

# Considering about the Fire Fighting at the Wildland/Urban Interface The Example of the City of Marseille

C.Picard<sup>1</sup>, B.Muscat<sup>2</sup>, F.Giroud<sup>3</sup>, J.C.Drouet<sup>4</sup>

<sup>1</sup>Centre d'Essais et de Recherche de l'Entente, Sécurité civile, Domaine de Valabre,  
RD7, 13120 Gardanne, France,

Phone : +334 42 60 86 90, Fax : +334 42 60 86 85, E-mail : pic.pic@wanadoo.fr

<sup>2</sup>Bataillon de Marins-Pompiers, 9 Bd de Strasbourg, 13003 Marseille, France

Phone : + 334 96 11 75 00, Fax : +334 96 11 77 00, E-mail : pleabmpm@voila.fr

<sup>3</sup>Centre d'Essais et de Recherche de l'Entente, Sécurité civile, Domaine de Valabre,  
RD7, 13120 Gardanne, France,

Phone : +334 42 60 86 90, Fax : +334 42 60 86 85, E-mail : f.giroud@wanadoo.fr

<sup>4</sup>Institut Universitaire Technologique Aix Marseille II, Av. M.Sandral , BP 156, 13708  
La Ciotat Cedex, France,

Phone : +334 42 98 08 71, Fax : +334 91 42 99 12,

E-mail : jeancharles.drouet@wanadoo.fr

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## Abstract

The population has been moving towards the south of France because of the development of the communication networks and the closure of many industrial sites. The desertion of cultivated areas and the new buildings at the forest massif borders contribute to the increasing rates of forest fire occurrence. In order to reduce the forest/urban fire risk, special measures have to be made taking into account our experience in the field of urban fires. Here and now, the city of Marseille, protected by the Naval Firemen Battalion, has to face this type of problem. Recommendations are provided for the 120 kilometres of forest/urban interface of this city.

## Introduction

The gradual desertion of the agricultural activity leads to a colonization of farm lands by garrigue-type species (scrubland) and coniferous trees; this wild increase of vegetation defeats those former "firebreaks" used by the human. Within the deserted areas, we sometimes find again olive trees, fig trees or vines that were formerly blocked out the flame front propagation.

At the same time, the urban areas have reached saturation point due to the population increase and the population moving towards the south of France, and the buildings have overlapped the forest massifs. These massifs are now surrounded by fallow land including highly flammable vegetation. The areas are crisscrossed by communication lines, electrical lines, and illegal dumpsites that all constitute fire prone places.

More and more people go visiting the forest massifs due to new conditions of life promoting a return to nature and leisure time policy. The forests are fire prone areas, but most of the time no information is provided and the city dwellers are very fond of this environment without being aware of how dangerous their behaviour could be (cigarette butts, barbecue, car carbon deposits...).

In this framework, a new type of risk is rising that combines the forest fire risk to the urban risk just like in the city of Marseille. Nowadays, the city has 850 000 inhabitants and is more known through its marine environment instead of its natural environment and wooded areas. Nevertheless, Marseille stretched over 24 000 hectares, 9 000 natural wooded hectares out of them. In this way, Marseille represents 120 kilometres of wildland/urban interface, i.e. 120 kilometres where a urban plot adjoins a natural or a wooded area. The naval firemen have to cope simultaneously with forest fires and urban fires.

### **New Technologies and Urban Fire Regulations: Reminder**

For the fire fighters, the oldest fire-fighting framework is the urban fire. These types of fire present a fast propagation often setting on fire several houses. The search and the implementation of new building rules and the materials used have contributed to reduce significantly such a fire occurrence. As well, the tower blocks are a successful example of prevention and prediction because of their inner firebreak compartments. The safety regulations related to public structures are based upon three principles:

- The layout of the premises, the structures, the materials and the equipments have been designed to fire protecting
- They have to be isolated from dangerous premises
- The building and the arrangements must ensure an evacuation facility in case of disaster

In parallel to the implementation of a safety regulation, elements will be tested such as floor/wall-covering, doors, building materials...every element will be registered in relation with its fire resistance and will be implemented in an appropriate layout.

In order to complete these recommendations, the called “induced risk” premises (boiler room, car park...) will be insulated by security spaces. Standardized access for relief vehicles will achieve the prevention plans.

When we list the solutions to protect sensitive structures such as firebreak door, smoke sensor, fire extinguisher, dry riser, fire hydrant, ... we notice that all lead towards an automatic or manual self-protection.

These few reminders about the development and the solutions to the fire risk in the structures keep us close to the problem generated by the forest fire outbreaks and propagations. The final objective is the same: to find a compromise between urban development and a real safety connotation.

## **Transfer of the Safety Regulations from Urban Areas to the Wildland/Urban Interface**

As mentioned above, the structures within an urban area are set up according to specific rules of building to limit fire occurrences. The consideration of problems related to the wildland/urban interfaces has to be based on the conception and structuring of these rules. This paper does not intend to be the right response to the demand, but the author considers that the following statements are the essential bases to generating a regulation paper.



The traffic roads: in order to allow the people evacuation and the relief intervention, the inside arrangements of a structure have to be correlated with its outside servicing. The way used by the relief vehicles has to meet some characteristics (minimal width, slope, resistance...). But if the traffic roads among an area at the urban interface are well sized and maintained, access to the forest massifs is often difficult. It urges that “first class” tracks should surround the massif, parallel to the line of prevailing winds. This first emergency management targets several objectives:

- to ensure mobility and rapid arrival of the relief teams
- to permit flank attacks in order to reduce any possible fire fronts on the area
- to limit the fire size and its propagation along an inescapable line
- to enable possible evacuations

The maintenance of these access roads is as essential as their construction.

The relief work area: Next to the buildings, we find car parks and areas dedicated to the work to be performed by the fire fighters (e.g. place reserved for the big ladders). This arrangement makes easier the relief intervention concerning security and rapidity of action. At present, if we imagine the transfer of this system towards the wildland/urban interface, that will mean creating this type of intervention area between the dwellings and the forest. The setting up of fighting platforms depends on a decrease of the flame front intensity that may reach the places. A reduction of the fuel mass has to reach this objective through the setting up of zigzags. The zigzag positioning disrupts the fuel and thus channels the fire and breaks its rate. When changing two parameters of the vegetation present within a zigzag such as the type of vegetation and the fuel mass, you produce an area with a reduced combustibility and flammability rates.

When changing the type of vegetation we have an effect on two aspects of the fuel: its flammability and its combustibility. The plant flammability varies according to their species, their water content, and their phenol conditions. In some of the cases, the ignition time can be increased by four depending on the species. The observation of the fire behaviour in the existing natural zigzags such as fields of olive and almond trees, vineyards..., confirms that these plants have a lower flammability than some forest species.

The first relief means : the self-protection : all the extinguishers, fire hydrants, water sprayer... are part of the range of first emergency intervention means, all of them focusing towards the self-protection of the structures. If their impact on a starting fire doesn't exclude the fire fighter intervention, one may say that these few minutes of preliminary attack can act as an asset to the development of a fire.

The same approach must be developed in the interface areas: **reverse the trend**. Positioned at the border of the fighting platforms, equipment such as farm sprinklers, water spraying, and water supply equipped with motor-pumps, present many interesting aspects:

- Effect of security for the population with a self-protection of the structures
- Ease of use for the fire fighters, the forest fire committees, the residents
- Active participation of the residents
- Cheap to set up

Fighting platforms with such equipment represent a strategic fighting base, easy to access and gathering all the required security and effectiveness conditions for the fighting operations.

The fire resistance of the building materials: all the elements of the structure and the building materials used are recorded according to their fire resistance. This class index obtained from experimental fires will be used as a pilot index in relation with the risks defined for each type of structure. At present, there is no specific recommendation for the selection of building material to face a forest fire front. The CEREN (The Research and Experimentation Centre of the Entente) and the I.U.S.T.I. (University Institute for the Industrial Heat Systems) have tested the performance of the building materials when facing a flame front. An instrumented wind tunnel (thermocouples, meteorological mobile station, flux sensor, Pitot tube, infrared camera, video) in which a vegetative environment is built up (Douglas pine, Kermes oak, brooms) to be used for simulating a vegetation fire. A siporex made wall equipped with glazing, shutter, and wood, all elements representative of a structure wall, is exposed to a flame front within the tunnel.

According to the vegetation type and condition, the experimental data collected then will help to better understand the effect of a flame front intensity on the structure elements on the one hand; and to validate the I.U.S.T.I. numerical model that will be used for the fire modelling at the wildland/urban interface.



### **The Forest Fire Risk Management in the City of Marseille**

Marseille is surrounded by 700 metre high hills that represent a valuable ecological resource for the region. We go through few hundred of metres from the coast to reach the urban zone, then the wildland/urban zone and finally we reach the large natural spaces. This space is part of protected spaces in the frame of Natura 2000 as provided for by an European directive.

The town had then to develop a special policy to match the major risk management especially concerning the forest fire risk.

#### Overall Analysis of the Natural Risks

Marseille is exposed to three major natural risks:

- Landslide
- Flood
- Forest fire

Special procedures are now utilised to manage these three risks.

The risk is the combination of a hazard and the vulnerability of a stake. The hazard is a physical phenomenon like the flood or a forest fire. The people, the property or the preservation of the economy activity represents the stake. The stake vulnerability is its weakness when exposed to a hazard.

So to reduce the risk means:

- Either reducing the hazard, in the case of the forest fires: to clear the ground;
- Either reducing the stake, to ban any building in forest fire prone areas;
- or reducing the stake vulnerability, to build “fire-resistant” dwellings.

Due to its location, its geography and the weather conditions of the area, Marseille is specially exposed to the forest fires in the wildland/urban spaces because all the fires start in the wildland/urban zone and threatens the city.

### The Inflicted Hazard and the Induced Hazard

The inflicted hazard mainly concerns the north of the city exposed to prevailing wind, the mistral that blows from north-west to south east. The fires start in the natural spaces and threaten this part of the city.

The induced hazard rather concerns the wildland/urban areas of the south of the city where the fires that start in the vicinity of inhabited areas in the wildland/urban interface threaten the large natural spaces specially sensitive from an ecological and tourist point of view.

When we overlap the two hazard maps (inflicted and induced) we notice that almost the whole wildland/urban area and the natural spaces of the city are exposed to a very high risk in term of forest fires.

We inventory different types of wildland/urban areas:

- “Bottom of the valley” type areas that were not inhabited or inhabited only by some cottages, but that have been highly built up, that largely expanded with limited access, shortage of water supplies, very dense vegetation with difficult-to-access places;
- “Scattered dwelling” type. Areas with scattered dwellings, often located at the hill flank where the structures have been built step by step without any logic for servicing, difficult access to the houses distributed over the hill;
- “Linear contour” type. There are also wildland/urban areas with a linear contour. Most of the time, they are big settlements with a road network that makes easier the surrounding of the area in case of danger and permits its fire protection.

### The Land Use Plan (Plan d’Occupation des Sols - POS)

In France, any building process has to be based on the Land Use Plan paper (POS). it defines all the rules related to the right to build.

Since April 2001, the former paper has been updated. The new one is based on a mapping of the 3 major risks that helps determining the areas where building is permitted and areas where no building is permitted.

We have a map of all the areas where building is permitted but with special instructions related to the forest fire risk, and where no building is permitted for many reasons especially related to the forest fire risk.

One has to know that over the 9000 hectares of natural spaces, 4500 hectares out of them are subject to instruction.

For these areas, about 1000 planning permissions are being examined every year. For validation reasons, a committee that is in charge of putting forward an opinion about the planning permissions in the risk areas assists the mayor of Marseille.

## Measures to be taken concerning the forest fire risk

The main principles are:

- To remind the requirement for ground clearance
- To increase security of the area surrounding
- The instructions that should help making the dwellings fire resistant
- Specific relief systems such as semiautomatic sprinkler in the surroundings of the dwellings

The instructions can even ban the building of a structure considered as presenting a risk in relation with its distribution and characteristics. Therefore, the article R 111-2 of the code for the town planning stipulates that:

- *“ The planning permission can be rejected or accepted subject to the respect of special instructions if the building, because of its location or its size, could be able to threaten public health or safety.”*

The special committee called “Risk and Town Planning Committee” examines the planning permissions on the basis of this article and submits instructions to the mayor who enforces them.

### **The main objectives are:**

- To suppress the risk of fire outbreaks
- To limit the fire development
- To permit the self-resistance of the threatened dwellings during 30 minutes in the absence of the relief
- To limit the impact on the wildland/urban interfaces
- To permit the intervention of the relief vehicles
- Not to worsen the risk when it could be fought in good conditions
- To ensure the security of the population
- To make the people responsible

The purpose is to analyse the situation of the project in relation with the massif, according to different parameters:

- Located at less than 100 metre distance from the massif, or not
- Next to an area listed as natural
- Near a watershed
- On an area where the fire speeds up
- Near a fire lane

All the parameters will tend to precisely increase the risk.

The risk can also be analysed through responses to the following questions:

- What are the type and the density of the vegetation?
- Are the access tracks narrow or wide?
- Are there any turnaround areas, parking areas?
- Are there any escape routes for the relief or the public?
- What is the water cover of the project?
- Are there any mapped areas in the vicinity of the fire post, the fire hydrants or any other hydraulic systems?

Thus we'll be able to define the risk, whether it concerns the inflicted risk (the fire that makes advance within the inhabited areas) or the induced risk (the natural space is threatened by human activities).

The projects are classified into 4 classes according to the analysis and the risk :

- First class F1: the low risk  
The risk is very limited and the project does not require special instructions
- Second class F2: high risk  
We are facing a project that requires specific instructions
- Third class F3: severe risk  
The risk is severe, the instructions are strict.
- Fourth class F4: due to major risk, the building is banned

It concerns the project as it has been planned for realization, at a given location, and presents such a risk that the committee has rejected it, meaning that the realization of the project as being proposed is forbidden.

#### Implementation Range for the Instructions

The range of the instructions is wide, so some general safety measures have to be reminded like:

- The requirements for clearing the ground
- Instructions related to the access, turnaround areas, bypassing roads, a backward strip between the natural space and the inhabited area
- Specific instructions related the hydraulic cover and the relief resources

The information to the public is also planned as well as the setting up of an evacuation plan.

#### **Conclusion**

Whatever could be the quality and the amount of the means positioned to ensure the security of the interfaces, an information policy has to be developed prior to any action. The holiday-residents are not always familiar with the forest fire risk. The dissemination of a guidebook including a straightforward set of recommendations such as closing the shutters when a fire occurs, keeping away any flammable source (wood stack, cars..) could be a first step towards a liable behaviour. The proposed developments should be set up in close collaboration with the fire fighters for sure, but also with the inhabitants who will have to involve themselves in the protection of their property.

Marseille is the first city of the south of Europe that has arranged for special measures generated by the Marseille's Naval Firemen through considerations and feedback experience. Combined with the tests developed by the CEREN, they will rely in the future upon technical references that will provide them with a support to deal with their task.