Culture of Fire and Environmental Education in Wildfire-Prone Areas: Current Situation in Spain[1]

Clara Quesada-Fernández [2] and Daniel Quesada-Fernández [3]

Abstract

The *culture of fire* in the context of climate change has become a complicated relationship between people and natural areas. The interaction between people and fire is not a new issue. The use of fire by humans in most aspects of life, especially in rural areas, together with rapid and haphazard growth of structures in wildfire-prone areas, has led to the owners and residents living there being less involved due to an urban conception of natural and forest areas. At the same time, rural areas have been decreasing and their populations aging due to migration to cities. Although the authorities responsible for forestry and civil protection, both at the national and regional-local levels, have implemented various wildfire prevention strategies in these areas, they have discovered that these are insufficient to curb the problem which is increasing with time. For this reason it has been concluded that the public should move from being part of the problem to being an active part of the solution. Furthermore, human behavior is largely unpredictable, especially in emergency situations, such as those in wildland-urban interface areas, which increases the risk value in these areas. Thus, through environmental and forestry education activities, as well as those in emergencies, it is possible to carry out information, training and awareness-raising efforts about the problem. This paper provides a summary of some of the examples of the current situation in Spain in wildfire-prone areas in a wildland-urban interface situation and outlines what future recommendations and measures could be adopted to protect property and life and contribute to safer firefighting work.

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[2] Forest Engineer, MSc Forest Fire Management, MSc Civil Protection and Emergency Management (claraquesada@gmail.com)

[3] Professor, Faculty of Education, Departament of Social and Experimental Science Teaching, Universidad de Córdoba (Córdoba, España) (danielquesadafernandez@gmail.com)

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Introduction

The *culture of fire* in the context of climate change has become a complicated relationship between people and natural areas. The interaction between people and fire is not a new issue. The use of fire by humans in most aspects of life, especially in rural areas, together with rapid and haphazard growth of structures in wildfire-prone areas, has led to the owners and residents living there being less involved due to an urban conception of natural and forest areas. At the same time, rural areas have been decreasing and their populations aging due to migration to cities. Wildfires are an endemic problem in the countries of the Mediterranean basin. The latest overall statistics indicate that the area affected in recent years has remained the same or increased slightly. But in the summer of 2012, a dramatic increase occurred in Spain. The total number of acres burned quadrupled over the last decade and the size of the average fire has doubled in some areas over the previous year. The quantification of hectares affected that used to be evaluated in the hundreds has now become thousands or, in the most extreme cases, tens of thousands.

All Spanish regions are being affected by environmental problems and public safety, public health and civil protection emergencies directly or indirectly. Many areas are experiencing their worst disasters in recent decades (Valdemaqueda, province of Madrid; Coín, province of Málaga) or even in their history (Castrocontrigo, province of León; Cortes de Pallás and Andilla, province of Valencia; La Gomera Island, province of Tenerife) by area affected and assets threatened and affected but mainly by the tragic consequences on people's lives. Many of the affected area are located near population centers, most of them wildland-urban or wildland-rural interface areas.

The overall situation

The Spanish forest area is very important both overall and in each of the Autonomous Communities-Regions (Table 1) and presents interesting economic values both in tangible and intangible values, from the point of view of production, recreational and environmental aspects.

In many regions there are major depopulation problems, as many of the inhabitants of rural villages have migrated to urban centers. The exponential growth of many of these centers, coupled with the concentration of inhabitants and the proximity of the rural and forest environment, facilitates the occasional outing to

these natural areas by those seeking tranquility and relaxation. Life in the cities and towns with high population densities (Table 2), often with exaggerated and incompatible values for the citizenry itself, has become somewhat uncomfortable and therefore residents need to periodically distance themselves from these built-up areas. However, these people do not have the same environmental awareness as in the past since their conception of the rural and forest environment is from the point of view of people in an urban environment.

Table 1— *Main features of the forest area from information contained in the National Forest Inventory (IFN3 and IFN4) and the Forest Map of Spain (MFE50 and MFE25).*

Autonomous Community (Region)	Treed area (ha)	Treeless area (ha)	Total forest area (ha)
Aragon	1,543.465	1,071.868	2,615.333
Canaries	132.142	434.276	566.418
Cantabria	213.718	148.396	362.114
Castile-La Mancha	2,708.098	889.462	3,597.561
Castile and León	2,944.948	1,870.336	4,815.284
Catalonia	1,606.236	330.720	1,936.956
Andalusia	2,922.691	1,544.446	4,467.137
Community of Madrid	258.106	163.225	421.330
Chartered Community of Navarre (1)	435.003	159.389	594.392
Valencian Community	747.821	519.216	1,267.036
Extremadura	1,897.506	830.353	2,727.859
Galicia (1)	1,429.775	610.947	2,040.722
Balearic Islands	173.126	44.371	217.496
La Rioja	165.812	135.381	301.193
Basque Country	397.306	98.696	496.002
Principality of Asturias	441.946	323.983	765.929
Region of Murcia	301.708	185.669	487.377
Ceuta and Melilla (3)	n.d. (2)	n.d. (2)	n.d. (2)
Total	18,319.405	9,360.734	27,680.139

(1) CCAA with MFE25 figures. (2) n.d. = no data available. Source: Statistical Yearbook of Forestry 2009 of the Ministry of the Environment and Rural and Marine Affairs of Spain (MAGRAMA). (3) Autonomous Cities.

This attempt to escape from urban areas materializes on numerous occasions in homes, established legally or illegally, built in the forest in the urban mode but without following zoning and safety rules. Most of these zones constitute the wildland-urban and rural-urban interface areas that cause major problems.

Table 2— *Characterization of the regional area and population in Spain.*

Autonomous Community (Region)	Population (2011[(1)])	% total population	Area (km^2)	% total area	Population density (hab/km^2)
Andalusia	8,424.102	17,85	87.591	17,32	96,18
Aragon	1,346.293	2,85	47.719	9,44	28,21
Principality of Asturias	1,081.487	2,29	10.604	2,10	101,99
Balearic Islands	1,113.114	2,36	4.992	0,99	222,98
Canaries	2,126.769	4,51	7.447	1,47	285,59
Cantabria	593.121	1,26	5.321	1,05	111,47
Castile-La Mancha	2,115.334	4,48	79.463	15,71	26,62
Castile and León	2,558.463	5,42	94.223	18,63	27,15
Catalonia	7,539.618	15,98	32.114	6,35	234,78
Valencian Community	5,117.190	10,84	23.255	4,60	220,05
Extremadura	1,109.367	2,35	41.634	8,23	26,65
Galicia	2,795.422	5,92	29.574	5,85	94,52
Community of Madrid	6,489.680	13,75	8.028	1,59	808,38
Region of Murcia	1,470.069	3,12	11.313	2,24	129,95
Chartered Community of Navarre	642.051	1,36	10.391	2,05	61,79
Basque Country	2,184.606	4,63	7.234	1,43	301,99
La Rioja	322.955	0,68	5.045	1,00	64,01
Ceuta[(2)]	82.376	0,175	19	0,004	4335,58
Melilla[(2)]	78.476	0,166	13	0,003	6036,62
Total	47,190.493	100	505.980	100,06	93,27

(1) Reference date January 1, 2011. Source: Population data from the National Statistics Institute (INE), regional area data from the National Geographic Institute (IGN) 2012. (2) Autonomous Cities.

On the other hand, the implementation of forest rehabilitation policies in areas degraded by forest fires and/or other causes combined, paradoxically, with the lack of management in these and other areas have led to the accumulation of biomass in our forests. According to data from the Third National Forest Inventory (IFN3), conducted from 1997–2007, and the first data available for some provinces from the start of the Fourth National Forest Inventory (IFN4), treed forest areas have increased while those of sparse and scattered forests and treeless forests have decreased.

Consequently, available forest biomass, in both older and younger trees, has increased in value.

At the same time the population that once made use of this biomass has aged and can no longer carry out this work, while younger people find that the social, energy and economic remuneration for these activities isn't adequate and therefore they either reduce or abandon them.

Although the authorities responsible for forestry and civil protection, both at the national and regional-local levels, have implemented various wildfire prevention strategies in these areas, they have discovered that these are insufficient to curb the problem which is increasing with time.

Forest fire prevention

Forest fire prevention is an essential element in the fight against wildfires and in carrying out policy planning, resource allocation, organization of mechanisms and in the implementation and achievement of results. This is a long-term task in terms of the desired effects, in terms of both forest timeframes and attitudinal change in people.

General prevention

Forest fire prevention has traditionally been seen as an activity involving medium or large scale forestry actions consisting of reforestation, through seeding or planting, and cleaning and repairing forest roads. Actions such as forest hydrologic restorations were later incorporated. In many areas, primarily in rural communities, it was not considered essential to perform any other type of task because the use of biomass and the management of the land through the so-called *culture of fire* made it unnecessary. The population was involved in its environment, its use, its exploitation and, above all, in its conservation. However, the change in social uses was compromising this maintenance as well as the involvement of the population.

Need for prevention and social participation

In addition to taking standard intervention actions in rural areas, their populations must also be taken into account. These inhabitants of the forest and rural environment, the aging population or the new urbanites, need to be involved in the development, improvement and conservation of the environment. To do this, changing attitudes and mentalities to raise awareness that the environment is not what it was in the previous generation, nor is it of the urban type, also requires a long-term process involving residents living in the area.

In working with the users of the forest area, it is possible to carry out preventive

proposals, communicating what they are (information task) and their purpose (training task) before performing them (either by themselves or helped administratively and in carrying them out). Knowing the environment and the risks involved helps to take measures to prevent them from occurring.

An added aspect is the proliferation of areas where forest and urban areas are close to one another and overlap, resulting in wildland-urban interface areas. The result of intended forest use of the land by the urban population or the urban-minded is a series of additional problems and increased risk in these areas, both for users and for emergency personnel who come there in the event there services are required.

Although the authorities responsible for forestry and civil protection, both at the national and regional-local levels, have implemented various wildfire prevention strategies in these areas, they have discovered that these are insufficient to curb the problem which is increasing with time. For this reason it has been concluded that the public should move from being part of the problem to being an active part of the solution.

The main elements in reducing fire risk in wildland-urban interface areas are: management of vegetation and other fuels, measures on buildings and actions on road and defense infrastructure, active and passive, and on homes. Suitably protected infrastructure contributes significantly to the safety of residents and firefighters alike and facilitates a rapid response to wildfires. Unprotected buildings, whose owners have not taken preventive measures, may cease to be a priority in the activities of civil protection teams. The collaboration of owners is necessary to ensure the defense of buildings in interface areas. These aspects can be achieved through awareness-raising, educational and sensitization activities.

A general approach aimed at the general public allows the dissemination of fire prevention messages and information on appropriate forest use through institutional outreach and promotional campaigns by organizing conferences, seminars and courses and putting out publications with a general focus in the region or in more specific environments, such as the urban, residential and rural ones. Given that this system is aimed at the general public, real participation should be given to civil society with collaboration in local prevention plans and outsourcing of services through technical assistance and hiring. Other measures that have been used to great effect in other areas include the use of volunteerism as an educational method and the integration of disadvantaged groups.

A school-level approach must take into account that it is targeted at a young audience with great perception skills and the ability to learn new concepts. Information campaigns in this approach occur through contact with students with activities designed to raise awareness among children through educational events at schools and forest excursions. As a reinforcement measure, it is important to put out

publications and take advantage of the benefits and ease offered by new technologies and the current adaptation to them that schools have. Education is the appropriate tool to promote social and behavioral changes, so targeting forest fire prevention campaigns at the school population is seen as an especially important issue to take into account in the planning phase.

In another proposed approach, that of the local level, the geographical framework in which the information campaign takes place is different. The proximity of residents who may feel the problem is closer when they are given specific examples and details from their own area should be taken advantage of. The customized information, advice, verbal deterrence, awareness-raising and personalized education that can be provided in these cases are all important.

Study cases

The Regional Administrations of the Autonomous Communities and the General Administration through the Ministry of Agriculture, Food and the Environment are conducting information campaigns to inform the public about the implications of the misuse of fire and the risk of forest fires that can lead to wildfires causing serious ecological and economic losses. In the case of the wildland-urban interface areas, the very important task of awareness-raising is being performed. There are numerous examples of tragic events that occurred in 2012 involving people living in wildland-urban and rural-urban interface areas.

The Ministry of Agriculture, Food and the Environment conducts statewide campaigns, influencing the rural population in many areas (Vélez, 2007) through the work performed since 1998 by the Integrated Forest Fire Prevention Teams (EPRIF). These teams consist of technical and operational personnel who act in areas where fires caused by human activities have a greater incidence. At the urban and general level, it also develops other awareness-raising and sensitization campaigns such as the school campaigns.

At the regional level throughout the year 2011, the practical application of tasks resulting from the *Pyrosudoe* project study of the *culture of fire* in residents/owners in wildland-urban interface areas was developed. This project, which falls within the Interreg IV program of the European Union's Seventh Framework Programme for Research (FP7), involved the collaboration of specialists in forest fire prevention from the participating partners, France (Aquitaine, Languedoc-Roussillon), Portugal (Algarve) and Spain (Andalusia, Aragon, Balearic Islands), and provided for the implementation of measures to reduce the risk of wildfires in forests near wildland-urban interface areas.

In this sense, briefings were held with municipal officials to convey the concern of the Regional Administration in this regard. It is the municipalities, at the local

level, which should be responsible for self-protection plans in their territory, and it is the citizens thereof who should be involved in this process and who should demand their creation and, especially, their eventual implementation. The municipalities participating as pilot study areas hosted these initiatives with interest and concrete actions are now being carried out in some of them.

In Andalusia some information sessions were held with municipal officials, citizens and anyone else involved in land management, both public and private. In this regard, officials from urbanized areas, architectural and design firms and forest plant suppliers attended. At the technical level, other training sessions were held that were attended by the heads of the Regional Government responsible for forest fire prevention and suppression (INFOCA Plan), as well as those responsible for Civil Protection agencies.

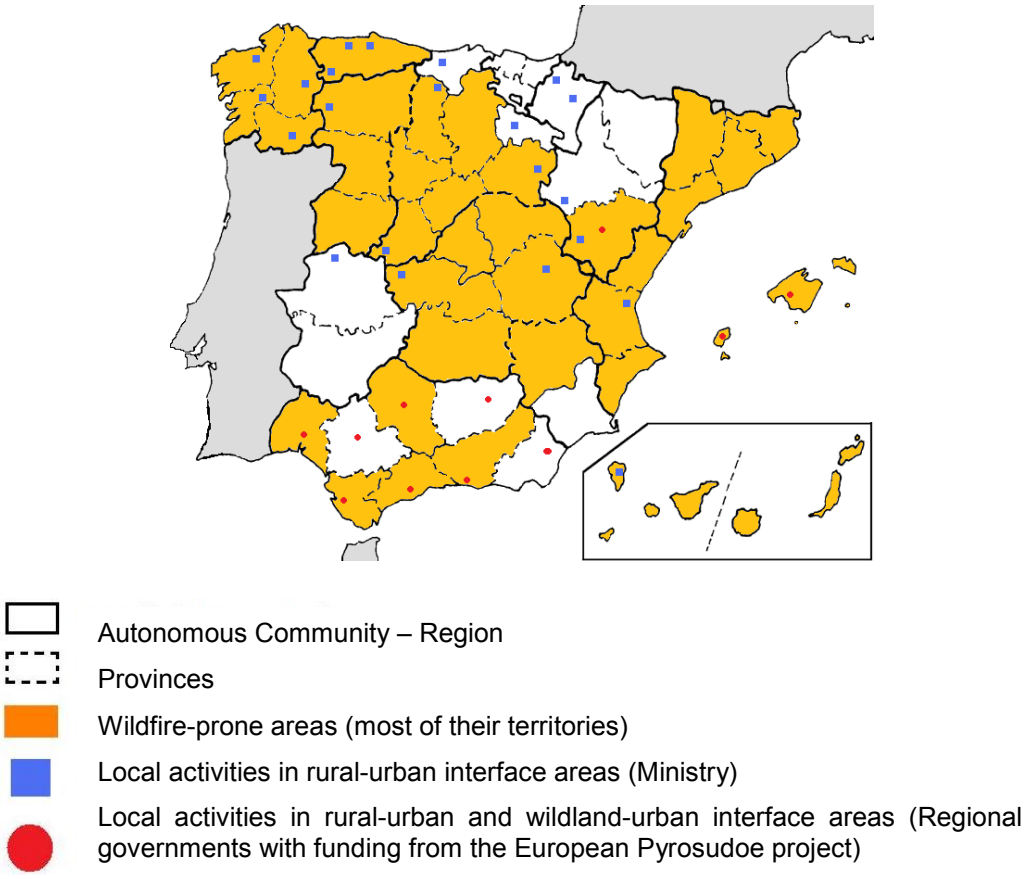

Figure 1: Examples of public information programs conducted in wildfire-prone areas. Source: Quesada, D., 2011 & 2012.

On the Balearic Islands, meetings were held with forest owners and managers. Several informational handouts were issued on the subject. It is worth noting the added difficulty of information tasks in this community due to the importance of foreign tourism and the presence of owners and residents from other European countries.

In both cases it was concluded that the people living in the population centers of the wildland-urban interface areas and bordering areas tend to have loyalty to the municipality with the personal decision not to change their place of residence. However, this circumstance does not imply the perception or experience of the risk of forest fires.

Similarly, the Regional and Local Administration should also work so that Forestry and Environmental Agencies and officials responsible for natural areas with environmental protection categories join interests and reconcile wills in an attempt to raise awareness about the problem through meetings with naturalist groups, farmers, livestock farmers and hunters.

In the case of the Balearic Islands, there is little tradition of using silviculture and forest management on private and public properties as a tool for prevention through stand improvement. Thus, the need arises to demonstrate adaptive forestry through carrying out work aimed at mitigating impacts. Therefore, it is essential to develop a previous planning task to identify risks, vulnerable areas and guidelines to reduce this vulnerability.

The characteristics of the wildfire risk areas in the wildland-urban interface suggest that it is not possible to separate the forest environment from the inhabitants living in it and that they have great heterogeneity in the perception of that risk.

The overall risk of natural phenomenon perceived by citizens is primarily focused on the risk of wildfires as a weather risk. The population does not perceive that there is a higher risk because of being in populated areas in the forest environment because they do not see the wildland-urban interface areas as such. That is, they perceive wildfires as being caused by human action but also to a large extent as an unpredictable natural phenomenon. However, in certain areas there are many people who acknowledge the significance of the wildfire risk in the wildland-urban interface as they have suffered the consequences of fire and consider it a personal risk. In this regard there have been numerous examples over the last several years, many of them in 2010, 2011 and 2012, both in the Balearic Islands and Andalusia with thousands of acres burned and thousands of residents evacuated as a preventative measure in the affected areas. In the Balearic Islands, the wildfires include, among others, those that occurred on the island of Ibiza: Benirràs, in 2010; Cala Longa and Morna-Sant Joan de Labritja, in 2011 and on the island of Mallorca: Santa Margalida and Artà in 2011; Capdepera, in 2012. In Andalusia, wildfires that

can be cited as examples are those that occurred in the provinces of Almería (Mojácar, 2010 and Bédar, in 2012), Málaga (Manilva, in 2011 and Ojén, in 2012), and Granada (Lanjarón, in 2012).

Moreover, much of the public often does not have a clear idea, or does not even consider, whether state logistics in the field of forest fires presents the degree of suitability required. There is a belief that increased investment in resources implies risk reduction in the wildland-urban interface with better results in terms of fewer fires and acres burned. At the same time, the population perceives that forest fire prevention is much less expensive than management of forest areas and that the existing obstacles in risk prevention are not of an economic or technological nature but rather of a political-organizational one. In this regard, legislative initiatives aimed at preventing risk are well-received and hence the need to involve the private owner and to shift the share of responsibility that corresponds to the individual. The Administration and the institutions that should be involved in the management of forest fire risk in the wildland-urban interface correspond to the municipalities through the tasks of prevention, management and intervention.

In parallel, plans call for the project's results to be publicized in order to raise awareness among forest landowners and the general public of the need for this type of forest management and adaptation.

Conclusions

Despite the degree of awareness and increasing sensitization in society about the negative impacts associated with forest fires, it is necessary to intensify efforts and perform new tasks in order to give residents living in the wildland-urban interface areas greater knowledge, show them the risks involving forest fires that can be found and enable them to be able to consider these risks in their entirety. In this sense, it would be necessary to carry out studies leading to knowledge of risk perception on the part of the population, and then, based on these results, conduct an educational and awareness-raising campaign followed by monitoring and control.

Research into the causes of forest fires will allow determining the extent of the problem in each area and sociological research will allow analyzing the social attitude to forest systems. These aspects should allow for feedback at all times on public awareness through correction elements.

To create awareness of risk in the population and of the proper use of fire in forest areas, the public should be educated to raise awareness in the field of forest fire prevention. The information must be provided at various levels depending on the population involved and it must be taken into account that there are various channels for the dissemination of information and that the recipients thereof are in

heterogeneous groups of perception. Information campaigns are a useful tool for the prevention of forest fires in areas where their causality has a markedly anthropic origin. The ultimate goal, however, remains the same. The identified pathway begins at the general level, passes through the schools and ends up at the local level.

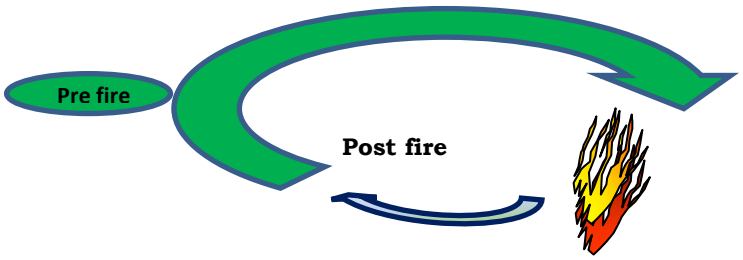

Figure 2— Desirable general efforts applied to the wildfire process from the standpoint of prevention. Source: Quesada, D, 2012.

Summary

Environmental education campaigns on the culture of wildfire risk in the wildland-urban interface provide data on local and sectorial problems essential for the planning of any policy on forest fire prevention. They also allow attaining a high level of social participation and joint responsibility to address this problem, while establishing a closer manager-managed relationship. In this regard, legislative initiatives aimed at preventing risk are well-received and hence the need to involve the private owner and to shift the share of responsibility that corresponds to the individual. The Administration and the institutions that should be involved in the management of wildfire risk in the wildland-urban interface correspond to the municipalities through the tasks of prevention, management and intervention.

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