EUROPEAN FOREST FIRES NETWORK - EUFOFINET

Synthesis of good practice

GP4: Cartography of risk

INTRODUCTION

Leader: CESEFOR (SPAIN)
Donor Partners: ONF, TUSCANY, AGASP, FRI, NORTHUMBERLAND
Recipient Partners: PEDA, TUSCANY, ONF, AGASP, CESEFOR, FREDERIKSSUND, THESSALY, EPIRUS.

The definition selected for this topic when the project was launched is as follows:
"Cartography, hazard: the mathematics and geomatics are efficient tools planning out parameters of potential risks on the entire territory".

This topic was the subject of a workshop in León, Spain (Workshop "Cartography of Risks" and Open Forum "A new European Regional Forest Fires Prevention Network") on 21st-22nd-23rd February 2012.

Location of the event: Centro para la Defensa contra el Fuego / "Centre for Defense against Forest Fire " (CDF) - Junta de Castilla y León, C/ Comandante Cortizo s/n. C.P. 24008 León, Castilla y León (Spain).

BACKGROUND

The main objective of the Interreg IVC EUFOFINET project is the transfer of already identified good practices to improve national or regional policies on forest fire prevention and management into the Operational Programmes of the PP's M.A.
One of the objectives of the workshop was to work around prevention and Cartography of Risks, around GIS technologies. Interreg IVC EUFOFINET partners presented their experience in this field. Other European project's partners participated in the meeting: Interreg IVC "EFFMIS" and SUDOE project "PYROSUDOE" initiatives.
Another aim was to advance on a European forest fires prevention network. In this sense, this meeting hosted a debate around its needs and framework as an additional activity of a meeting of the European project Interreg IVC EUFOFINET. During the last day of that meeting, this Open Forum was the dialogue space where a proposal of the creation of a European Forest Fire Prevention Network was presented. This action, one of the planned activities of the Interreg IVC EUFOFINET project, is identified as a need from different fields of forest fire fighting.
The Open Forum was divided into two parts. During the first part representatives of FAO, the Joint Research Centre, lead partners of six related European projects and the Junta de Castilla y León presented their perspectives. This was followed by an open debate. The findings of this debate are presented below.
During the discussion there was broad agreement on the need for greater collaboration in prevention at European level, being an area where significant challenges lay ahead.
To complete these activities, some side events of Interreg IVC "EFFMIS" projects took place: bilateral meetings and training staff exchanges.
As a side event, 2 technical rooms took place for external organizations and companies to present their experience in these project's topics.

CURRENT SITUATION AMONG PARTNERS

Castilla y Leòn Region:

9.422.543 ha Total Surface - 4.807.731 ha Forest Surface - 2.982.317 ha Tree Covered Surface. Evolution of the forest: Crop Abandonment (400.000 ha in 40 years) and intense repopulation and natural regeneration.

Statistics: Most fires are found in mountainous areas in the west part of the Region and 50% of attempts thanks to the smooth running of the operation unfolded, adjusted weekly according to risk.

Check Times: 73% of fires are controlled in less than 3 hours, 82% are extinguished in less than 6 hours and fires over 500 ha account for 0.32% of the total and affect 46% of the forested areas and 34% of forest areas.

Investigation of causes: Over 90% of fires caused by humans, either intentionally or negligence or accidents, of fires caused by man over 70% have their origin in agricultural and livestock causes.

Cartography of Risk:

- Structural risk: The local risk index is calculated by multiplying the frequency index, the causality and hazard fuel derived from forestry. The combination of local risk index and the vulnerability of values to be protected provide the potential risk

- Weather Risk: The weather risk mapping is queried from different sources: prediction and observation. Combination of meteorological variables, statistics, information on fuels and other factors to improve risk indices.

- Risk of daily risk (structural -weather) 4 DEGREES SET: NORMAL, WARNING, ALARM and EXTREME WARNING.

- Anthropic Steps in the analysis for each hazard: Locate it, Collect status information, Define overall corrective measure and / or unique to each location, Establish a level of assessment for this risk, Create a map of risk and Inform responsible.

GIS Applications: SIPRO Fire Simulator, the Emercarto and the NOMO.

Conclusions: Risk mapping is an essential tool in making: Searching the anticipation; Making the deployment of risk-based media (floppy, convoys, media scaling); Risk analysis need to know if workers must work on prevention or fight (stop modules); It is based on protocols according to risk (fires, artillery ...); Preventive measures adapted to the risk (Spot: warning statement and permanent risk periods).

GIS applications are an essential tool in decision-making: Simulation, localisation and perimeter calculation.

North Aegean Region:

Prevention, fighting and management of forest fires are, perhaps, the most important issue, in contemporary forestry. The problem of forest fires is, of particular importance for Greece, due primarily to a significant shift, in the socio-economic conditions over the last decades.

Increased fuel loads, as a result of urbanisation and forest abandonment, and increased number of forest visitors result, in both, an increased number of forest incidents, as well as increased fire intensity and burned area.

The first reaction time in a wildfire is directly related to the difficulty of intervention and the intensity of forest fire, and depends of the time detection (by permanent or mobile observers). The performance of observers depend of the available number, their level of knowledge of the terrain, their resistance, the location of the observatory etc. Last years the problem of the early detection of fire events is solved by using modern methods for example by use wireless camera detection networks to get early detection - notification – monitoring of forest fires.The coordination problem is more complex because the forest fire prevention and fighting is under the responsibility of a numerous services and organisations: Fire Brigade, Forest Services, Municipalities, Army and Volunteers.

Providing a common platform of an integrated data base of geographical information system (G.I.S.) could be a solution to the above problems. The cartographical material produced using in the GIS environment allows the Fire Brigade to control more effectively the area where the fire incident is located, to improve the time of first intervention and the coordination of ground and aerial interventions forces, so well as all the services involved.

An adapted special software (as “Behave” or “farsite”) allowing the prediction of the front of forest fires according the climatic parameters and the fuel type and amount of the vegetal formations in the fire event has been adapted and integrated. This is a very strong, and useful decisions tool, in the hand of the coordinator, in order to carry out, forecasting and scenario planning interventions.

All maps are on the project website INCENDI and are available for all the services involved (Fire Brigade, Forestry Services, Municipalities, Educational and Research Organisations, volunteers, etc.).

Conclusions:

1. The time of awareness and preparation of fighting forces is drastically reduced.

2. It improves the overall efficiency of the intervention and fighting forces since the process of the related information is faster and more reliable.

3. The improving of an effective intervention at the stage of fighting creates, as it is expected, the conditions for the reduction of expected damage and losses. This resulted from the capacity for the coordinator to have reliable and updated information at real time helping him to take the more efficient decisions.

National Forest Centre (Slovak)

Slovak republic is composed by 68,2 % forest, 9 national parks, 1082 small protected areas and 382 sites of European importance.

Input data: relief of the simulation area, climatic characteristics and fuel model.

Output data: digital model of forest fire, depending on climatic conditions in time steps.

This GIS data information is in the format *.ASC, and it's provided by: National Forest Centre, State Forests “TANAP” and the Ministry of Interior, Department GIS Information.

On line: Biometeorological monitoring: http://www.emsbrno.cz

FUEL model includes: initial fuel humidity and for 1,10,100 hours, Min. and max. fuel humidity, fire calorific value, volume the living or dead particles, depth of soil cover and the adjustment model.

Office National des Forêts (France)

2 models: the cartography of risk in the interfaces and the evolutive cartography of vegetation sensitivity.

General facts on French cartography of risk: Static risk and Daily risk.

- Static risk (or intrinsic): This risk relates to the physical characteristics of where it is described. It is dependent on many characteristics which the main are vegetation and topography.

- Daily risk or evolving risk. Also often called "weather risk" or "weather danger" because it takes into account mainly the meteorological component which unlike other factors is changing quite rapidly.

Cartography of risk in the interfaces: In the static cartography of risk at the scale of a municipality, of a massif or of a department, the most important areas to consider are the wildland-urban interfaces, because that's where are concentrated the highest issues (natural issues passing always in the background behind the protection of persons and goods).

To better define the risk levels and to adapt the measures, it appeared necessary to characterise these interfaces. A first work was done in 2006-2010 in the European research project FIREPARADOX by French research institute CEMAGREF (now IRSTEA) crossing habitat grouping types with aggregation of vegetation types.

A second study was conducted in 2010-2011 within the framework of European cooperation project PYROSUDOE in which ONF participated. This project has made progress in defining habitat grouping types and in defining areas of influence of these types, which seemed perfectible points in the previous work. The first results and their uses are the subject of this form of good practice.

Evolutive cartography of vegetation sensibility: To respond to a need of the Inter ministerial General Staff of Defence Zone South (Mediterranean region), which coordinates the activities of all extra-departmental resources (national resources and reinforcements from other departments or other zones), ONF in 2009 produced a map of sensibility of the vegetation. This map is based on maps of stands made by the National Forest Inventory grouped into 31 types.

During the seasons 2010 and 2011, ONF has developed a methodology which allows modulating the sensitivity of vegetation according to the drought calculated by Météo-France. Drought is an index into 5 levels calculated from the indices IH (humus index) and IS (soil index) of the Canadian method, they evaluated from the cumulative rainfall and evapotranspiration. This index is calculated daily and spatialised (1km pixels), but changes very little rapidly in the absence of rainfall. The modulated sensitivity map is generated 2 times a week plus intermediate production in case of heavy rainfall.

Rather than a systematic offset of index, modulation is done by cross tables, which can take into account different behaviors, depending on stand type, biogeographic zones, slopes and sunshine. A different modulation was also introduced for the start of the season (called "spring modulation ", versus "summer modulation ").

Forest Research Institute (Poland)

Classification of forest area in Poland: Forest fire risk category is calculated for each Forest District, every 10 years.

Forest fire risk category is based on: number of forest fire during last 10 years for 1000 ha, type of forest stand (rich sites, poor sites, coniferous or broadleaves), climatic factors: air humidity, share of days with litter humidity less than 15%, Human factor (population density). Can be calculated for RD, province, subregions, districts.

The “Forest fire forecasting system” and the “Forest fire risk degree”. The purpose of forest fire risk forecasting is determination of fire occurrence possibility on a given day depending on dynamic weather changes.

Forest fire risk degree determines the type of organizational actions for which forest services (forest divisions or national parks) and rescue services are obliged on a given day.

Main purpose of the NFFIS (National Forest Fire Information System):

- Creating the nationwide base about forest, agriculture land and wasteland fires.

- The NFFIS is a reliable data source about all forest fire sand cultivated lands in Poland.

- The NFFIS enables the data management about forest fires and agriculture lands coming from three different sources as well as makes reports and balance sheets formally of European Union.

Detailed data are made available in the different range, depending on authorizations of logged in user.

Accordingly seven user groups were formed, i.e.: I -Administrators; II -National parks -the level of the country; III -National parks -the level of the park; IV -The General Directorate of the State Forests; V –The Regional Directorate of the State Forests; VI -The Central Statistical Office -the level of the country; VII -The Central Statistical Office -the level of the province.

AGASP/Xunta de Galicia (Spain)

Galicia and the forest fires: The high forest fires incidence during the period 1969-2008: 46% of fires of Spain – 225,100 fires (minimum of 17% and maximum of 64%); 25% of the burnt area of Spain – 1,728,000 has (minimum of 3% and maximum of 65%).

The law 3/2007 of April 9 about prevention and defense against forest fires in Galicia: shall maintain a system of forest fires and keep records cartographic and computer of burnt areas and the networks of defense against wildfires of districts and to integrate all the necessary information in this system, will be regulated and standardized the data capture procedure.

Priorities identified: the need for a simple visual environment that shows global information in real time the status of the fires in Galicia and need for a GIS to collect all information related to the prevention of forest fires.

The XeoCode: it is a geographic information system that can integrate, store, edit, analyses, share and display geographically referenced all the information necessary for the prevention and suppression of forest fires in Galicia. There are different applications, planning instruments and information sources that provide to XeoCode the data that user wants to use.

Problems / solutions incurred:

Implantation of GIS across the device: the number of persons responsible for entering information and using it is very high and many workers were not accustomed to managing computer systems.

Solutions: Specific training for each professional category, Development of protocols to unify and standardize the information, Development of guidelines for managing the GIS and Support and monitor the data input from the central coordination center.

Transferability of the specific good practice: Success Factors thanks largely to:

• Political will to improve the coordination, management and availability of information on

preventing and extinguishing forest fires.

• Normative support through the law of forest fires in Galicia.

• Availability of funding.

• Demand by professionals of tools to facilitate decision making and allow for prioritizing

actions.

Risk factors: It is necessary to sustain the effort in updating information and standardizing the data so that XeoCode continue to provide its full potential.

Northumberland/University of Manchester (United Kingdom)

National and regional context: PDNP 1438 km2, first National Park established 1951. It’s a flat plateau, open moorland and wooded valleys. Blanket peat important carbon store, badly degraded by fire, pollution, etc : costly restoration 90% in private ownership. Home to 39,000 people. Semi-natural, working upland landscape, 69% of land under agricultural subsidy. Public access contributes to fire risk; 16M visitors pa. 36% is Access Land – closed at times of high fire risk, MOFSI (Met Office Fire Severity Index).

Dense network of statutory rights of way remains open. Multiple ecosystem services: Biodiversity, carbon regulation, water supply, forestry, grazing, grouse shooting, outdoor recreation, 13% is heather moor, mostly managed for grouse by burning -- controversial for biodiversity & wildfire.

Wildfire management superimposed upon complex land use, land ownership and regulatory framework: restrictions on use of fire; fire Operations Group; highly successful partnership approach.

Multi-criteria evaluation (MCE) static risk map:

How the map is used: fire ponds, fire watches, fire breaks.

Impact: “Wildfire risk mapping has directly informed the design of our ranger early ‘wildfire warning system’; a system that we estimate has prevented at least five potentially large incidents [since 2007]” [PDNPA Head of Field Services, 2011]. And, in spring 2011, 12 fires, largest 1 mile2 (2.6 km2).

Recommendations:

- Differing interpretations of ‘risk’: workshop better than online survey

- Flexibility in map output; provide digital data

- Fire ground location needed, not call-out or rendezvous point.

- Burned area needed; GPS fire scar perimeter since 2003

- Cross-referencing with Fire Service incident number

Tuscany Region/University of Florence (Italy)

In Tuscany the cartography of risk is developed at different levels, and namely: Static risk map, Dynamic risk map, ODIF Map and IRM Map.

1. STATIC RISK MAP: The model takes into account the most important parameters that characterise the Mediterranean ecosystem and affect the wildfire events. The input parameters for the model are: FOREST FIRE DATABASE (AIB), ROAD NETWORK AND URBAN AREAS, REGIONAL FOREST INVENTORY (forest regional inventory at 400 m), DTM (elaborated at 90 m to make the layer easier to use), and METEO DATA (meteorological station network).

2. DINAMYC RISK MAP: This index is calculated applying the Fire Weather Index (FWI) (Canadian index). In order to calculate and map the index the following steps are followed: meteorological data collection from the regional station network, Daily spazialisation of the meteorological variables by means of algorithm daymet (www.daymet.org) implemented by LaMMa (pixel= 1km), and the Calculation of the following indices included in the Canadian method: FFC (Fuel moisture - indicator of the relative ease of ignition and the flammability of fine fuel). FWI (is a numeric rating of fire intensity).

Use of the maps: On the basis of the daily bulletin of the dynamic risk level each Province has to provide at: The assessment of the risk level in each operational area, i.e. the area in charge at each fire boss; and, if the FWI for the day and the next two days is high, sharing the high alert level among the firefighter agencies and organizations in the area.

3.ODIF MAP: Assessment of the efficiency and effectiveness of firefighting; ODIF analyses several factors affecting the suppression activities carried out by aerial and ground resources; ODIF model was applied to 70,000 hectares and is still in experimental phase.

ODIF is the combination of two main indices: GROUND OPERATIONAL DIFFICULTY INDEX (GODI) and HELICOPTERS OPERATIONAL DIFFICULTY INDEX (HODI).

4. IRM MAP: Map of infrastructure risk in Wild-Urban Interface areas . Based on the operational guidelines of the National Department of Civil Protection. A wildland-urban interface (WUI) refers to the zone of transition between unoccupied land and human development; These lands and communities adjacent to and surrounded by wild lands are at risk of wildfires. The map was built for the province of Florence and is still in experimental phase. Touristic infrastructure" (such as hotel, camping, residence, ect.) ware taken into consideration (many people may be threatened by forest fire during the fire season).

The study of WUI involves multiple disciplines and consequently requires the cooperation of various actors (forest fires specialists, fire brigade specialists, researchers);

The study only evaluates variables connected to the forest sector, but the model could easily be adjusted to accept data from different fields (i.e. the evaluation of building characteristics and materials).

SYNTHESIS

The eight cases presented at the workshop reveal a large and common platform and some new particular experiences.

I. Geographic Information Systems (GIS)

All the experiences are based on the progress of Geographic Information Systems (GIS). All the partners are working on a platform that includes a comprehensive GIS inventory of land (vegetation-fuel models, road infrastructure, water points, areas of concentration of people, etc..). The cartography has been developed everywhere as a web application design, enabling a broad range of users. Generally it requires field training for the staff to use it, also the constant updating of the data, essential to the usefulness of the tool.

In all cases, the maps of wildfire risk are developed in a GIS platform. This system is also used to plan the preventive measures, the fire simulation, to monitor the work of extinction, and for the mapping of the burnt areas.

There is an (almost) complete overlap in the design; while the look (aspect) of the tools is different.

II. Forest fire simulation tools

Almost all members have referred to the integration of a fire simulation tool based on Farsite in a GIS platform. It incorporates real-time weather data and detailed weather forecast in the short term.

It may be useful to assess the danger or risk for people or for the infrastructure, and in general for the potential impact of the fire and thus provide support for strategic decision making on response to wildfire. However, the application for tactical decisions for the extinguishing part is very limited.

III. Static risk map

The structural risk maps are produced for a given period (3 to 10 years according to each partner) based on factors which are not short-term variable: topography, fuels and fire statistics (occurrence and causality).

There have been some examples, which include general climatic conditions or human presence factors (population, infrastructures ...). Also, some cases where a full assessment of the extent of damage or loss, in case of forest fire can affect people, property and the environment. These best practices can guide those that only work considering the three general factors mentioned in the first paragraph.

It is common to establish a classification of risk levels, ranging from 3-5 according to each partner. As a result we calculate the level of risk by geographic area (county, forest district or municipality) to obtain the map. This mapping is important for planning preventive measures (vegetation, defense infrastructure, regulates the uses) and organizes the operation of extinction.

As a general rule, the maps are available on the GIS web application.

IV. Dynamic risk map

The use of dynamic risk maps is common, but with a wide variety of designing. It is also known as weather risk because it takes into account mainly the meteorological component which unlike other factors is changing quite rapidly.

In some territories the adaptations of the Canadian Fire Weather Index - FWI method have being imposing (for example the ONF, in Castile and Leon, in Galicia and in Tuscany).

Some partners presented several examples of good practice of weather risk combined with the structural risk to define a risk map daily (daily risk map). In some cases two or three daily updating. It is usually defined ranging from 4-6 with a definition of measures to be taken for each level.

As for the static risk map it is assigned a risk level by area (district or forest district) for the mapping, which is available on the GIS web application. Having this tool is helpful to properly inform and alert the public.

It is also interesting the use of risk maps with specific weather phenomena such as thunderstorms.

As a result of the workshop, several partners have known good practices to improve their daily risk map, an element of great help in the management of forest fires. There is a hope for progress and cooperation.

V. Singular experiences

During the workshop different singular experiences were presented. They are challenges for the future and offer an interesting way to cooperate. Most of them are still in an experimental phase. Some relevant experiences are:

- Vulnerability index for wild-urban interface infrastructures (Tuscany)
- Cartography of risk in the interfaces (ONF)
- Evolutive cartography of vegetation sensibility (ONF)
- Big fire index map (Castilla y León)
- Supression operational difficulty index - ODIF map (Tuscany)
- Multicriteria evaluation static risk map in Peak District national park (UK)

Developed by CESEFOR and Region Castile and León