An Approach to a System for Monitoring the Impact of Extensive Forest Fires in Spain[1]

Ricardo Vélez,[2] Balbina López[2]

Summary

Fire, as a natural element, has been a decisive factor in the composition of the forest landscape. Nevertheless, the recurrence of forest fires in certain areas and the extensive area they may cover can endanger the survival of forest systems.

Studies on the impact of fire have centred on establishing the development of the ecosystem following the fire and the evaluation of financial loss; however, less frequent is analysis of the landscape component of the impact produced by fire, and its permanence in the eco-system

From 1990, Spanish statistics for fires include this effect on the landscape although no analysis has been made from the results obtained, nor has the subsequent development of the affected landscapes been examined, which in some cases will have been restored whilst in others the eco-system has developed naturally.

A study of what happened in previously burned areas may be interesting as an instrument in forestry policy and should describe the zones under analysis, both before and after the fire and indicate the series of processes from the time of the fire to the present situation.

The Spanish Forestry Administration has undertaken the study of nine large-scale forest fires occurring in the last twelve years as a pilot scheme in which the permanent impact of the fire will be examined evaluating its state and analysing the causes which may or may not include human activity.

The study will establish normalised procedures for the systematic control of areas affected by large-scale fires in the future and will facilitate a system of periodic prospecting to evaluate impact.

Introduction

Forest fires cause a series of ecological disturbances which are often decisive in the subsequent regeneration of the burned ecosystem. The magnitude of the effects produced by fires depends to a large degree on aspects such as the fire regime: intensity, type of fire, recurrence of fires within a specific zone, the time of year when the fire occurs, in terms of the stage of development of the vegetation present, the type of vegetation, its ability to adapt to fire and its germination characteristics

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[2] General Directorate for the Conservation of Nature, Ministry of the Environment, Gran Vía de San Francisco, 4. Madrid. CP 28005.

[2] Tecnologías y Servicios Agrarios, S.A. (TRAGSATEC). Julián Camarillo, 6. Madrid. CP 28037.

post-fire, meteorology, or even the effect of the microclimate linked to different exposure or the exploitation following the fire.

Given the number and complexity of the factors which may arise in each case, the effects of a fire on the ecosystem are extremely variable, which can hinder forecasting, with any real guarantee, the possible re-growth of vegetation following a fire.

Monitoring of the development of forested areas affected by large-scale fires where in some cases restoration work will have been carried out, and in others left to nature, is a basic tool in assisting the assessor to establish the most appropriate strategies for recovering burned areas .

At the end of 2003, the Spanish Forestry Administration set up a study to develop a **System for Monitoring the Impact of Large-Scale Fires** which, through individualised, continuous and systematic monitoring of areas affected by large-scale fires occurring in the last twelve years, would help to define subsequent courses of action, establishing normalised procedures for the control of areas which have been burned.

The study intends to describe the zones included in the study both prior to and following the fire, and to explain the processes which led to the present situation from the onset of the fire, to ascertain the permanence of the fire's impact mid term, examining its present state and analysing the causes of that state, which may include human activity or the absence thereof.

Nine large-scale fires which occurred in the last decade have been selected from seven Autonomous Communities of Spain, considering that the eco-systems affected are sufficiently representative to extrapolate the results obtained to those of the remainder of Spanish territory *(table 1)(fig. 1)*.

Table 1—*Location of the nine large-scale fires selected for the study.*

Year	Community	Province	Municipal District	Surface area affected (ha)
1991	C. Valenciana	Valencia	Buñol	15.400
1994	Murcia	Murcia	Moratalla	24.817
1994	Castilla La Mancha	Cuenca	S. Martín Boniches	17.859
1994	C. Valenciana	Alicante	Montgó-Denia	820
1994	C. Valenciana	Castellón	Altura	5.000
1995	Canarias	S.C. Tenerife	Rosario	2.677
1995	Galicia	Pontevedra	Vilaboa	775
1998	Extremadura	Cáceres	Descargamaría	820
1998	Castilla and León	León	Castrocontrigo	2.763

Figure 1—Location of large-scale fires.

Method

The main objective of the study is to facilitate the periodic and systematic monitoring of land units affected by large-scale fires, developing an adequate methodology for the procedure, and identifying the normalised information for inclusion in the EGIF General Database. Defining an appropriate methodology for obtaining this objective would be based on the conclusions reached in different phases of the study. *(fig. 2)*.

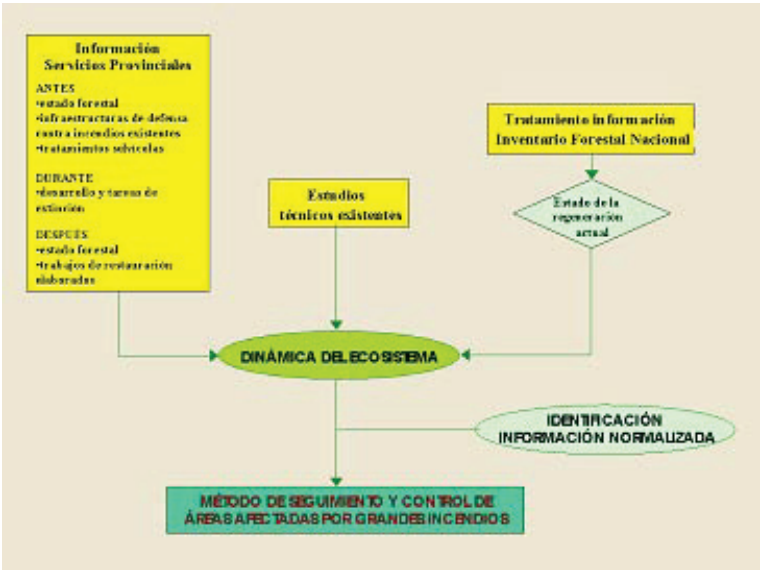

Figure 2—Content of the study.

Initially, it would be necessary to ascertain the forested state of the ecosystems

prior to the fires occurring: aspects such as specific composition of the ecosystem and the state of its development: pastures, scrub land and wooded areas, any forestry activity or exploitation, whether or not the land had an adequate infrastructure for fire fighting and fire prevention or the state of the communications network, road networks, water supply networks etc. in addition to conditions of the outbreak and spread of the fire, so it that would be easier to understand the processes which have led to the current situation following the fire.

The development of forests affected by large-scale fires depends to a large degree on the ecological conditions and the type of activity to be carried out but the structure and constitution of the existing young population constitutes one of the most determining factors.

It is therefore essential to ascertain the state of regeneration at the present time achieved by looking at the main indicators:

Type of regeneration: Provides information in respect of the origin of the woodland.

Development Category: Classifies regeneration on the basis of normal height and diameter, in order to ascertain the development stage of young trees.

Regeneration Density: Provides information on the degree of density of a specific species.

The main source of information for discovering these indicators is the National Forestry Inventory. The mapping and alphanumerical information of the plots of land provides the value of the variable density of regeneration for each sample area *(fig. 3)*.

Figure 3— Geographical location of the fire in Rosario 1995 (S.C.Tenerife, Canaries) and Map of the location of the plots of the National Forestry Inventory.

In order to define the spatial trend of the variable, spatial interpolation techniques may be used to estimate the value of the variable in specific points not taken as samples in the area covered by the existing plots. It is also necessary to create a buffer zone, namely an area between the limits of the surface area and a

fictitious limit towards the outside of the original border, since knowing the regeneration data for the plots included in the buffer zone and applying the method of spatial interpolation, it is possible to generate the model up to the very edge of the burned area, correcting any lack of values by using statistical techniques *(fig. 4)*.

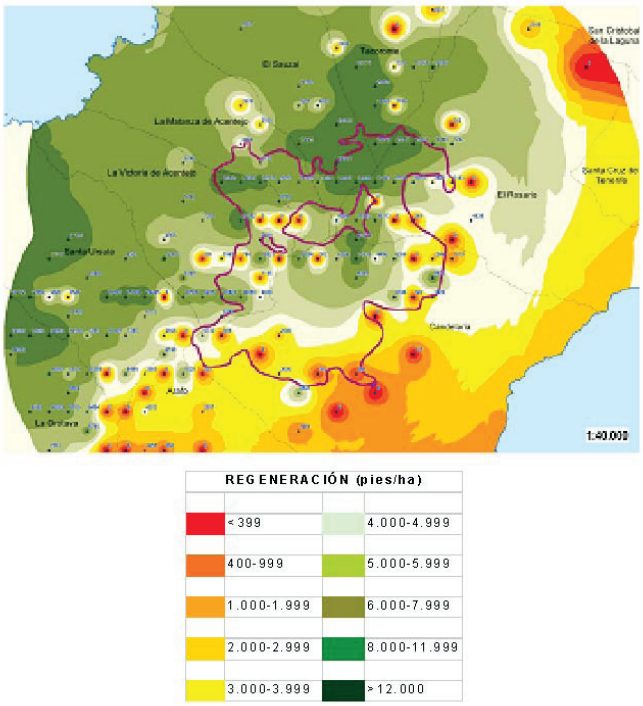

Figure 4—Map of forest regeneration Rosario forest fire 1995 (S.C.Tenerife, Canay Islands)

Working with such large-scale land dimensions does not permit a detailed control of the numerous variables which influence regeneration; however, the results permit the definition of each study zone in a general manner.

Finally, an interpretation will be made of the information contained in the studies and the restoration activities subsequent to the fire specifically carried out in affected sectors to increase knowledge of the factors and elements involved in the composition of the present landscape.

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