

# ENVIRONMENTAL AWARENESS PROJECT: “MEDITERRANEAN FOREST, FIRE AND YOU”

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## **Abstract**

Forest fires receive much pressure from the society, while fire is a natural and old phenomenon. Society needs information to understand the problem and to participate with professionals in the solutions. Understanding the problem implies having knowledge on fire behaviour and ecology. Fire must be understood as a natural and frequent perturbation of the ecosystem in the Mediterranean area, which society must learn to tolerate. Education is a first step towards coexisting with fire, integrating it and not trying, unsuccessfully, to avoid it. This environmental sensitization implies a realistic point of view of nature, replacing this idyllic concept of the late centuries.

In the year 2003, a project was started about training school-aged children entitled “Mediterranean forest, fire and you”. This consists of analyzing, defining and implementing an effective and agile tool of training about forest fires, including information about the actual situation of our forests and management issues.

This line of work hopes for a future society with a mature opinion on fires and the forest and reflected on a rational reaction based on all data, not solely on an emotional one.

**Keywords:** education, young and kids, fire ecology, forest management.

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## Introduction

The inhabitants of the Mediterranean zone have to understand two basic concepts in relation to their forests:

- Forests are natural elements intensely modified by the inhabitants of the area during thousands of years; they are humanized forests and not virgin or wild forests.
- When we worry about the causes of a forest fire, we are too late. In other words, the current approach of forest fire prevention is based on the cause of the ignition. What is needed is to reorient more efforts towards the cause of the propagation. Such a simple idea is directly correlated with forest management.

Concentrate on causes of ignition or of propagation: a simple reasoning can help us through this dichotomy. Most of our forest are highly loaded with fuels and closed dense canopies. Any ignition (intentionally, negligently, etc.), on a hot, dry or windy day can provoke a forest fire capable of burning thousands of hectares, even with increased resources of extinction or of police. As we cannot eliminate all persons who can provoke fires (nor the lightning), we are not in conditions of eliminating fires from our forest.

Technical (and not judicial) research of the causes of the forest fires helps us broaden fire knowledge, and so helps us to reduce simultaneity of fires, improving fire prevention and selecting alternative extinction methods, but eventually a large fire will occur despite our efforts.

Minimizing the conditions of the forest favourable to large fires is the main task since most of the ignitions can be easily stopped by firefighters, and the problems are the few fires with very high intensity and spread to be controlled by firefighters. The struggle to eliminate the causes is a struggle against weather phenomena, the human personality, luck, etc. The only factor favourable to a large fire that can be easily affected is vegetation.

Our Mediterranean forests are placed in a climate with aggressive weather phenomena that produce every year both forest fires and rain. Both of them produce different effects and can maintain or destroy our forests. The Japanese live in buildings adapted to the earthquakes; we have to live with forests adapted to a certain regime of forest fires. Without human intervention, the forests would be adapted to a lightning regime, but in our actual condition just very few mature forests or some highly productive managed forests can keep structures quite resistant to fires. The rest are consequences of very intense management during a long time, and are now unstructured forests. To the lack of Mediterranean structure adapted to our fire regime, we can add the lack of profitability of the traditional resources and the loss of the forest culture. The results are some very young forests very vulnerable to high intensity fire.

These forests need urgent corrective measures. At present there are two types: (1) the direct measures which are planned to hamper the progression of the fires when they present themselves, such as implementing measures of indirect attack (known as tools of passive extinction or pre-extinction) such as firebreaks, areas or lines with low fuels, securing zones for extinction resources, water sources, etc); (2) the indirect measures that derive from the sustainable management of the forest and that in an

indirect way avoid fire starts or the fire behaviour escapes from the extinction methods.

The measures of passive extinction are complex to place correctly and expensive to execute and maintain. For these reasons, they must be used with a lot of care and they can not be abused. They must be considered as global and non-local perspectives.

Indirect measures to fight fires are low cost and are very stable since those costs are paid for the main activity. Examples of indirect measures are selective mechanical treatment to reduce continuity from shrubs to trees, moderate thinning to increase forest production, or letting a flank of a fire burn at low intensity to avoid future reignitions (hot points). We think that the main way to fight fires in a Mediterranean ecosystem is a sustainable forest and fire management. Mature Mediterranean forest can be achieved in the far future using fire and silviculture together as the main tools.

In any one ecosystem, there are different stages in the cycle of vegetative structure; some of these stages are more prone to complete mortality than others when a high intensity fire occurs. Creating a mosaic of vegetative structures within an area of sustainable management, provided the funding is planned for in advance, is a key step to reduce the excessive continuity of high intensity forest fires and to improve suppression capabilities. To achieve this we have to open roads, to cut plants, and to execute controlled burnings. Developing a silviculture that contemplates fire as an element of the Mediterranean ecosystem is needed, as in the north of Europe is done with the wind. All these treatments modify the forest but this modification, made by the competent professionals and with the necessary technical knowledge, does not produce a permanent negative effect in the long term.

Once this integration is achieved we will live together better with the endemic phenomenon of our forests called forest fire. This integration will be possible only if we are able to transfer these concepts to the society, so that we value and we decide our future together. The perception of the nature by children and teenagers does not have yet the emotional burden linked to the urban and boreal vision of the forests, and they have in their hands the future of the management of the ecosystems. Their education and training is very important for the future of our forest.

## Applied Methodology

A multidisciplinary team with representation from forest owners, forest managers, firefighters and the pedagogic world was created. The main objective was to establish the ideas that would shape the axis of an environmental awareness program for young pupils in the primary and secondary schools based on present problems of forest fires; additionally the team discussed the most suitable methodology for the children to understand the concepts, as described below.

Main concepts were:

- Forest fire is an unavoidable phenomenon in our Mediterranean mountains with episodes of annual recurrence.
- The vulnerability of different forest structures to fires, including mature sustainable forest.

- The effective protection through the sustainable forest management (different types of structures, structures resistant to the fires of low intensity, different types of management tools, economic performance, funding, maintenance, etc.).
- Effects of controlled and uncontrolled fire.
- Fire as a management tool including prescribed burning and backfires.

Two principles are used to apply these concepts: the theoretical concept and the contact with the nature. The intention was to combine the conceptual assimilation and the activities in the free air in the mountain, provoking interactivity with the students. Not only was the program about theoretical concepts, but also so the children could observe the concepts and apply them in the field.

### **Schools**

The developed project was applied to 167 children with ages of 10, 11, 13 and 14 in Anoia (Barcelona). The schools were:

- CEIP Pompeu Fabra
- Col·legi Jesús Maria
- Escola Pública de Castellolí
- IES Mercader
- Escola Anoia

Project preparation was developed by a multidisciplinary team, which consisted of education resource managers (from the Pedagogical Resource Centre), foresters, landowners and firefighters. The schoolteachers did not participate due to their lack of previous training in the subject material.

### **Didactics**

#### **Theory**

Theory was developed with audiovisual tools such as PowerPoint based on real images and graphs that reflect these ideas.

#### **“Pinet”**

An icon was created to be an emotional link with the younger children (10-11 years). This visual icon could appear glad, sad, or even crying depending on the concept to explain in each slide. Moreover, the development of a family with different members of the family (grandparents, parents, siblings, newborns) enabled the relation to the growth of the trees both as individuals and as a forest.

Pinet's name (Little Pine) is chosen to break a wrong perception deeply rooted in the urban society; the belief is that the pines are bad because they always burn and what should be promoted are Holm oaks and the oaks, which do not burn.

**Figure 1**-The “Pinet”, icon. “Pinet” family is useful both to explain forest dynamics, and as an emotional link with students.



### Primary School (10-11 years)

A theoretical class was carried out as an individual exhibition of 65 minutes. Next the workshop (2 hours in total) was performed. Next, the contents were presented (complemented with trunk slices with scars, seeds of white pine, pines).

IDEA	METHODOLOGY and JUSTIFICATION
<b>Fire, normal in the Mediterranean area</b>	Surface low intensity fire arriving to the urbanization. Pinet is happy. What is pretended is to give an idea of proximity to fire. Pinet provides a calm environment.
<b>Uncontrolled fire and forest fragility.</b>	Large fire images, effects of high intensity fire, and unmanaged forest. Pinet is crying. To show reality as it is. The attitude of Pinet is bound to what we do not want to happen but is actually happening.
<b>Controlled fire</b>	Daily images about the use of the fire: heating the food and the water, artificial fires, etc. The pupil understands fire can have a use and be beneficial if we can control it.
<b>And what after a fire?</b>	Happy Pinet and sad Pinet. Images of burned zones that recover. Images of the different strata of vegetation. Images of the strategies of the plants. Pinet doubts. Strategies of plants in Mediterranean areas after fire and steps of recovery (grass, shrubs, trees)
<b>Managed versus unmanaged forest</b>	Daily images about the use of the fire: Drawings of managed forest and unmanaged forest with effects of the forest in these two types of forest. Images of the different systems of forest exploitation and/or management (mechanized, traditional, fire). Historical images of the same place and Pinet making the students' questions. Observe that fire is ALWAYS present but the effects on the vegetation will be different if the forest is well managed or unmanaged. At the same time understand that NOW, in comparison of 40 years back, there are more trees.
<b>Forest cycle</b>	Forest burning. Pinet's family. A tree growing; from seeds to adult trees. Relate forest recovery after a fire with the scale of time of people.

## Secondary schools (13-14 years)

IDEA	METHODOLOGY AND JUSTIFICATION
<b>Fire as being normal in the Mediterranean area</b>	Images of a fire arriving near houses: forest fires in Catalonia and different resources of extinction. Graph that shows the statistical data of the forest fires in Catalonia from the year 1968.
	Give to the pupils an idea of proximity of fires, picking up their attention with one battery of spectacular images. Show the resources of extinction and wonder how it is possible that with all these resources we continue having forest fires. The graph is read in historical key; observing the increase of the forested area.
<b>Uncontrolled fire and forest fragility.</b>	Large fires arriving to urbanization. Graph where the forested and populated areas are located.
	Real examples of uncontrolled fires, and their potential to populated areas.
<b>Have forest fires have been there always?</b>	Forest fires burnt in Catalonia. Signs in vegetation (scars, cores, etc.)
	Introducing, from an historical point of view, that the fires have always been present and tools to know how many years have passed since last fires.
<b>What is forest management and why is it needed?</b>	Images of the same landscape now and 50 years ago, managed forest and management systems (traditional, mechanized, etc).
	Observing the evolution of the vegetation with an increase of forested area. Explain briefly the rural abandonment of the sixties. Showing different systems of forest management and their effects.
<b>The strategies of the forest species in front of the controlled fire and the uncontrolled fire</b>	Images of the 4 main tree species. Images of post-fire succession. Images of a controlled burn and a forest fire; and their respective effects. Lightning fires.
	Explain the adaptations of Mediterranean species to fire (scar, fruits, etc.) and how vegetation recovers after a fire. To observe the differences between a high intensity and a low intensity fire (i.e., lightning).
<b>Prescribed burning. Technical use of fire</b>	Lightning. Show images in an unmanaged forest, and succession after a prescribed burning in 3 months.
	Explain how fire recurrence in high and low intensity is related to what's left. Observe a prescribed burning to portray that fire can be useful for forest management and to help avoid burning all trees in the next wildfire.
<b>Limit of capacity of extinction</b>	Real extinction videos. Last questions about previous concepts.
	Open a debate about the limit of capacity of extinction and improvements. Understand fire as a natural agent. Forest management allows us to control fire without eliminating the forest.

### Workshop

The objective of the workshop that only was carried out in primary school consisted of creating two forest stages differentiated by forest fuel; it served to relate the forest structure with the fire behavior and the extinction capacity of firefighters. The

concepts of forest management and using prescribed burns were demonstrated. The pupils participated in creating the stages with recycled material (paper and cardboard) in accordance with the established instructions. Later they were burned in an open place by firefighters to view the results in a visual way.

### Project Implementation

The structures (trees and brushes) were arranged on 2 wooden bases, in accordance with the defined densities. The bases were positioned with a slope of 15 percent. Before the prescribed burning the brush stratum was prepared. The first stage (with a larger fuel load) consisted of 4 cm of shavings of 1 cm width and 1.5 cm thick and newspapers broken in strips of 3 cm width. The second stage consisted of strips of newspaper cut in long strips and placed in a discontinuous, random way; the shavings were placed in the same manner.

Once the stages were prepared the two fuel beds were burned in a simultaneous way.

During the execution of the prescribed burning and once finished the following points were discussed:

- Letting the pupils wander among the 2 stages so that they experience the radiated heat (under the protection of an adult), in order to relate with the capacity of extinction.
- Placing the huts of cardboard in the stages where the pupils believed they would not burn to emphasize perimeter management. During the prescribed burning the results were observed.
- The effects of the prescribed burning in the 2 stages are different. The residual structures (wire and trees) represent the different effects on the forest after a fire.
- The undergrowth of the first stage is more efficient when transmitting the heat than in the second stage; in the latter, the fire is faster and does not burn for long. The fire in the first stage will take longer than in the second.
- Crown fire and the burning of the two forest types were observed.



**Figure II**-The scenarios of the workshop. Effects of forest management in fire behavior and effects on trees are visualized.

## Forest visits

### Primary Schools

Content:

ZONE	ACTIVITY	CONTENT
1	<b>Historical fire 2001</b>	Fire behaviour in an interurban zone. Colonization of the vegetation. Ancient cultures. Morphological differences between the <i>Pinus halepensis</i> and the <i>Pinus pinea</i> . Basic keys for the identification of species.
2	<b>Forest management</b>	Forest structures. Mediterranean natural forest. Firebreaks. Artificial reforestation. Relationship of extinction capacity. Activity: taking the logging slash to a chipping machine (with gloves and protective glasses).
3	<b>During lunchtime</b>	Structures. Vertical and horizontal continuity. Natural regeneration. Observing the mechanized works. Activity: observing the work that a forest company carries out. Game of species identification.
4	<b>Strategies</b>	Natural strategies of defense. Seed of <i>Pinus pinea</i> , <i>Pinus halepensis</i> , <i>Quercus ilex sub. ilex</i> , <i>Quercus ilex sub. ballota</i> .

### Secondary Schools

Content:

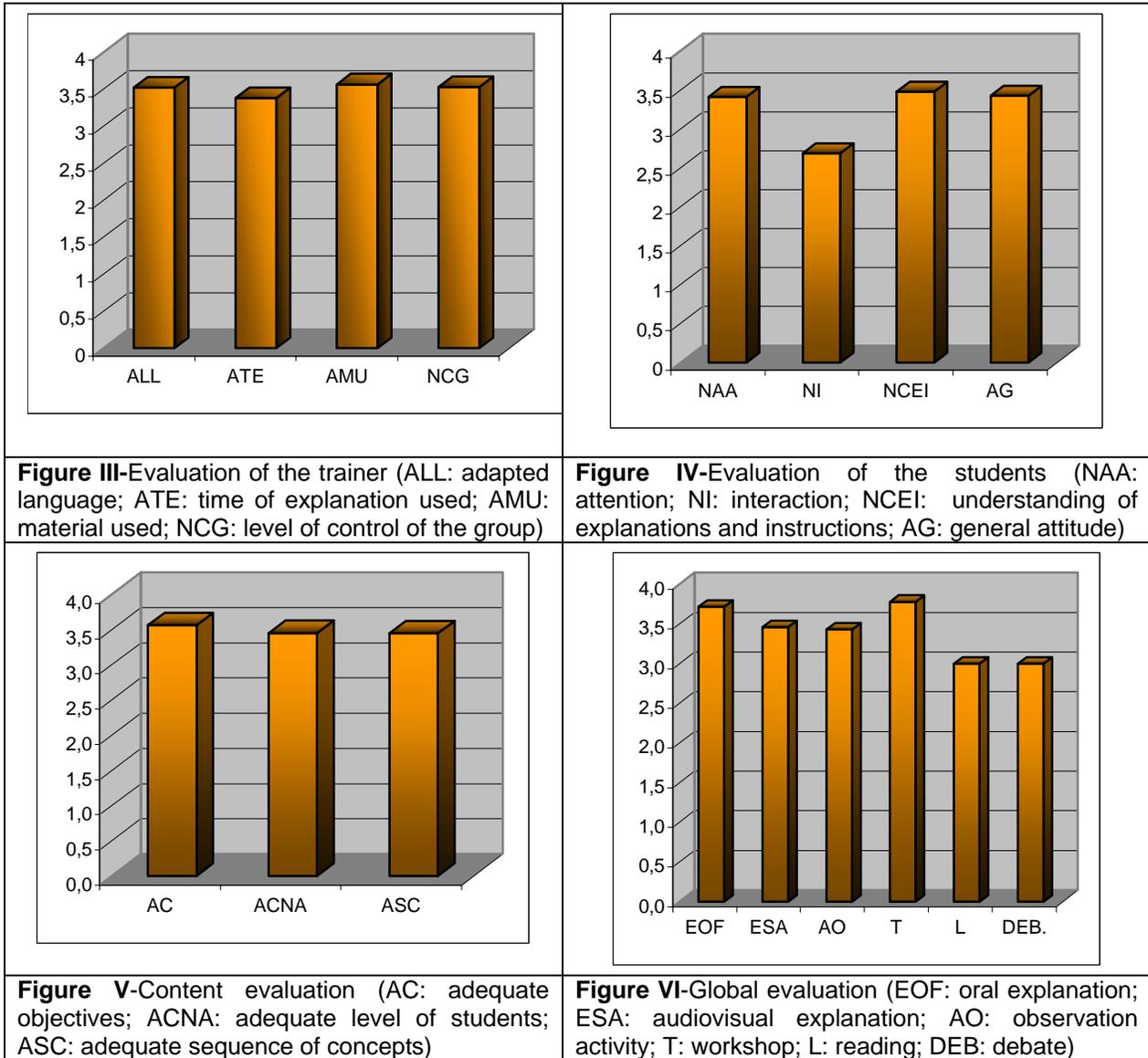
ZONE	ACTIVITY	CONTENT
1	<b>History of the plot</b>	Explanation of the origin of the forest area. Determining the age of trees with increment boring. Species and strategies (regeneration of <i>Pinus halepensis</i> ).
2	<b>Effects of burns</b>	Structures IN or OUT OF capacity of extinction. Strategic plots. Lines of anchorage. Evolution of the vegetation. Pictures.
3	<b>Prescribed burning</b>	Objectives. Material and tools. Burning methods. Lines of control. Safety measures and protective equipment. Control of effects on personnel (facial radiation, smoke inhalation).
4	<b>Meteorological station and look-out</b>	Variables. Functioning. Data to observe (colour, condensation, inclination, etc.).
5	<b>Manual and mechanized works</b>	Thinning. Objectives. Material and tools. Organization of works. Safety measures and equipment of protection.

## Results

During the different pedagogic activities an exhaustive follow-up was carried out about different aspects; the organization, the pupils, the contents were discussed in order to be able to detect deficiencies for improving the second phase of the pilot test.

The group of observers consisted of the facilitators, teaching staff, private companies, forest owners, firefighters and forest volunteers; to ensure valuable results, this group had previous knowledge of the subject material. In total the group completed 80 surveys, which was a sufficient sample to detect the main deficiencies of the project.

The surveys were graded from 1 (low) to 4 (high). Next, as graphs, the obtained datum is set forth.



From the analyzed data the observed evaluation average of the pilot test is from 3.3 to 4. It is important to note that the lowest score received was in the section of student

interaction (2.7), which assessed if they made questions or asked for clarifications. This fact has to reorient the pilot test for achieving more participation of the students but in a controlled way to avoid excessive pressure on participation.

From the students' surveys the following data was determined:

- Pupils who relate the difficulty of suppressing a fire with the lack of forest management: 90%.
- Pupils who relate the difficulty of suppressing a fire with the lack of forest management and the intensity of the fire: 62%.
- Pupils who relate the utilization of the prescribed fire with the decrease in the intensity of possible fires: 82%.
- Pupils who, after experiencing a controlled burn, believe that the vegetation will grow again: 21%

## Conclusions

In general, the evaluation is very positive. The students (during the 7 days after the activity) answered 10 questions, directed to evaluate the degree of assimilation of the explained concepts.

For the authors of this project, it is satisfying to note that more than 150 pupils (78%) assimilated the concept of forest management and its relationship with the capacity and ability of the extinction system for forest fires. This fact makes us think that the cause of fire propagation can enter notoriously into the environmental awareness of society, and not only the cause of the ignition, as has happened until now.

On the other hand, the students understood that fire in a controlled way can be used by the specialists, as it is shown in the answers of the final test. A previous pedagogic work has been carried out to overcome the existing risk when talking to kids and youngsters about fire and the work has been rewarded by these results. The experience demonstrates that the work in this aspect has been carried out with the sufficient tact.

Other positive aspects of this pilot test are for example the concept of the private forest, which the students, for the first time have started to assume.

In the phase 2 we need to have a series of considerations:

- The theoretical talks do not have to overcome the 45 min.
- In the format of explanation-debate it is advisable to finish with the videos, the questions, the slices and the launch of seeds, to cause the debate.
- The language has to keep a level simple. In spite of being able to use a technical language punctually in the theoretical talk, during the field trip the concepts are more illustrative; especially the managed forest (cared forest).
- Forest management concept must be simplified with practical and home examples, such as pruned or not pruned tree.

- We must to insist on the forest management to minimize the impact of the forest fires and, not to resign oneself only with the strategy of the floors as only solution.
- Prescribed burning, as well as the forest works, acts as a VACCINE for the forest.
- The concept is to resist the past of the fire.
- The workshop has to achieve the spectacular searched.
- The workshop is a very polyvalent activity that allows among other: reinforcing theoretical concepts, participating in the management of a forest and observing the effects, observing the evolution of a fire in 3D if the panels are orientated in a different way.
- During the forest visits the pupils have to speak in the programmed activities, they can not be mere listeners, they have to touch the floors, tools (with the due precautionary and preventive measures), to organize the works, etc.