Good practice

Forest fire risk assessment and mitigation in Mirandela (Portugal)

For the Portuguese municipality of Mirandela the risk of forest fires is very tangible. The municipality is located in a rural, mountainous area with a lot of forest. Yearly fires burn forest areas of over 1000 acres at average. The resulting risk awareness is high. The municipality therefore invests in several methods to assess and mitigate this risk.

Data research of the past occurrence

Insight in the actual risk of forest fires begins with historical research. Meticulous registration of forest fires by the fire department generated excellent insight in the occurrence, but also in the annual, monthly, weekly and hourly distribution of fires.

In the past 20 years the average occurrence of forest fires was 75 times a year, or in other words at average once every 5 days. The peak year was 2000 with 145 fires. The yearly result of all these fires has been an average of 1000 acres burnt, meaning an average of 14 acres for every forest fire. The peak year in this respect was 1991 with over 6000 acres lost, mostly due to one massive forest fire.

The monthly distribution of fires shows the summer (mainly July and August) as the period with by far the highest risk. This results in a great strain on fire brigades during summer vacation, but also provides possibilities for targeted prevention and preparation.

The distribution of fires over the weekdays shows that at Saturday the most fires occur. However, the most acres are burnt on Sunday. The explanation for this paradox turned out to be twofold. Firstly, inhabitants of the municipality of Mirandela like to barbeque in nature on Sunday. Secondly, in summer during festivals fireworks are lit on Saturday evening. This may cause a forest fire, which sometimes stays undetected overnight and in any case causes most damage during the Sunday, although they are started Saturday evening. This provided two useful insights for targeted mitigation: educating the people on fire risks and sometimes even prohibiting barbeques and fireworks during high risk periods.

Finally, the hourly distribution reveals the times from 11h to 12h and mainly from 15h to 16h hav

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e the highest probability of fires. This information can enhance the preparedness of the fire brigades.

Triggers of forest fires

Another important kind of research is the evaluation of causes or triggers of actual forest fires. Specific registration and research in the period 2001-2006 provided the necessary insight. Most of the fires are caused by negligence: 40% is caused by small agricultural fires, barbeques and fireworks. The second largest trigger is intentional: 29% of fire is started by arson. Furthermore 11% of the fires had a natural cause (thunderstorm) and 4% a technical cause (power lines). The remaining 16% had an undetermined cause.

Forest fire risk mapping

Besides the temporal distribution also the spatial distribution of fire risks is important information in the mitigation process. The municipality therefore decided to develop a specific risk map for forest fires. The risk map was designed to provide insight in the different elements of the concept of risk:

Risk = hazard x potential damage

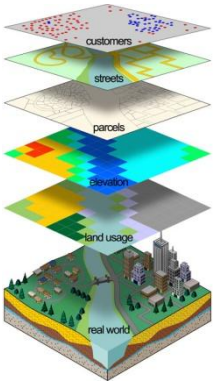
In this definition hazard consists of the probability of a fire trigger and the susceptibility of the area. These are firstly defined by past occurrence of fires. This historical approach to fire occurrence (mapping of areas burnt in the past) allowed the classification of the territory in five classes of probability.

Class	Yearly probability	Return rate (years)
1. Low	< 0.01	> 100
2. Moderate	0.01-0.025	40-100
3. High	0.025-0.05	20-40
4. Very high	0.05-0.1	10-20
5. Extreme	> 0.1	< 10

An additional approach to the definition of the fire hazard is the mapping of surface fire characteristics, like land use, type of vegetation and the mountain slope. This is likewise divided into five classes.

Class	Fire intensity in kW/m	Description
1. Low	< 500	Surface fires of low intensity. Easily controllable by direct attack with fire fighter equipment.
2. Moderate	500-2000	Surface fires of moderate intensity. Moderately controllable with terrestrial means.
3. High	2000-4000	Fire with elevated intensity, which may partially involve the trees. Difficult to control and fire aircraft needed.
4. Very high	4000-10 000	Fire of the trees with very high intensity. Control of the fire front very difficult.
5. Extreme	> 10 000	Fire of extreme intensity. Control of the fire is impossible.

The potential damage constitutes of the vulnerability of the elements at risk and the economic value. These are defined by land use. In the risk map the combination of a 'hazard layer' and a 'damage layer' led to a risk map in which four areas where identified with high risk:



- Serra de Santa Comba (forest of pinus pinaster)
- Romeu - Natura 2000 Network (forest of quercus suber)
- Aguieiras at the North end of the municipality

- Serra do Cubo and Abreiro at the South end of the municipality

Mitigation: reducing fire fuel

One way of reducing the forest fire risk is to reduce the fire 'fuel':

- manual or mechanical cutting of the forest
- chemical treatments to reduce inflammability
- grazing by life stock
- so-called 'prescribed fire'.

Prescribed fire means the deliberate use of fire under specific fuel and weather conditions to achieve defined management objectives:

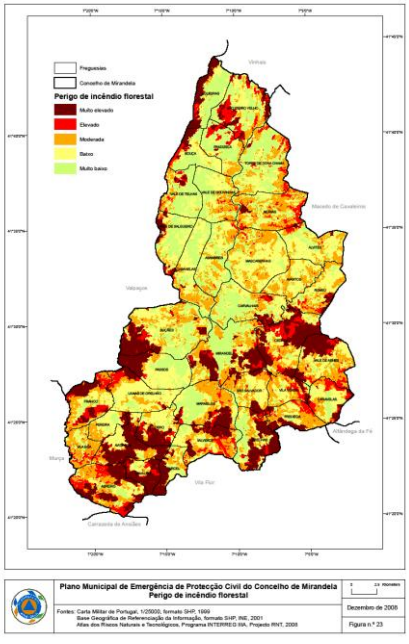
- to manage the build-up of flammable fuel (live and dead vegetation) thus reducing the impact, and difficulty of suppression of wildfires.
- protection and conservation of biodiversity and other environmental values. Ecosystems have evolved in the presence of fire and they require a certain fire regime.
- re-establishment of forests following commercial timber harvesting ('slash burn').

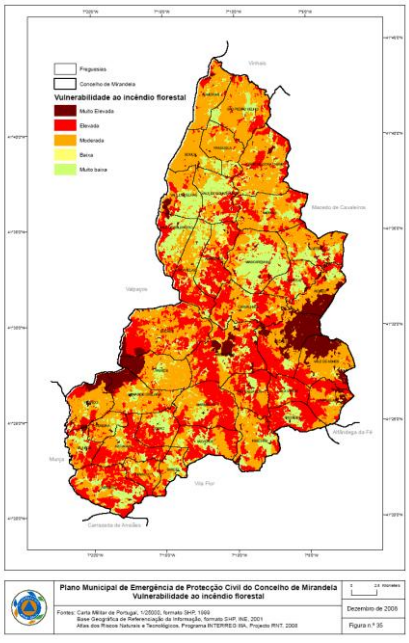
The technique is being strategically used in areas which are identified as a high risk in the risk map. For Mirandela prescribed fire has proven to be the most effective surface fuel treatment, because of the low costs, the minimal complementary operations required, the versatile objectives served and the large spatial scale of application. The treatment however always poses a risk and strict weather conditions should always be observed.

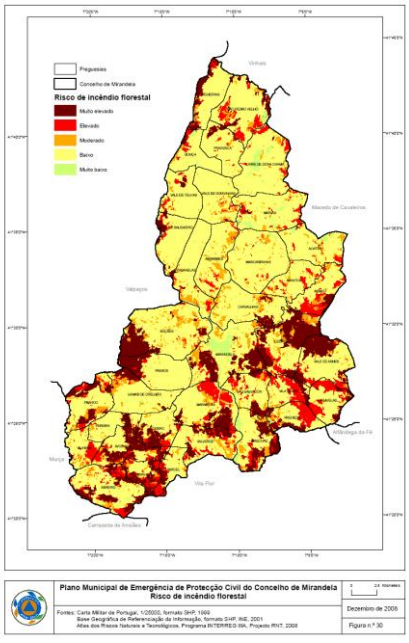
Lessons learnt

The municipality of Mirandela has learned some valuable lessons:

- Good incident registration and historical research provide a firm basis for informed policy decisions. With insight in temporal and spatial occurrence and causes specific prevention and preparedness measures can be taken.
- With risk mapping the areas burnt in the past, areas with high probability due to surface fire characteristics and areas with a lot of vulnerabilities can be analyzed. The overlapping of these areas gives direct insight in the high risk areas and thus pinpoints the possible areas for specific mitigation like 'prescribed fire'.
- For risk mapping the use of accurate GIS-information and high quality cartography are important success factors. Furthermore the updating of information has to be guaranteed.







The MiSRaR project

The MiSRaR project is about Mitigation of Spatial Relevant Risks in European Regions and Towns. The project is a cooperation between seven partners in six EU member states:

- *the Safety Region South-Holland South, The Netherlands (lead partner)*
- *the city of Tallinn, Estonia*
- *the region of Epirus, Greece*
- *the province of Forlì-Cesena, Italy*
- *the municipality of Aveiro, Portugal*
- *the municipality of Mirandela, Portugal*
- *the Euro Perspectives Foundation (EPF), Bulgaria.*

The goal of the project is to exchange knowledge and experiences on risk mitigation in spatial policies. The project will result in a handbook in which the lessons on the mitigation process are described and the good practices from the partners are presented. The Risk Assessment and Mapping Guidelines for Disaster Management of the European Commission will be implemented in the handbook.

The MiSRaR project is cofinanced by the European Regional Development Fund and made possible by the INTERREG IVC programme.

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