RESEARCH ARTICLE

A look at forest fires in Portugal: technical, institutional, and social perceptions

Cristina Ribeiroa*, Sandra Valentea, Celeste Coelhoa and Elisabete Figueiredob

aDepartment of Environment and Planning, Centre of Environmental and Marine Studies (CESAM), University of Aveiro, 3810-193 Aveiro, Portugal; bUnidade de Investigação em Governança, Competitividade e Políticas Públicas (GOVCOPP), Department of Social, Political and Territorial Sciences, University of Aveiro, 3810-193 Aveiro, Portugal

(Received 31 December 2013; accepted 6 November 2014)

Forest fires affect Portugal and other southern European countries to a greater or lesser extent every year, causing severe environmental, social, and economic damage. This research is based upon the analysis of the results of a case study on the technical and social perceptions of multiple dimensions of forest fires in Portugal, which brings together the views and perspectives of different entities with expertise in forest management and in forest protection against fires, forest owners, and members of the public. Assessing perceptions of forest fires has proved to be relevant when it comes to a greater involvement of the local population in forest management. The results show that the opinions of local respondents were consensual in identifying crime as the main cause of the forest fires. Additionally, it is the repeated failure to clean the forest biomass which cause the rapid spread of forest fires. Damage caused to the environment was more of an issue with the local forestry technicians, and economic issues were at the forefront for the local community. Various solutions were put forward to mitigate these problems, but everyone agreed that cleaning the forests biomass and punishing arsonists should be at the top of the list of priorities.

Keywords: perception; forest fires; forest protection against fires

Introduction

Portugal is one of the countries in Europe with the highest amount of burnt land. In the last 30 years, the average percentage of forest area burnt in Portugal stands at 3% each year (JRC/EU 2010). The compulsory afforestation of uplands, pastoral and agricultural areas in the early decades of the twentieth century, and the rapid demographic and socioeconomic changes and widespread abandonment of rural practices from 1950s onwards are amongst the many problems that have led to an increased fire risk. There has also been a marked increase in the vulnerability of the land in general and the people who live there to the occurrence of forest fires (Fernandes 2007; Vieira 2008).

Understanding the social perceptions of forest fires is a particularly relevant issue, if we are to foster stakeholder and local population involvement as well as the implementation and acceptance of forest management strategies and measures. In Portugal, literature and research addressing these topics are relatively scarce.

Recently, there has been discussion about the importance of integrating the perceptions, knowledge, and experience of local technicians and local citizens in the decision-making processes. This integration is considered to be extremely important in fostering stakeholder participation when it comes to achieving sustainable forest management (Ananda & Herath 2003; Niemelä et al. 2005; Diaz-Balteiro et al. 2009). Understanding the knowledge and opinions of people, with different levels of expertise and from various professional fields, is crucial to the forest protection against fires. It can create effective and locally adapted strategies and measures, which may receive greater social acceptance.

Sustainable forest management relies on the involvement of communities, forest agencies, local companies, and public agencies throughout the entire process (Leskinen 2004; Dhubhain et al. 2008). Knowing the social perceptions and practices so that decisions made about forest management can be improved, reduces conflicts of interest, and promotes a greater consensus about the goals and fundamental actions of the sustainable forest management (Ryan & Hamim 2008). It helps to develop trust among public entities, forest organizations, and citizens (Olsen & Shindler 2010). Ryan and Hamim (2008) highlight that the public perception of the institutional framework of natural resources management depends on a preexistent sense of confidence in the entities themselves and on the experiences of past collaboration. However, other aspects such as socio-demographic characteristics and individual and social perceptions about the environment are also important variables influencing these perceptions.

This paper aims to analyze the technical and social perceptions of forest fires in Portugal, based on the

*Corresponding author. Email: cristinaribeiro@ua.pt
results of a survey applied to the national and regional stakeholders and local technicians responsible for forest management, as well as the local community of the municipality of Mação.

**Forest fires in Portugal – evolution and management mechanisms**

The history of large-scale forest fires in Portugal is fairly recent and has become most evident since the beginning of the 1980s. In the past three decades, the large variation of fires has been remarkable both in terms of the number of fires and the areas that have been burnt (Figures 1 and 2). In the years of 2003 and 2005, the damage was particularly catastrophic and the area burnt went up respectively from 40,000 to 350,000 ha (Figures 1 and 2). According to Moreira et al. (2010), despite an increase in the number of fires in densely populated areas and in urban-rural interface areas, the fires and the large areas of land that were burnt were actually forest and scrubland and were located in sparsely populated areas.

The fires in Portugal occurred mainly in the northern and central regions of the country and, to a lesser extent, in the Algarve region. In terms of the forest species most affected by fire, eucalyptus and maritime pine trees have been the areas hardest hit. *Pinus pinaster* Ait. and *Eucalyptus globulus* Labill. are the main reforestation species of the Mediterranean basin and are highly combustible compared with oak trees (Conacher & Sala 1998; Fernandes 2007).

The cause of the fires themselves could be natural or anthropogenic, but in Portugal, this situation has been blamed mainly upon human activity (Galante 2005; Silva & Rego 2007; Galante et al. 2009).

Apart from the causes of the fires themselves, there are factors that contribute to a greater or lesser extent in making fire spread and cause greater damage across a wider area. Factors such as the atmospheric conditions, the type of relief and type of vegetation (Ventura & Vasconcelos 2006; Fernandes 2007; Antunes et al. 2011; Fauria et al. 2011), combined with socioeconomic and cultural conditions, population density, urban/forestry interface, also play a significant role both in the origin and intensity of the fires (Fernandes 2007; Antunes et al. 2011). This situation is responsible for severe damage on economic, social, and environmental levels (Damasceno & Silva 2007; Fernandes 2007; Galante et al. 2009). Desertification in southern Europe region is also frequently associated with the regularity and severity of fire (Piussi & Farrell 2000; Coelho et al. 2005). This is the case in Portugal where fires have produced a major impact on soil and water degradation (Ferreira et al. 2008; Silva et al. 2008; Ferreira et al. 2009).

The catastrophic fires of 2003 and 2005 had repercussions in the definition of national forestry policies and especially in the implementation of forest protection against fires (Carreiras et al. 2014). Since 2006 Portugal has a national system to forest protection against fires, which defines three action axis: (1) structural prevention, increasing the territory resilience to fire and improving people behavior in forest areas; (2) vigilance, detection and inspection; and (3) combat and post-fire vigilance, with the backup of various entities belonging to a range of different ministries in collaboration with landowners and forestry workers (Valente 2013).
The national plan for forest protection against fires establishes the strategy and actions to promote forest management for fire hazard mitigation. Additionally, each Portuguese district and municipality has a specific commission for forest protection against fires and most of the municipal councils have in their structure a Forestry Technical Office, which is responsible for the formulation of a municipal plan for forest protection against fires and for supporting forest owners’ interventions.

Portuguese forest is mainly owned by non-industrial private forest owners (75% of the forest). The small size of forest properties is one of the major constraints of forest management, especially in north and central Portugal. Forest owners’ cooperation and organization is increasing since the 1990s. From 2000 to 2013, the number of forestry associations has increased more than 150% (Valente et al. 2013).

Since the 1990s, and despite an effort to increase the cooperation and organization of forest owners, as well as to make the whole process more professional, the Portuguese forest is not managed in accordance with the strategies and measures of the national interests of the country. This undermines the effectiveness of the measures to prevent forest fires and mitigate their impacts.

Material and methods

Data collection instruments

Three different research instruments were used to collect the empirical data, aiming to assess diverse stakeholders’ views at different levels of decision and interest:

- A semi-structured interview (Supplemental Material, see Appendix 1) aimed at national (N = 4) and regional (N = 5) stakeholders, who are decision-makers or technicians involved in forest management and in the forest protection against fires;
- A questionnaire (Supplemental Material, see Appendix 2) aimed at local forestry technicians integrated in local governmental and non-governmental organizations (N = 168);
- A questionnaire (Supplemental Material, see Appendix 3) directed at the local community of Mação case study, both forest owners and other citizens (N = 323).

Each interview was recorded and lasted an average of 1 h:40 m. The recordings were transcribed and the discourse was analyzed using content analysis procedures, based on the following categories: the years in which most fires occurred; how the fires were started, how they spread, the impacts and damages caused, and future measures.

Data from the questionnaires were analyzed using Power of Advanced Statistical Analysis (PASW) Statistics 18 software, through frequency and cross-tabulations and bivariate analysis, particularly non-parametric tests, such as the chi-squared test of independence and Cramer’s $V$ to measure the association between variables.

National and regional stakeholders

The national stakeholders that took part in this study were the Secretary of State for Forestry and Rural Development, the president of the National Forest Authority, the responsible for the Forest Protection Unit integrated in the National Forest Authority and a
representative of the National Authority for Civil Protection. Five regional directors of the National Forest Authority were also interviewed.

The interviews were conducted in person following a pre-arranged appointment and a script that was prepared in advance (Supplemental Material, see Appendix 1), between 9 February and 1 June 2011. A total of nine interviews were carried out.

**Local forestry technicians**

All the local forestry technicians working for the municipal forestry offices were surveyed. In cases where there was no Forestry Office, the person responsible for the forestry sector of the municipal councils took part in the survey. The technicians from the forestry associations (non-governmental organization) were also included in the survey. A total of 334 questionnaires were sent out by email (272 technicians from municipal forestry offices and 62 technicians from forestry associations). Two hundred and six answers were actually validated. The response rates were 52% in forestry offices and 37% in forestry associations. The questions used in this survey (Supplemental Material, see Appendix 2) are part of a questionnaire developed in the research project Forestake (PTDC/AGR-CFL/099970/2008).

**The local community of Mação case study**

Mação municipality is located in central Portugal and lies in a transition area between the densely populated coastal areas and a depopulated interior. At the beginning of the twentieth century, Mação had a highly diversified landscape supporting a wide variety of activities, including subsistence farming (e.g. olive production), sheep and goat grazing, and forestry (e.g. timber production and resin extraction). In the 1950s and 1960s, large-scale migration to Lisbon led to a huge process of depopulation and abandonment of traditional activities. Rural abandonment and the increase of natural pine regeneration and eucalyptus plantations in former agricultural and grazing lands have contributed in increasing Mação’s vulnerability to forest fires.

Mação was selected as one of the Forestake project’s case studies, not only due to its vulnerability to fire hazard, but also due to the predominance of small holding of forest land and lack of forest management. The questionnaire (Supplemental Material, see Appendix 3) was personally carried out by research assistants in situ within two distinct periods, in 2010 and in 2012.

A total of 323 (from which 68% were forest owners) inhabitants of Mação responded to the survey, corresponding to 5% of the population aged 18 or above, according to the 2011 census. Respondents were selected using a quota sampling, based on gender, age group, level of education, and residence. The proportion of these characteristics was considered across the total population over the age 18.

**Results**

**Characteristics of the respondents**

*Local forestry technicians*

The respondents in this group were divided between respondents from forestry offices (86% of the total) and respondents from forestry associations (14% of the total).

A brief characterization of the entities was made by their respective forestry technicians, showing that more than 80% of those taking part in this study were only involved in a municipality. The views of the various respondents showed significant differences between technicians from forestry offices and technicians from forestry associations concerning the role of the entity they represent. While the main role of the forestry offices is to produce and manage information concerning the protection of the forest, the main role of the forestry associations is to support the creation of the forest intervention areas. Forestry offices have been established for between 5 and 10 years ago and usually have just one employee. Forestry associations have usually a higher number of employees and existed for over five years.

There were no significant differences among the respondents’ characteristics depending on which organization they came from. About 69% were technicians and 25% were decision-makers. Respondents were evenly distributed between male and female and about 50% were aged between 25 and 34. All respondents hold a degree either in sciences or in forest engineering. About half of the respondents have been involved with their specific organizations for between 5 and 10 years and 35% have worked there for less than five years.

*The local community of Mação case study*

The survey included 323 inhabitants living in the Mação municipality. A brief analysis of the characteristics of this group of respondents showed that respondents were divided between men (47%) and women (53%), over 40% were more than 64 years old and most of them had elementary school (40%) or were illiterate (17%). In terms of employment, 36% of the respondents were active people, 46% retired, 12% housewives, 2% students, and 4% unemployed. It should be noted that 208 respondents (64%) were small-scale forest owners.

*The issue of forest fires*

The national and regional stakeholders included in the survey were asked to identify the main constraints within the forestry sector of Portugal. From a whole range of
problems listed by the respondents, forest fires were reported by the President of the National Forestry Authority and the Regional Director of the Northern region as being one of the major problems affecting the national forest, due to the fact that it is a major disincentive to investment.

The local forestry technicians were asked to identify up to four problems affecting the forest in their particular area. Forest fires, alongside the issues of fragmentation and compartmentalization of property, were the problems most referred by more than 50% of the respondents of this group (Table 1).

The same question was posed to the respondents of local community and more than 80% of forest owners and citizens alike said that fires were the greatest threat to the forests in the municipality of Mação (Table 1).

The occurrence of forest fires

Both national and regional stakeholders were asked about the evolution of forest fires in the country or region of intervention. In fact, the regional respondents were consistent in identifying 2003 and 2005 as the years that saw the worst fires. The year 2004 was also extreme for the regions of Lisbon and Vale de Tejo and Alentejo as was 2010 for the Northern and Alentejo regions.

The local forestry technicians were asked to identify the years of the three worst fires in their respective local municipalities. The respondents identified the occurrence of fires since the 1980s, highlighting the most recent fires, namely 2005, quoted by 50% of the respondents and 2010 and 2003 that were both mentioned by 25%. There were significant differences across the five regions of the country. The year 2005 was identified by the respondents from the north and centre regions; 2003 and 2010 were mentioned by all the regions, except for the Algarve region where 2004 was the year that stood out most.

The same question was posed to forest owners and other citizens of Mação. There are no differences between these two groups of respondents, and these events were recalled by 99% of respondents. The year 2003 was the most frequently mentioned (by more than 32%) followed by 2005 (identified by 15%) and 1991 (for more than 8%). About 43% said they did not remember the exact year, stating that the fire had occurred more than 10 years ago.

The causes of the ignition of forest fires

Both national and regional stakeholders believe that forest fires are caused by negligence or started criminally by arsonists. This ambivalence is illustrated in the following interview extracts:

inevitably there are criminals, there are (...) the number of forest fires in given places, things that indicate that it is a criminal act and they are caught. But there is a lot of negligence. We are generally negligent. (National stakeholder)

Because negligence is a very important factor and is responsible for the number of fires that occur, but the crime is the most important factor, at least in the cases where major fires occur. (Regional stakeholder)

When asked about the main causes of the ignition of forest fires in their local areas, the local forestry technicians (both from the forestry offices and forestry associations) cited negligence at 37%, resulting mainly from ‘uncontrolled bonfires’ followed by arson at 35%.

About 79% of the population surveyed in the municipality of Mação stated that the main cause of the forest fires was arson. No differences were found between the perspectives of forest owners and other citizens.

The different groups of respondents included in the survey were united in their opinion that the main causes for the ignition of forest fires are either negligence or arson. However, the main difference between the local community of Mação and the local forestry technicians is that while forest owners and other citizens clearly identified arson as the major cause, local technicians were divided between arson and negligence ($\chi^2(7) = 81.207, p \leq 0.05$).

Reasons for the spread of forest fires

Both national and regional stakeholders referred that past fires had spread because of increased combustible waste (forest scrub/pine needles). This is highlighted in the following excerpt:

there are factors which contribute to the spread of fire … if we have had a very rainy winter, it is logical that the forests will have lots of combustible residue after that. (Regional stakeholder)

Other multiple reasons mentioned by these stakeholders were the abandonment of agricultural corridors, the lack
of territoriality, the widespread existence of forest monoculture, the lack of management, and multiple occurrence of fires in several places and regions close by, as well as the climatic factors and the characteristics of the landscape.

Local forestry technicians indicated the failure to clean the shrubs and pine needles from the forest floor (identified by 85% of the respondents) and the fact that there are lots of highly flammable species growing there (58% of the respondents) as the main causes of the spread of fires in their local areas.

Considering the local community respondents, the most frequent answer was also the failure to clean the shrubs and pine needles from the forest floor (mentioned by 73% of the respondents included in this group), followed by climatic conditions (43%). These views were also shared by forest owners and other citizens.

The standard chi-squared test of independence provided evidence of an association between the identification of some causes of the spread of fires and the type of respondent. In fact, while local forestry technicians had mentioned the presence of highly flammable species as an important cause, this was not considered an issue to the local community of Mação case study ($\chi^2(1) = 107.445, p \leq 0.05$; Cramer’s $V = 0.468$), highlighting that forest owners with holdings smaller than 0.5 ha said that they had not carried out work on a frequent bases on their properties.

The impact of forest fires

National and regional stakeholders referred as global impacts of fires the lack of regenerative capacity within forest stands, the falling living standards, the damages to tourism, the abandonment, and depopulation of rural areas, the increase in unemployment, the progressive disinterest in management and the diverse losses at the environmental level. Some of these impacts are expressed in the following excerpts:

- disinterest in management (…) it isn’t really worth it as there is not much profit and even less so with the forest fires. (Regional stakeholder)
- desertification … the few villages that are left are getting older and older and the population is diminishing. (Regional stakeholder)
- the diminution of carbon that is not retained, the oxygen that is not produced, the pollution that is caused, the erosion that is going to occur afterwards, the problems it causes to hunting, fishing, biodiversity. (Regional stakeholder)

For local forestry technicians, increased soil erosion along with landslides and the loss of biodiversity had most impact upon their municipalities. These problems were referred to by more than 80% of the respondents (Figure 3). Other impacts like the loss to the commercial value of timber were also mentioned by 70% of the respondents. The local community of Mação stated that the worst impact for them was the loss of timber. This was stated by 75% of forest owners and by other citizens alike, followed by the destruction of the local economy and the destruction of homes, properties, and other goods.

The two groups of respondents had identified different impacts from fires. While forest technicians valued more the environmental impacts (such as soil erosion and losses of biodiversity), the local people, including those who actually owned forests, were more concerned with the economic damages.

![Figure 3. Impacts of fires reported by the local forestry technicians.](image-url)
Measures

National and regional stakeholders stated that Portugal has the development and planning instruments available at both a national and local level, including those related to the forest protection against fires. However, they stress the importance of implementing measures such as preventive forestry, prescribed fire (Schwilch et al. 2012), establishing primary strip network system for fuel management (Schwilch et al. 2012), to set up and support a fire-fighting program, the creation of forest intervention areas (Schwilch et al. 2012), among others.

The local forestry technicians recognized the various plans and instruments for forest management and for forest protection against fires (Figure 4). The opinions expressed by these technicians emphasized the importance of investing in forest management and planning. More than 50% of respondents emphasized also the need to make heavy investments in cleaning the woods and forests, implementing measures to manage forest fuel/waste, punishing arsonists and people who break fire hazard rules, and restoring burned forest areas.

Local community of the Mação study case, and particularly forest owners, said that they had no knowledge about the management plans and strategies of the forest protection against fires. Most of these respondents (70%) recognized the importance of cleaning the forests and woodlands.

Discussion

The results show that the views of local respondents (forest technicians and the local community) were consensual in identifying arson as the main cause of forest fires, alongside with the lack of cleanliness in the woods, which was seen as the cause of the rapid spreading of forest fires. Although the views of technicians were not consensual about the causes of ignition, local inhabitants were unanimous in identifying arson as the main cause of forest fires.

The reasons for the fires spreading resulted from a host of atmospheric conditions and the type of terrain and vegetation (Ventura & Vasconcelos 2006; Fernandes 2007) as well as the socioeconomic and cultural circumstances (Fernandes 2007). The respondents were consensual in their view that the failure to clean the forests was the main reason for the fires spreading.

The respondents had different perceptions about the impact of the forest fires. While the technicians were more concerned about the environmental impacts, the local community was more worried about the economic losses. Although income deriving from the forest is often an extra revenue for local families, the loss of that revenue represents a deprivation which, together with the losses in terms of animals and agriculture, may assume an important role in an already fragile socioeconomic fabric. On the other hand, if we take into account the age and type of training that the forestry technicians have had, it is not surprising that they value more the environmental impacts and have a more comprehensive outlook on the role of the forest and the environmental issues at stake. However, post-fire management is receiving much less attention than the other components of fire management (Moreira et al. 2012) and the interventions to restore burnt areas in Portugal are still more focused in structural improvements after fires.
Recent government policies have taken various steps to minimize the occurrence of forest fires in Portugal. Despite these efforts, the frequency of fires continues to be high. Forestry technicians know about the instruments in place to combat the fires, but the local community and forest owners pay little attention to them. This may be explained by the private nature of most forest holdings which seems to be an obstacle for the acceptance of alternative methods of forest management, such as the forest intervention areas (Valente et al. 2013).

The different respondents present diverse perceptions on the measures that need to be taken to prevent forest fires. Not surprisingly, the measures that are more valued vary according to respondents’ areas of intervention and their needs. National and regional stakeholders consider important to put various measures and instruments into force, which have been stipulated by law. On the other hand, the local community was more focused on practical issues, such as cleaning the forests and woods and on punishing arsonists. The local forestry technicians also shared the aforementioned views, but they are also keen on creating management structures to clear combustible waste and to rehabilitate the burnt areas.

In conclusion, the data analyzed proved the existence of diverse perceptions regarding forest fires and forest management, both from technicians and from local inhabitants. These differences are often related to the role of the diverse stakeholders vis-a-vis forest issues and to the diverse scales of intervention. It is important to take these differences into account in the design and also in the reformulation of already existent plans as well as in the implementation of plans and measures regarding the forest protection against fires and forest management as a whole.

Since 2003, various mechanisms and entities have been created in order to enhance the national strategy. However, despite these measures, forest fires are still a major problem in Portugal. Although, as we have already discussed there is a myriad of reasons explaining the reasons for forest fire in Portugal, we do think that a very relevant one is related to the forest owners and local communities’ ignorance regarding the above mentioned instruments, as well as to their general lack of knowledge, perceptions and experiences concerning forest matters. Therefore, understanding the perceptions of all the stakeholders involved in the forest, particularly of forest owners and caretakers in general seems to be fundamentally important in fostering their integration in the decision-making processes and their involvement as a whole in forest management and fire prevention practices (Carreiras et al. 2014). This would also contribute in reinforcing trust amongst the various parties involved.

Although this paper aims to make a contribution to fill the gap on social and technical perceptions of forest fires and forest management in Portugal, we are aware of its exploratory nature, particularly when it comes to the visions of forest owners and local inhabitants, as only one case study was analyzed. Therefore, in order to address the social perceptions of forest fires and forest management, more empirical evidence, from other regions of the country, is needed, as well as a corresponding theoretical reflection on the subject.

Acknowledgments
We thank António Louro, Nuno Bragança, Inês Mariano, and João Fernandes for kindly providing information; João Pinho, Andreas Kläy, José Portela for valuable feedback in the questionnaire design; and João Soares, Teresa Carvalho, and Joana Silva for helping in the implementation. Thanks to Georgina Hodge for translation.

Funding
The research described in this paper was conducted in the framework of ForeStake project (PTDC/AGR-CFL/099970/2008), funded by FCT with co-funding FEDER, through COMPETE and of the Ph.D. Grant of Sandra Valente [grant number SFRH/BD/47056/2008].

Supplemental data
Supplemental data for this article can be accessed at http://dx.doi.org/10.1080/02827581.2014.987160.

References
Ananda J, Herath G. 2003. Incorporating stakeholder values into regional forest planning: a value function approach. Ecol Econ. 45:75–90.
Antunes CA, Viegas DX, Mendes JM. 2011. Avaliação do risco de incêndio florestal no concelho de Arganil [Evaluation of forest fire risk in Arganil municipality]. Silva Lusitana. 19:165–179.
Carreiras M, Ferreira ADJ, Valente S, Fleskens L, Gonzales-Pelayo O, Rubio J, Stooft C, Coelho COA, Ferreira CSS, Rítsema C. 2014. Comparative analysis of policies to deal with wildfire risk. Land Degrad Dev. 25:92–103.
Coelho C, Laouina A, Regaya K, Ferreira A, Carvalho T, Chaker M, Naafa R, Naciri R, Boulet AK, Keizer J. 2005. The impact of soil water repellency on soil hydrological and erosional processes under Eucalyptus and evergreen Quercus forests in the Western Mediterranean. Aust J Soil Res. 3:309–318.
Conacher A, Sala M. 1998. Land degradation in Mediterranean environments of the world: nature and extent, causes and solutions. Chichester: Wiley; 512 p.
Damasceno P, Silva JS. 2007. As causas dos incêndios em Portugal [Fire causes in Portugal]. In: Silva JS, editor. Proteger a floresta – incêndios, pragas e doenças. Árvores e Florestas de Portugal [Protect the Forest – wildfires, plagues and diseases. Trees and forests of Portugal], Vol. 8. Lisboa: Público, Comunicação Social, SA e Fundação Luso-Americana para o Desenvolvimento; p. 41–67. ISBN 978-989-619-105-4.
Dhubbán AN, Fléchard MC, Moloney R, O’Connor D. 2008. Stakeholders’ perceptions of forestry in rural areas – two case studies in Ireland. Land Use Policy. 7:9.
