "*Relatório Acerca Da Arborisação Geral Do Paiz*," p.149
[xx] Ignacio García Pereda, Helena Gregório, and Joana Gaspar de Freitas, "Fixação e Repovoamento Florestal Das Dunas No Sudoeste Da Península Ibérica," *Ler História*, no. 83 (2023): 95–117.
[xxi] Nicole Devy-Vareta, "O Regime Florestal Em Portugal Através Do Século XX (1903-2003).," *Revista Da Faculdade de Letras: Geografia* 19 (2003): 447–455, p.449.
[xxii] Devy-Vareta, "O Regime Florestal Em Portugal," p.449.
[xxiii] Devy-Vareta, 451; Maria Margarida Sobral Neto, "A População de Mira e a Desamortização Dos Baldios Na Segunda Metade Do Séc. XIX," *Revista Portuguesa de História*, no. 19 (1981): 15–58; Adriano J. de Carvalho, *O Regime Florestal Em Serpins. Exposição e Crítica.* (Coimbra: O Regime Florestal em Serpins. Exposição e Crítica., 2023).
[xxiv] Maria Carlos Radich and Fernando Oliveira Baptista, "Floresta e Sociedade: Um Percurso (1875-2005)," *Silva Lusitana* 13, no. 3 (2005): 143–57, https://doi.org/10.4000/lerhistoria.12374.
[xxv] Radich and Baptista, "Floresta e Sociedade: Um Percurso (1875-2005)."
[xxvi] João Antunes Estêvão, "A Florestação Dos Baldios.," *Análise Social* XIX, no. 77-78–79 (1983): 1157–1260, 1172–74; José Machado Pais et al., "Elementos Para a História Do Fascismo Nos Campos: A « Campanha Do Trigo » : 1928-38 (II)," *Análise Social* 14, no. 54 (1978): 321–389, 427–33; Dulce Freire, "A Campanha Do Trigo," in A. Simões do Paço (ed.) *Os Anos de Salazar. 1933 – A Constituição Do Estado Novo*, vol. 2 (Lisboa: Centro Editor PDA/Planeta DeAgostini, 2008), pp.31–39.
[xxvii] E. de Oliveira et al., "The Use of Vegetation Fire in Portugal: Historical Legislative and Normative Analysis," *Environment and History* 0, no. 0 (November 1, 2023): 1–25, https://doi.org/10.3828/whp.eh.63835725711833; Inês Gomes and Frederico Ágoas, "Good Fire and Bad Fire: The Science of Fire and the Traditional Knowledge of Scrubburning" (Sixth Biennial Conference of the European Rural History Organization (EURHO), Babes-Bolyai University, Cluj-Napoca,Romania, September 11, 2023).
[xxviii] For exemple: José Augusto Fragoso, "A Cultura Do Pinheiro Bravo" (Lisboa, Instituto de Agronomia e Veterinária, 1908); José Joaquim Tello Rasquilha, "Breves Notas Sobre a Cultura Do Sobreiro" (Lisboa, Instituto Superior de Agronomia, 1924).
[xxix] Alcides Lino Pires, "O Incêndio de Outubro de 1945 Na Serra Da Louzã (Projecto de Arborização Da Área Atingida Pelo Fogo)" (Lisboa, Instituto Superior de Agronomia, 1950).
[xxx] See also: António Bello Dias, *Elementos Para a Organização Da Defesa Contra Fogos No Património Florestal.* (Lisboa: Ministério da Economia. Direcção Geral dos Serviços Florestais e Aquícolas, 1955).
[xxxi] Alves da Silva, "O Problema Dos Fogos."
[xxxii] Bello Dias, *Elementos Para a Organização Da Defesa Contra Fogos*, p.8.
[xxxiii] Bello Dias, Bello Dias, *Elementos Para a Organização Da Defesa Contra Fogos*, p.55.
[xxxiv] Pires, "O Incêndio de Outubro de 1945 Na Serra Da Louzã (Projecto de Arborização Da Área Atingida Pelo Fogo)," p.10.
[xxxv] Radich and Baptista, "Floresta e Sociedade: Um Percurso (1875-2005)."
[xxxvi] Radich and Baptista, "Floresta e Sociedade: Um Percurso (1875-2005).".
[xxxvii] Pires, "O Incêndio de Outubro de 1945 Na Serra Da Louzã (Projecto de Arborização Da Área Atingida Pelo Fogo)," pp.31–32.
[xxxviii] Tania Murray Li, "What Is Land? Assembling a Resource for Global Investment," *Transactions of the Institute of British Geographers* 39, no. 4 (October 1, 2014): 589–602, 589, https://doi.org/10.1111/tran.12065.
[xxxix] See for instance: Robert Peden, "'The Exceeding Joy of Burning': Pastoralists and the Lucifer Match: Burning the Rangelands of the South Island of New Zealand in the Nineteenth Century, 1850 to 1890," *Agricultural History* 80, no. 1 (2006): 17–34; Simon Pooley, "Fire in African Landscapes," *The Oxford Research Encyclopedia of African History*, 2021, https://oxfordre.com/africanhistory/display/10.1093/acrefore/9780190277734.001.0001/acrefore-9780190277734-e-984; K. Sivaramakrishnan, "The Politics of Fire and Forest Regeneration in Colonial Bengal," *Environment and History* 2, no. 2 (1996): 145–94.
[xl] James C. Scott, *Seeing Like a State: How Certain Schemes to Improve the Human Condition Have Failed* (New Haven and London: Yale University Press, 1998), p.18.

[xli] Simon Pooley, "Recovering the Lost History of Fire in South Africa's Fynbos," *Environmental History* 17, no. 1 (2012): 55–83; Fred Cahir et al., "Aboriginal Fire-Management Practices in Colonial Victoria," *Aboriginal History*, no. 45 (2021): 109–30; Albert G. Way, "Burned to Be Wild: Herbert Stoddard and the Roots of Ecological Conservation in the Southern Longleaf Pine Forest," *Environmental History* 11, no. 3 (2006): 500–526.
[xlii] Some of the benefits pointed were: i) helping the reproduction of desired species; ii) destroying undesirable species; iii) disease control; iv) improving the soil; v) as a preventative measure. In this last area, the author recognizes that fire had already been used to "destroy the living cover and understory of stands": Alves da Silva, "O Problema Dos Fogos."
[xliii] E. de Queiroz Ribeiro, *As Queimadas.*, Boletim 6 (Beira: Governo do Território da Companhia de Moçambique, Direcção de Agricultura, 1940), p.11.
[xliv] M. Gomes Guerreiro, *A Floresta Africana e Os Factores Bióticos. Primeiras Observações de Um Ensaio Em Moçambique.* (Luanda: Instituto de Investigação Científica de Angola, 1966), p.48.
[xlv] Queiroz Ribeiro, *As Queimadas*, p.11.
[xlvi] Queiroz Ribeiro, *As Queimadas*, p.10.
[xlvii] Alves da Silva, "O Problema Dos Fogos Nos Maciços Florestais," p.19.
[xlviii] Alves da Silva, "O Problema Dos Fogos Nos Maciços Florestais," pp.133–34. Bello Dias, the head of the Section for Defense, proposed that the impact of prescribed fires in Portugal be examined with the objective of reducing the quantity of fuel present in the forest.
[xlix] Alves da Silva, "O Problema Dos Fogos Nos Maciços Florestais," p.134.
[l] Bello Dias, *Elementos Para a Organização Da Defesa Contra Fogos No Património Florestal.*, p.68.
[li] Bello Dias, *Elementos Para a Organização Da Defesa Contra Fogos No Património Florestal.*, pp.90–91.
[lii] Li, "What Is Land? Assembling a Resource for Global Investment," p.591.
[liii] Scott, *Seeing Like a State: How Certain Schemes to Improve the Human Condition Have Failed*, p.24.
[liv] Scott, *Seeing Like a State: How Certain Schemes to Improve the Human Condition Have Failed*, p.24.
[lv] Bello Dias, *Elementos Para a Organização Da Defesa Contra Fogos No Património Florestal.*, 96.
[lvi] Bello Dias, *Elementos Para a Organização Da Defesa Contra Fogos No Património Florestal.*, 98.
[lvii] Bello Dias, *Elementos Para a Organização Da Defesa Contra Fogos No Património Florestal.*, 90.
[lviii] Aves da Silva pointed: "We are of the opinion that we should inquire into the character of the forest's neighbors and, in the event of discontent, increase vigilance so as to enable the capture of any arsonists, who would be severely punished as was not only fair but an example to the rest. If just one case were to occur, we would certainly see a decrease in the percentage of the 'evil' cause." In Spain, the forestry legislation enacted by Franco for the Galician commons also served to exacerbate social conflicts. In this context, forest fires became a weapon of struggle and resistance to the state's authority over land use. Freire, "Os Baldios Da Discórdia: As Comunidades Locais e o Estado."; Alves da Silva, "O Problema Dos Fogos Nos Maciços Florestais," p.115; Ana Cabana, "Los Incendios En El Monte Comunal Gallego. Lugo Durante El Primer Franquismo," *Historia Agraria* no. 43 (2007): 555–577.
[lix] In the 1960s, a new fighting fire plan was proposed. The great novelty was not the actual forms of firefighting, but rather a model for privately-owned forest regions where depopulation was producing increasingly devastating fires. For the first time, clear measures were proposed to make the forest owner responsible (even though the issue of private ownership had been discussed for years). It is interesting to note his proposal to set up forest villages to settle families. The main objective would still be to facilitate the recruitment of personnel for the brigades, and not so much the creation of a multiuse forest whose occupation of the land would reduce the intensity of fires. The low level of education and culture of the mountain people was still seen as one of the main causes of fires. Their knowledge was still not valued. Vasco Quintanilha, Ernani José da Silva, and José Moreira da Silva, *Princípios Básicos De Luta Contra Incêndios Na Floresta Particular Portuguesa* (Porto: Direcção Geral dos Serviços Florestais e Aquícolas, 1965).
[lx] C. M. L. Baeta Neves, "Bases Para a Organização de Uma 'Campanha Educacional' Num Plano de Luta Contra Os Fogos Florestais.," *Agros* 47, no. 6 (1964): 475–88.
[lxi] Steve Rayner, "Uncomfortable Knowledge: The Social Construction of Ignorance in Science and Environmental Policy Discourses," *Economy and Society* 41, no. 1 (2012): 107–25, https://doi.org/10.1080/03085147.2011.637335.
[lxii] Scott, *Seeing Like a State: How Certain Schemes to Improve the Human Condition Have Failed*, p.13.
[lxiii] C. M. L. Baeta Neves, *Os Fogos, a Silvicultira e a Protecção Da Natureza* (Lisboa: Instituto dos Produtos Florestais, 1978), p.8; José Moreira da Silva, "Historique Des Feux Contrôlés Au Portugal.," *Forêt Méditerranéenne* XVIII, no. 4 (1997): 299–310, 300–302.

[lxiv] João Pinho and Paulo Mateus, "Retrato a Carvão: A Gestão Do Fogo No Âmbito Da Administração Florestal e Do Ordenamento Florestal Do Território. Subsídios Para Uma Perspetiva Histórica e de Futuro.," *Territorium*, no. 26(II) (2019): 61–88, 76.
[lxv] Comissão Fulbright - Comissão Cultural Luso-Americana, "José Lagrifa Mendes," 1969, PT/FULB/FULB/023/0005/139 - José Lagrifa Mendes.
[lxvi] Stephen J. Pyne, *Fire in America: A Cultural History of Wildland and Rural Fire.* (Princeton: Princeton Univ. Press, 1982); Tony Marks-Block and William Tripp, "Facilitating Prescribed Fire in Northern California through Indigenous Governance and Interagency Partnerships," *Fire* 4, no. 3 (2021), https://doi.org/10.3390/fire4030037; Pooley, "Recovering the Lost History of Fire in South Africa's Fynbos"; Sarah Cogos, Samuel Roturier, and Lars Östlund, "The Origins of Prescribed Burning in Scandinavian Forestry: The Seminal Role of Joel Wretlind in the Management of Fire-Dependent Forests," *European Journal of Forest Research* 139, no. 3 (June 1, 2020): 393–406, https://doi.org/10.1007/s10342-019-01247-6; Rebecca Miller, "Prescribed Burns in California: A Historical Case Study of the Integration of Scientific Research and Policy," *Fire* 3, no. 3 (2020), https://doi.org/10.3390/fire3030044; Patrick H. Brose, "Development of Prescribed Fire as a Silvicultural Tool for the Upland Oak Forests of the Eastern United States," *Journal of Forestry* 112, no. 5 (September 3, 2014): 525–33, https://doi.org/10.5849/jof.13-088; G. W. Morgan et al., "Prescribed Burning in South-Eastern Australia: History and Future Directions," *Australian Forestry* 83, no. 1 (January 2, 2020): 4–28, https://doi.org/10.1080/00049158.2020.1739883; Kevin C Ryan, Eric E Knapp, and J Morgan Varner, "Prescribed Fire in North American Forests and Woodlands: History, Current Practice, and Challenges," *Frontiers in Ecology and the Environment* 11, no. s1 (August 1, 2013): e15–24, https://doi.org/10.1890/120329.
[lxvii] Baeta Neves, *Os Fogos, a Silvicultira e a Protecção Da Natureza*, p.8; Edwin Komarek and Betty Komarek, "Comments on the Wildfire Problem in Portugal in Relation to Forests, Wildlife and Range." (Tallahassee, Florida, USA: Tall Timbers Research Station, 1976).
[lxviii] Joaquim Manuel Batista, "Algumas Questões Da Arborização de Proteção" (Lisboa, Instituto Superior de Agronomia, 1978), p.1.
[lxix] Batista, "Algumas Questões Da Arborização de Proteção," p.47.
[lxx] Amândio José de Oliveira Torres, "O Fogo Controlado Na Prevenção Dos Fogos Florestais." (Relatório de Tirocínio de Engenheiro Silvicultor, Lisboa, Instituto Superior de Agronomia, 1979), p.2. As the incidence of forest fires in rural mountainous regions increased, the paradox of fire became evident. This paradox is reflected in the fact that fire suppression policies can lead to more frequent and more intense fires in the medium to long term. On the paradox of fire see, for example: Margherita Carlucci et al., "Socioeconomic Development, Demographic Dynamics and Forest Fires in Italy, 1961–2017: A Time-Series Analysis," *Sustainability* 11, no. 5 (2019), https://doi.org/10.3390/su11051305; Adrián Jiménez-Ruano, Juan de la Riva Fernández, and Marcos Rodrigues, "Fire Regime Dynamics in Mainland Spain. Part 2: A near-Future Prospective of Fire Activity," *Science of The Total Environment* 705 (2020): 135842, https://doi.org/10.1016/j.scitotenv.2019.135842; J.S. Silva, *Towards Integrated Fire Management: Outcomes of the European Project Fire Paradox*, European Forest Institute Research Report (European Forest Institute, 2010), https://books.google.pt/books?id=GtOkuAAACAAJ; João M. N. Silva et al., "Spatiotemporal Trends of Area Burnt in the Iberian Peninsula, 1975–2013," *Regional Environmental Change* 19, no. 2 (2019): 515–27, https://doi.org/10.1007/s10113-018-1415-6.
[lxxi] Torres, "O Fogo Controlado Na Prevenção Dos Fogos Florestais.," pp.2–5.
[lxxii] Torres, "O Fogo Controlado Na Prevenção Dos Fogos Florestais."
[lxxiii] Luísa Fátima Sara de Bragança, "Contribuição Para o Estudo Das Pastagens Sob Cobertos de Folhosas." (Lisboa, Instituto Superior de Agronomia, 1979). With regard to pastures, the aim of the work was to study the conditions for introducing pasture under hardwood cover in order to more easily obtain, whenever possible, areas of defense against forest fires promoted by hardwoods and at the same time allow for the existence of grazing areas.
[lxxiv] Alberto José S. M. Cavaco, "O Uso Do Fogo Controlado No Melhoramento Do Habitat Cinegético." (Relatório de actividade do estágio do curso de Engenheiro Silvicultor, Lisboa, Instituto Superior de Agronomia, 1979). This research intended to analyze the species or species to be benefited, the habitat required and the type of fire that creates, promotes or maintains the cinegenic habitat.
[lxxv] Cavaco, "O Uso Do Fogo Controlado No Melhoramento Do Habitat Cinegético.," pp.8–10.
[lxxvi] Torres, "O Fogo Controlado Na Prevenção Dos Fogos Florestais.," pp.32.
[lxxvii] Moreira da Silva, "Historique Des Feux Contrôlés Au Portugal.," pp.213–25.

[lxxviii] José Moreira da Silva, "Alguns Aspectos Ecológicos e Sociais Relacionados Com o Fogo." (Colóquio Defesa Património Florestal. A problemática dos Incêndios florestais., Lisboa: Associação Portuguesa de Economistas, 1981), p.3.
[lxxix] "Decreto-Lei n.º 124/2006, de 28 de Junho," Pub. L. No. Diário da República n.º 123/2006, Série I-A de 2006-06-28, 4586 (n.d.), https://diariodarepublica.pt/dr/detalhe/decreto-lei/124-2006-358491.
[lxxx] "Plano Nacional de Fogo Controlado; Plano Nacional de Sensibilização; Plano de Ação Nacional de Redução Do Número de Ocorrências," n.d., https://www.icnf.pt/florestas/gfr/gfrplaneamento/gfrplanos/planosespecificosdfci.
[lxxxi] José Rentes de Carvalho, *Ernestina* (Lisboa: Quetzal Editores, 2014), p.12.
[lxxxii] "Resolução Do Conselho de Ministros n.º 55/2018," Pub. L. No. Diário da República, 1.ª série — N.º 87 — 7 de maio de 2018 (2018).
[lxxxiii] "Decreto-Lei n.º 43/2019 de 29 de Março," Pub. L. No. Diário da República, 1.ª série — N.º 63 — 29 de março de 2019 (2019).
[lxxxiv] Decreto-Lei n.º 43/2019 de 29 de março.
[lxxxv] "Decreto-Lei Nº116/2019, de 21 de Agosto," Pub. L. No. Diário da República, 1.ª série — N.º 159 — 21 de agosto de 2019 (2019).
[lxxxvi] C. M. L. Baeta Neves, "Depois Do Fogo," in *A Natureza e a Humanidade Em Perigo.*, vol. II (Lisboa: Secretaria de Estado da Agricultura, Direcção-Geral dos Serviços Florestais e Aquícolas, 1970), 34.
[lxxxvii] In a recent essay Finnegan lists four distinct types or sub-categories of place in which scientists operate – sites, regions, territories, and boundaries: Diarmid A. Finnegan, "The Spatial Turn: Geographical Approaches in the History of Science," *Journal of the History of Biology* 41, no. 2 (June 1, 2008): 369–88, https://doi.org/10.1007/s10739-007-9136-6.
[lxxxviii] Manuel Carvalho, "Reforma Florestal Derrapou e Falha No Cuidado Dos Espaços Rurais," *Público*, September 18, 2022, https://www.publico.pt/2024/09/18/sociedade/noticia/reforma-florestal-derrapou-falha-cuidado-espacos-rurais-2104487.