

# Report on operational recommendations to enhance children, youth and teachers involvement in wildfire risk management through communication actions

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Efficient fire risk communication for resilient societies  
(eFIRECOM)

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## Executive Summary

After the meticulous studio submitted in the *D4.1 State of the art on fire risk communication to children, youth and teachers*, the implementation of political strategies and operative recommendations that develop those strategies in order to include forest fires knowledge in students scholar curriculum was concluded.

Countries with a wide experience like USA, Australia and Canada, lay bare that education in this topic contributes to achieve resilient societies against wildland fires.

The purpose of this document is to purpose a teaching program for teachers, children and youth.

In the first place, in order to accomplish the suggested goals, a learning program pointed to teachers is purposed. Whether they shall transfer scientific investigations and operational experience to children, a wide knowledge with correct concepts encompassing the whole range of approaches about wildland fires must be implemented.

On the other hand, a student scholar program is purposed, with concepts that must be included at each grade, adjusted to their age abilities and knowledge, in order to reach the final goal of getting a society that considers wildland fires not as a dramatic event but as a natural fact.

Finally, the guidelines of an assessment system are purposed. Educational program must be evaluated and its implementation adjusted, including learning techniques, pedagogical methodologies and the wide range of factors that affect to the program success.

## 1. INTRODUCTION

In the Mediterranean area, including eFIREcom partners, wildland fires are one of those situations that need a whole review in the way that we have been facing them in the past (and also in the present) because, as result, they are perceived as an “external of citizenship” problem. People from urban areas assume that there will be wildland fires every summer, regardless of human behaviour (except by pyromaniacs), and entrusting their own safety to the wildfire suppression services (and relating their efficiency with the number of aerial assets). In the rural areas, in spite of the fact that there is more knowledge about forest and traditional use of fire, wrong policies spread out the idea of “every fire is a bad fire”. The result is a slight difference between urban and rural citizenship requirements.

Meanwhile wildland fires are perceived as random and unavoidable events. As a consequence, and due to the unacceptable financial risk, the forest is not considered a real option for investments and as a non-productive system will trend to disappear.

According to the European Reference Framework of Key Competences, adopted by the Council and the European Parliament in December 2006 [13], new knowledge, skills and attitudes have to be developed in some key areas (emphasizing on the application of knowledge in real world situations) in order to get personal fulfilment, active citizenship, social inclusion and employment in the 21<sup>st</sup> century.

“LEARNING FOR UNDERSTANDING, UNDERSTANDING TO LOVE, LOVING TO PROTECT” is the Office de L’Environnement de la Corse slogan[19], one of the master developers of the awareness campaign of school fire prevention. This simple but meaningful principle suggests the need to design a whole education program tackling wildfire as natural events, inherently connected to the forest, and in consequence, to the past, present and future humanity development.

A common challenge in current society is to be able to protect the population, regardless of borders, create safer, more communicative and active societies, ready to confront and lead current situations that could affect us. Overall this would contribute in getting a more resilient and sustainable world. Thus, a legal framework and common policies are necessary when common situations and problems affect the population at a regional scale.

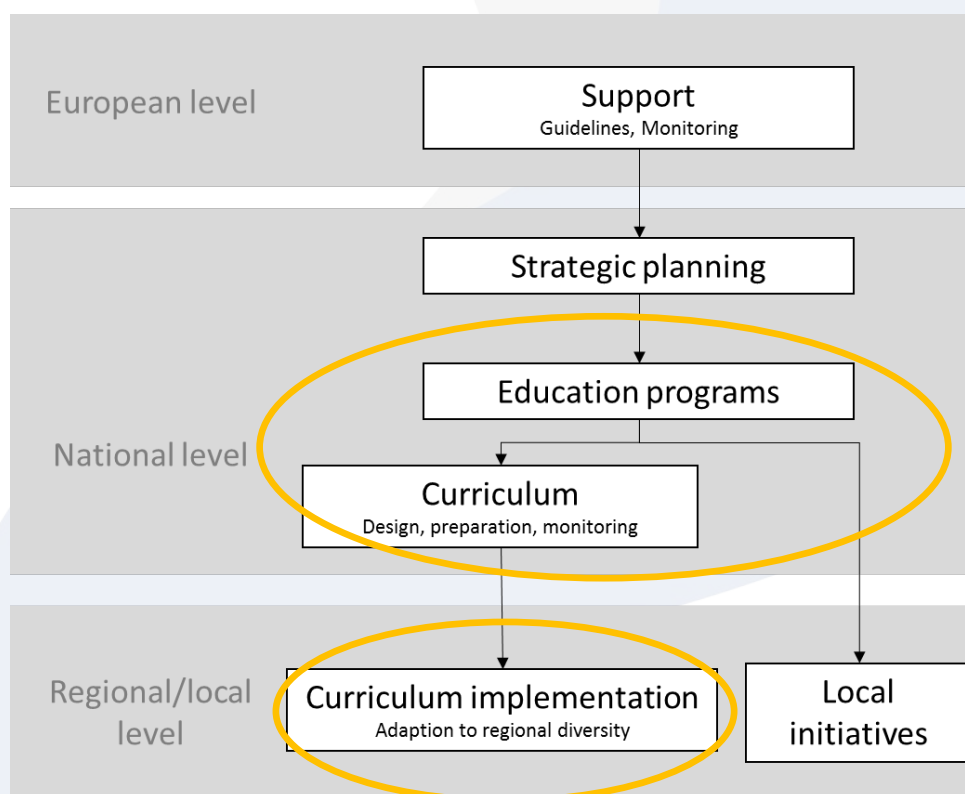
In order to achieve a real behavioural change developing a culture of risk, all educational levels have been assessed (*D4.1. State of the art on fire risk communication to children, youth and teachers*). The report concludes the need of designing a comprehensive education program, according with the student age abilities and emphasizing on teachers’ environmental training, to reach the required skills to teach children and youth while avoiding past mistakes.

## 2. OBJECTIVES

The main objective of this deliverable is developing a draft of a comprehensive environmental education program, addressing wildland fires from two different points of view:

- Wildland fires as an emergency event.
- Wildland fires as an ecological and natural event.

The countries from the eFIREcom partners shall integrate this double approach to their educational programs in order to promote and get resilient societies. According to the schematic published on deliverable *D18, Report on political recommendations to promote a fire risk culture amongst children, youth and teachers*, the current report will provide different toolkits relying on the scale of work:



### 3. WILDLAND FIRES EDUCATION PROGRAM.

As it was said in the D4.1 *State of the art on fire risk communication to children, youth and teachers*, USA, Canada and Australia, countries with a huge and extended experience in forest fires have developed and integrated innovative programs related to fire risk communication with children, youth and their teachers. But it is not only a matter of fire risk, but the need to spread the significance of maintaining a sustainable forest, that motivated them to include an absolutely-needed dynamic environmental curriculum into the educational system.

Based on the huge careers and resources that USA [5] [6] [18], Canada [2] and Australia [9] have invested on their own forests sustainability through children and youth education and the positive results will assure the continuity of these investments in the future. In this deliverable we suggest an adaptive education program, opened to be adapted by each eFIREcom partner to its particular wildfire quandary, as well as their own necessities and educational policies. Nonetheless, keynotes are necessary to ensure a common development within the countries taking part in this project.

As it concludes the D18, *Report on political recommendations to promote a fire risk culture amongst children, youth and teacher*, **guidelines** for the development of educational programs which include fire ecology and safety education should contain[5][13]:

#### 3.1. Key values to transfer

- ✓ Fire is an essential, natural process.
- ✓ Leaving nature alone has consequences, risks and trade-offs.
- ✓ All components of the environment function as a dynamic, interdependent and interrelated system.
- ✓ The scientific knowledge on fire and its behaviour is important.
- ✓ People are part of nature, and their actions have effects on the land.
- ✓ Society's influence has altered natural fire cycles, leading to a dangerous and difficult build-up fuel loading in wildland areas.
- ✓ People, especially those living in the forest, have obligations related with nature care.
- ✓ The complexity of forest land management is directly related with the number of people living near or within its boundaries.
- ✓ There are limits to sustainable development.
- ✓ Forest fires are not the problem, they are the result.
- ✓ Fire risk is not simply a residual summer problem.
- ✓ Currently, some forest conditions are not natural or healthy.
- ✓ Because of unnaturally dense conditions, our forests are at risk of having destructive wildland fires, insect infestations and diseases.
- ✓ In the future there is only one option: to improve overall forest health and lessen the risk of high-intensity, destructive wildland fires. This can be reached by bringing the forests closer to historic, ecological conditions.

- ✓ Prescribed fire is a tool used by forest management services to meet ecosystem goals.
- ✓ Firefighting management is disaster management.
- ✓ The cost of today's prevention will be saved tomorrow on extinction and restoration.
- ✓ Prevention management through planning, rural development and landscape prevails over extinction management (emergency, uncertainty, contingencies, etc.).
- ✓ Without extinction, prevention is pointless; without prevention, extinction is impossible.

### *3.2. Goals and objectives to be set by the program*

- ✓ Build an educated and involved society on forest fire ecology and management.
- ✓ Promote a risk culture that minimizes exposure to danger and promotes mitigation.
- ✓ Build a close relationship of collaboration and knowledge exchange between local communities and wildfire suppression services.
- ✓ Disseminate the basic understanding about scientific principles related to the role of fire in the ecosystem and forest management.
- ✓ Gain community support on forest programs and management techniques.
- ✓ Demonstrate the real-world applications of the lessons learnt from text books.
- ✓ Provide opportunities for students to learn about a range of potential careers.
- ✓ Demonstrate and raise awareness about rural life opportunities, integrating a new model of economic development based on uncertainty reduction through environmental knowledge in order to build resilient societies.

### *3.3. Guidelines for including fire ecology and safety education in the scholar curricula*

#### *3.3.1. Teachers*

Society has been taught that all fires are bad and that suppression is our only option. Teachers shall be able to transform children and youth in the conductors of the information that must be spread to the population in order to change the global perception about fire. Thus, any education program shall begin by training teachers on teaching children and youth on topics, such as wildfire ecology and management, that are often unknown by the educators themselves. It is therefore necessary that the values of learning environmental education related to wildfires are first taught to teacher together with the overall societal benefits.

A comprehensive draft about wildland fire knowledge has been designed in order to achieve well-trained teachers:



- 1) Introduction
  - a) *History of humans and fire.*
  - b) *Main concepts. Uncontrolled fire vs. Controlled Fire.*
- 2) Ecological Aspects of Wildland Fires
  - a) *Fire Triangle.*
    - i) *Heat: convection, radiation, conduction.*
    - ii) *Fuel: moisture content, size and shape, quantity, vertical arrangement.*
    - iii) *Oxygen.*
  - b) *Fire Behaviour.*
    - i) *Fuel. Influence on fire and flame spreading.*
    - ii) *Weather. Wind, temperature and humidity influence. Spot fire. Fire's own winds. Up and downslopes wind and their safety consequences. Day-night humidity fluctuation and its effects.*
    - iii) *Topography. Shape of the landscape, elevation and slope direction, amount of shade or sunlight, slope steepness.*
- 3) Fire Regimes.
  - a) *Ecological factors dependant on fire regime. Plants: protection, growth, reproduction, germination. Impacts on animals.*
  - b) *Fire dependant ecosystems. Fire exclusion policies. Effects of fire regime variation.*
  - c) *Fire-sensitive ecosystems.*
  - d) *Fire-independent ecosystems.*
  - e) *Fire exclusion policies. Effects of fire regime variation.*
  - f) *Ecologically appropriate vs desirable fire regime.*
- 4) Fire Effects.
  - a) *Wildland fire effects: animals, plants, environment, human resources and life.*
  - b) *Prescribed fire effects.*
  - c) *Public perceptions and attitudes toward wildland fires. Motivation and education.*
- 5) Fire Management.
  - a) *Fire as a management tool.*
  - b) *Prescribed fires.*
  - c) *Fuel management.*
  - d) *Public education is necessary to the success of fire management programs.*
- 6) Fire Prevention.
  - a) *Causality (campfires, smoking, fireworks, trash, vehicles, arson).*
  - b) *Risk awareness and societal responsibility.*
  - c) *Need and advantages of a resilient society.*
- 7) Fire Mitigation.
  - a) *Wildland-Urban Interface. Types of configuration and associated risks.*
  - b) *Society responsibility on its own protection.*
  - c) *The main concept: wildfires are going to occur. It is not a matter of 'if', it is a matter of 'when'. It is necessary to be prepared.*



In order to get a high motivation in teachers, new methods of learning must be implemented. A good example to take into account is the Forestry Institute for Teachers [8], where multidisciplinary training is taught in a dynamic environment. On the other hand, economic and professional encouragement must be set to ensure high participation at the beginning of the educational program. Teachers of rural areas, already concerned about wildland fire risk should be encouraged to participate in the program, as a way of easily spread the need of a high involvement within the educational community.

### 3.3.2. Children

- **KINDERGARTEN**

During this life period, children shall discover that Earth is made of land, air and water. Mountains, forests, rivers, lakes, oceans, valleys and deserts are parts of the Earth. They shall explore the characteristic of each ecosystem and identify the features of their local environment.

They shall understand the concept of *resource* and its relationship with life and natural systems. Next, they shall understand that places where we live change over time due to natural environment changes. Specifically related with wildland fires, the following table shows some guidelines to help developing the program[17]:

KINDERGARTEN
<i>General points to take into account:</i>
<ul style="list-style-type: none"> <li>• New knowledge must be told in a story.</li> <li>• Children are extremely experimental.</li> <li>• Children are extremely tactile and sensorial.</li> <li>• Attention spans about ten minutes.</li> <li>• Every new concept must be introduced by an age-adapted example.</li> </ul>
<i>Main concepts to be introduced</i>
<ul style="list-style-type: none"> <li>• Good fire/Bad fire.</li> <li>• What to do in case of forest fire.</li> <li>• The forest</li> </ul>
<i>Topics to talk about</i>
<ul style="list-style-type: none"> <li>• Simple questions about fire               <ul style="list-style-type: none"> <li>- Is fire hot or cold?</li> <li>- What happen if you touch a fire?</li> <li>- Have you ever seen a fire?</li> <li>- What was the fire doing? (campfire, cigarette, burning house...)</li> </ul> </li> </ul>
<ul style="list-style-type: none"> <li>• Telling stories about detecting a fire.               <ul style="list-style-type: none"> <li>- How does smoke smell?</li> <li>- What would you do? Urban and rural children have very different experiences and reactions.</li> </ul> </li> </ul>
<ul style="list-style-type: none"> <li>• Flammable and non-flammable materials. Leaves, brunches, glass, clothes.</li> </ul>

<ul style="list-style-type: none"> <li>• What to do if clothes ignite.</li> </ul>
<ul style="list-style-type: none"> <li>• Good fire: examples of fire that we need in our life.</li> <li>• Bad fire: uncontrolled effects.</li> </ul>

- **GRADES FIRST TO THIRD:**

At this age, students start to learn that animals and humans need shelter and food to survive, that healthy ecosystems offer benefits to their inhabitants, and that human activities can influence those resources, positively or negatively, changing natural systems.

During this stage animal life cycles shall be introduced and why these cycles are vital for species survival. They shall learn about animal evolution and adaptation, and factors that affect plants health and grow. Students also shall learn about the relationship between human needs and ecosystem’s resources, goods and services.

At the end of grade three, students shall learn how environmental changes, caused by living organisms, can have beneficial, detrimental or neutral effects on other organisms. At this point, students shall be able to identify ecosystems by the way humans have changed them.

GRADES 1 TO 3
<i>General points to take into account:</i>
<ul style="list-style-type: none"> <li>• Attention spans about 15 minutes for a sit-down program.</li> <li>• Children begin to absorb adult fears, concerns and restraints.</li> </ul>
<i>Main concepts to be introduced:</i>
<ul style="list-style-type: none"> <li>• Fire and animals on the forest.</li> <li>• The fire triangle.</li> <li>• The story of a forest. Ecology.</li> </ul>
<i>Topics to talk about:</i>
<ul style="list-style-type: none"> <li>• Four seasons + fire season <ul style="list-style-type: none"> <li>- Good fire: cleaning the ground.</li> <li>- Bad fire: the more brush and trees in the forest, the bigger the fire will be. Comparison with basic concepts (campfire...)</li> <li>- Plant adaptations to fire.</li> <li>- Human causality: good practices, activities that causes fires: campfire, matches, cigarettes...</li> <li>- Animal adaptations to fire.</li> </ul> </li> </ul>
<ul style="list-style-type: none"> <li>• Fuel – fire starter – oxygen. Practical demonstration. <ul style="list-style-type: none"> <li>- Applications of the fire triangle during fire suppression: fuel reduction, water dropping.</li> <li>- Reducing the number of trees high-intensity, fire can be reduced. Forests provide goods such as wood to make furniture, paper, firewood to be warm on winter...</li> </ul> </li> </ul>
<ul style="list-style-type: none"> <li>• Forest ecology <ul style="list-style-type: none"> <li>- Trees growing from seeds. Need of light into the forest.</li> <li>- Fires are a natural perturbation in unmanaged forests: <u>trees density and size increase</u> &gt; light</li> </ul> </li> </ul>

does not get to the ground > grass and flowers star to die > animals do not have enough food (if a forest fire occurs) > old trees die due to the fire > sunlight gets to the ground > grass and flower grow > animals can eat again > old trees that survived the fire keep producing their seeds > new trees star to grow > tree density and size increase... so we need good fires. [16]

- The natural cycle of fires imprinted in tree scars.
- Effects of removing the fire perturbation from forests: in dense forests there is a high competition for water and soil nutrients, thus lots of unhealthy and dry trees are ready to burn in very intense (bad) fires that ultimately kill all the trees, old and young, sick and healthy. [16]
- Current situation: dense forests induce large wildland fires.

- **GRADES FOURTH TO SIXTH**

At this point, students shall learn that plants are the primary source of matter and energy entering most food chains, the role of plants in those food chains and the importance of living things. They shall examine how all organisms, including humans consume energy and matter and how natural systems are the ultimate source of these resources.

They also discover that living organisms depend on each other and their environment for survival; how organisms compete with each other for food shall be analysed and students shall learn the role that humans can play in the health of an ecosystem.

At this stage, they will discover about energy: heat, energy transference, sources and a wide range of concepts that are primarily related with wildland fires [18][9][7]:

GRADES 4 TO 6
<i>General points to take into account:</i>
<ul style="list-style-type: none"> <li>• Attention spans about 20 minutes for a sit-down program.</li> <li>• Children are very physical and full of energy.</li> <li>• Some children can be reluctant to get involved.</li> <li>• They can assimilate major ecological concepts and discussions.</li> </ul>
<i>Main concepts to be introduced:</i>
<ul style="list-style-type: none"> <li>• Fire effects. Intensity and frequency.</li> <li>• Healthy forests.</li> <li>• Prescribed fires.</li> <li>• Wildland firefighters (at this point it is necessary a close collaboration with wildfire suppression national, regional and local services).</li> </ul>
<i>Topics to talk about:</i>
<ul style="list-style-type: none"> <li>• Evolution of fire suppression: from suppression to management.</li> </ul>
<ul style="list-style-type: none"> <li>- Application of scientific criteria after investigation.</li> <li>- Relationship between fire intensity and tree survival.</li> </ul>

<ul style="list-style-type: none"> <li>- Fire as a common and useful fact: good fires keep the forest healthy.</li> <li>- Low intensity and high frequency fires vs. one single fire of very high intensity.</li> </ul>
<ul style="list-style-type: none"> <li>• Current situation: dense forest is perceived as a good and healthy forest.</li> </ul>
<ul style="list-style-type: none"> <li>• Prescribed fires.</li> </ul>
<ul style="list-style-type: none"> <li>• When? Environmental conditions that allow controlled fires.</li> <li>• Why? Because these fires consume young, weak and sick trees, letting big trees to grow in a less dense and healthier forest. <ul style="list-style-type: none"> <li>○ Because they help reducing fuel load and preventing wildfires.</li> </ul> </li> <li>• Prescribed fires are a professional matter: like pills have to be prescribed by a doctor, prescribed fires have to be prescribed by a forest technician.</li> </ul>
<ul style="list-style-type: none"> <li>• Protective suit. Adaptable to every region.</li> </ul>
<ul style="list-style-type: none"> <li>• Objective: no firefighters injured or killed.</li> <li>• Nomex fabric: special fire –resistant material.</li> <li>• Fire-resistant vs. fire-proof.</li> <li>• Main equipment: Boots/helmet/glasses/ear plugs/leather gloves.</li> <li>• Others: first – aid kit, head-lamp...</li> </ul>
<ul style="list-style-type: none"> <li>• Firefighting tools: adaptable to every region.</li> </ul>
<ul style="list-style-type: none"> <li>- McLeod, Pulasky, hoe, shovel, chainsaw...</li> <li>- Challenge: eliminate all fuels that can burn (sticks, leaves, pine needles, young and sick trees) with tools to avoid the growth of the fire.</li> </ul>
<p>✓ It is important that children understand that firefighters are highly prepared professionals (carrying heavy tools, protective wearing and fighting against bad wildfires) with very high level both physical and technical training who assume a high risk when they work in order to protect society so, everyone has the responsibility of preventing forest fires trying to avoid that high risk to emergencies workers.</p>
<ul style="list-style-type: none"> <li>• Firefighter training</li> </ul>
<ul style="list-style-type: none"> <li>- The fire triangle:</li> </ul>
<ul style="list-style-type: none"> <li>▪ Fuel and its change over the time.</li> <li>▪ Fine fuels (grasses, pine needles and leaves) and heavy fuels (limbs, logs, tree trunks).</li> <li>▪ Why do we have bigger wildfires now than in the past? Because we have many fuels.</li> <li>▪ Air to supply oxygen for the flame.</li> <li>▪ Heat to start and continue the combustion process.</li> </ul>
<ul style="list-style-type: none"> <li>- Crown fires: most destructive fires, spreading from crown to crown instead of on the ground. Unstoppable.</li> </ul>
<p>✓ At this point, statistic information about wildfires, forest, ecology... can be provided.</p>

### 3.3.3. Youth

At this point, students begin to choose their own educational path, so the information transferred shall be focused on the students' main interests. In any case, there are two topics that must be included at this stage of the program, in order to spread information useful not only for children and youth, but for the whole community:

- a. Effects of fire on the diversity of the forest. Fuel management. Prescribed fires.
- ✓ Fire is an ecological action all over Mediterranean Region (example of plant adaptations: cork).
  - ✓ Humans will unavoidably have to live with fires. If we have to co-exist with fire, we have to manage it.
  - ✓ The causes of a fire are not as important as the resources that we have and use to manage it.
  - ✓ Most of fires remain small due to the fast suppression carried out by the extinction services.
  - ✓ Uncontrolled fires can be very devastating: threatening communities, whole forests and lives.
  - ✓ *Prevention*: we want to stop high-intensity fires before they start.
  - ✓ *Suppression*: detection (lookouts, emergency calls) and dispatch (assigning resources – ground and aerial ones - to the fire, depending on the fire evolution).
  - ✓ Wildland Fire Management: ‘let it burn’ and fire monitoring when required, mainly when low and medium fires occur through specific forest species. The fuel burnt in these cases will not be available in the future, reducing high-intensity fires probability.
  - ✓ *Fuel management*:
    - Fuel types: fine and heavy, dead and live fuels.
    - Determination of the best tools to manage those fuels: tree thinning and prescribed fires.
    - Why fuel management: to reduce the threat of large and intense forest fires, to get healthier forests without large wildfires like we had in the past, to protect life and communities, to get our forests closer to historic ecological conditions, to increase forest diversity...
- b. Fire in the wildland-urban interface (WUI).
- ✓ What is the WUI? Area where human development meets the wildland. Wildfires in these areas threaten lives and assets.
  - ✓ (FIRE + PEOPLE + INCREASING FIRE IGNITION + LARGER FIRES) = GREATER LOSS OF LIFE AND ASSETS → More money spent on Firefighting.
  - ✓ What can be done to reduce de WUI fire risk?
    - Assessing home safety in the WUI. Checklist design [12]
    - Explain to homeowners that they are living in an area “designed” by nature to burn.
    - Resource allocation: Water and electricity supplies.
    - Garden design.
    - House risks: what is the construction made of? Is firewood and other stored woods touching walls? Are weeds and tree limbs cleared away from the sides of the house? Does the house have a “green fence”?
    - Around the house risks: are trees and shrubs 5m apart or more? Are low branches cleared from underneath big trees?
    - Location house risks: is the house at the top of a slope? Is the road wide enough for fire engine circulation?

These two topics, closely related with safety and landscape management, must be introduced at every educational program in order to motivate a general knowledge about wildfires. On the other hand, specific programs can be introduced making the most of students interests. Following, there are two examples:

a. The role of Chemistry in Fire Management.

- ✓ The chemistry of fire. Oxygen + Fuel + Heat.
  - Fire = combustion.
  - Oxygen. What is it? Where is it? Is it enough in the atmosphere to sustain a fire?
  - Fuel. What is the fuel of a wildfire? Fuel Models.
  - Heat. What are natural and human-made ignition sources?
  - The combustion process of wood.
  - Flammable gases. Smoke components.
- ✓ The fire risk rating systems. (Weather + winds + draught rate + fuel) = Fire risk prediction.
- ✓ Using the chemistry to control wildfires.
  - Fire foam.
  - Fire retardant.
  - Combustion extinguisher.
  - Ignition balls.

b. People in fire's homeland (managing the fact that people live in the forest).

- ✓ Fire is a natural disturbance of the forest. When people move to the forest have to understand that they are exposed to new risks and obligations.
- ✓ Fire behaviour:
  - Diversity of landscapes and topography cause very different fire behaviour.
  - Applying scientific investigation, including topographical spreading, will help to better understand fire behaviour.
  - This knowledge has to be implemented to civil engineering and settlement design in order to be proactive against wildfire risk.

## 4. EVALUATION OF THE EDUCATIONAL PLAN

Evaluation of the educational plan is a key effort in order to assure high quality learning, adapted to the environmental reality, effective, efficient and worthwhile.

Although a comprehensive evaluation plan it is out of the goals of this document, some of the points that must be assessed are mentioned in the following points:

- *Student satisfaction*: an appropriate survey shall be designed to evaluate aspects related with the program contents, teachers, facilities, usefulness of perception and learning application.
- *Design and planning and teaching process*: it is necessary to know whether the educational plan it has been completed or not and why, analyse the reasons and try to correct them if necessary.
- *New knowledge acquired*: consists of getting the certainty that students have acquired the expected knowledge. Although different methods are used to reach this goal, active and dynamic assessment tests are recommended, instead of exams or theoretical tests.
- *Knowledge implementation to real life and learning impact on society*: it is not possible to make a direct and easy evaluation of this factor, mainly, because it is a long-term goal. An initial assessment should be related with the children's families and their homes, in order to observe if new knowledge it has been spreading from the students to the society.



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