Forest firefighting organization and approaches to the dispatching of forces in the European Union: Results of the workshop survey

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Introduction

During the "Improving Dispatch for forest fires" workshop, December 6-8, 2001, at MAICh, the opportunity was seized in order to get the point of view of the participants in relation to the subject of the workshop, and to obtain information on fire management in their respective countries. This was achieved by circulating a questionnaire that was filled-in by most of them. The questionnaire consisted of 7 questions. 18 persons, representing a cross section of all participating countries, as shown in Table 1, filled the questionnaire:

Table 1. Representation of countries among the participants who filled the questionnaire.

Country	Number of respondents
Belgium	1
Finland	1
Spain (mainly Madrid)	1
France	3
Germany	2
Greece	2
Ireland	2
Italy	1
Portugal	2
Sweden	3
Total	18

The group of Greek Fire Service officers that attended the seminar did not fill-in the questionnaire because they would have repeated the same information.

The answers to the questionnaire were entered in an Excel worksheet and were analyzed in order to provide, where possible, some useful conclusions related to the topic of the workshop. In some cases certain corrections and/or interpretations of the replies had to be made before entering a value in the spreadsheet. Such cases included, for example, some replies that were put in parentheses, or replies for which a specific maximum number of choices were requested and more answers than that were selected.

1st question: Profile of respondents

Please put an X at the selected answer (in regard to your country):

As a professional are you involved in (select all that apply)

Operational forest firefighting _____
Forest firefighting forces dispatching at a coordination center _____
General firefighting (including city ff) _____
General forest management _____
Civil Protection _____
Other specialization (specify) _____

Comments

In the first question it was tried to obtain an understanding of the function/role of the responding participant in order to understand their opinions and to explain any unusual responses. The respondents were allowed to choose more than one fire management activity, if they were involved in more than one. The results were as follows:

- Ten of the respondents were involved in operational firefighting.
- Four of them were involved in firefighting forces dispatching in a coordination center.
- For eight of them city firefighting was also in their duties.
- Five of them, obviously from the forestry sector, were involved in general forest management.
- Five respondents indicated that they were involved in Civil Protection.
- Finally, three of the respondents checked the "Other" category, one of them specifying that he was a senior teacher in an Emergency Services College while the other two stated "Fire Research" as one of their activities.

2nd question: Types of means and forces used for forest firefighting

Types of means and forces used for forest firefighting (select all that apply):

Crews with hand tools _____
Crews on firefighting trucks _____
Airborne fire crews (carried by helicopters) _____
Firefighting helicopters with capacity of less than 3 tons per drop _____
Firefighting helicopters with capacity of more than 3 tons per drop _____
Fixed-wing planes with capacity of less than 4 tons per drop _____
Fixed-wing planes with capacity of more than 4 tons per drop _____
Amphibian Canadair CL-215 water bombers _____
Amphibian Canadair CL-415 water bombers _____
Amphibian water bombers other than Canadair _____
Other (specify) _____
Other (specify) _____

Comments

- The replies to this question provided an insight into the existing needs and the mentalities in regard to forest firefighting in the countries being represented. The answers of the Italian representative were not relevant in regard to the ground forces. Of all the types of forces that were presented as reply options to the question, the only one selected by all participants was "Crews on firefighting trucks".
- Two countries (France and Belgium) replied negatively about the use of "crews with hand tools".
- The use of "Airborne fire crews carried by helicopters" was confirmed for Greece, Spain, Portugal and France while there were conflicting answers by the two participants from Ireland.
- In regard to the use of firefighting helicopters, France, Spain, Germany, Sweden, and Ireland have such capacity but the helicopters used deliver less than 3 tons per drop. Portugal and Italy use both helicopters with less than 3 tons/drop capacity and heavier ones (>3 tons/drop). On the other hand, Greece has opted for heavy helicopters only, with capacities exceeding 4 tons/drop.
- Small fixed-wing planes with less than 4 tons/drop capacity are used in Greece, Spain, Italy and Portugal. (note: The twin-engine CS 2F "Tracker" aircraft used in France probably also belongs to this category, but the respondents did not indicate so).
- Greece, Italy, Portugal and France, also use larger fixed-wing planes dropping more than 4 tons/drop.
- In regard to amphibian Canadair planes, they are only used around the Mediterranean. The older CL-215 model is still used in Greece, in Spain and in Portugal, while the new CL-415 is used in Greece, France, Italy and Spain (CL-215T). One of the Portuguese participants also indicated the use of the older Catalina amphibian aircraft in his country.
- The Spanish respondent also indicated use of D6H bulldozers and 10-ton ground water tankers. However, this does not mean that such resources are not used elsewhere.

3rd question: Use of retardants and foam

Do you use long-term fire retardants and/or foam in forest firefighting (select all that apply):

Fire retardants from fire trucks _____
Fire retardants from helicopters _____
Fire retardants from fixed-wing aircraft _____
Fire retardants from Canadairs _____
Foam by crews with hand tools _____
Foam from fire trucks _____
Foam from helicopters _____
Foam from fixed-wing aircraft _____
Foam from Canadair water bombers _____

Comments

The replies to this question indicated, in general, that there is significant use of retardants and foam in forest firefighting in Europe. However, there are noticeable differences in the means of application as shown below:

- Fire retardants are applied from fire trucks in France, Portugal, Finland and probably Germany and Ireland (conflicting answers on this by the two German and the two Irish participants)
- Helicopter application of fire retardants is exercised only in Portugal and Finland.
- Fixed wing aircraft from air-bases are used for aerial delivery of retardants in firefighting in Greece, Portugal and France. Canadair aircraft are only used with retardants in France and in Spain.
- Foam is used by crews with hand tools in Portugal, Germany and Ireland, while foam is applied from fire trucks in Portugal, France, Belgium, Germany and Finland.
- Foam is infused in helicopter drops in France, Portugal and Italy. It is also used from fixed wing aircraft in Greece, Portugal and probably France (one out of three French respondents indicated so).
- Finally, foam is used with Canadair water bombers in all countries where Canadairs are used.

4th question: Coordination centers operation

For dispatching of forces to forest fires, do you operate (select all that apply):

	Aerial means	*Ground means*
One central coordination center (CC) only	_____	_____
A central CC plus regional and/or local CCs	_____	_____
Independent regional/local CCs	_____	_____

Other (explain) _____

_____

Comments

In regard to coordination centers (CC) there are also marked differences between the European countries.

- First, in regard to centers coordinating *aerial* means, Italy and Greece have opted for one central coordinating center while in France, Spain, Portugal, Germany and Finland there is a central CC plus regional and/or local CCs. In Ireland and Sweden aerial means are coordinated from independent regional/local CCs.
- Examining the responses about CCs for *ground* means, it is noticed that there is a tendency for lower level coordination:
    - No country tries to coordinate all ground means from one central CC.
    - In most cases there is both a central CC plus regional and/or local CCs.
    - The replies were not consistent between respondents for the second and third option, probably indicating the existence of regional/local CCs but also a varying perception about their degree of independence.

5th question: Sophistication of dispatching

The dispatcher, in regard to forest fires, makes dispatching decisions with the help of (select all that apply):

His experience _____
Topographic maps _____
Vegetation maps _____
Detailed forest fuels maps _____
Weather forecasts (at specific times) _____
Real-time actual weather measurements and on-line forecasts _____
Forest fires simulation software (modeling) _____
Geographic Information System (GIS) for spatial info presentation _____
A Decision Support System (DSS) without spatial information support _____
A sophisticated DSS with GIS, fire modeling, databases, etc. _____
Verbal information from lookout towers and/or air surveillance _____
Visual information from on-line fire detection cameras _____
Visual information from aerial reconnaissance using cameras _____
Satellite reconnaissance _____

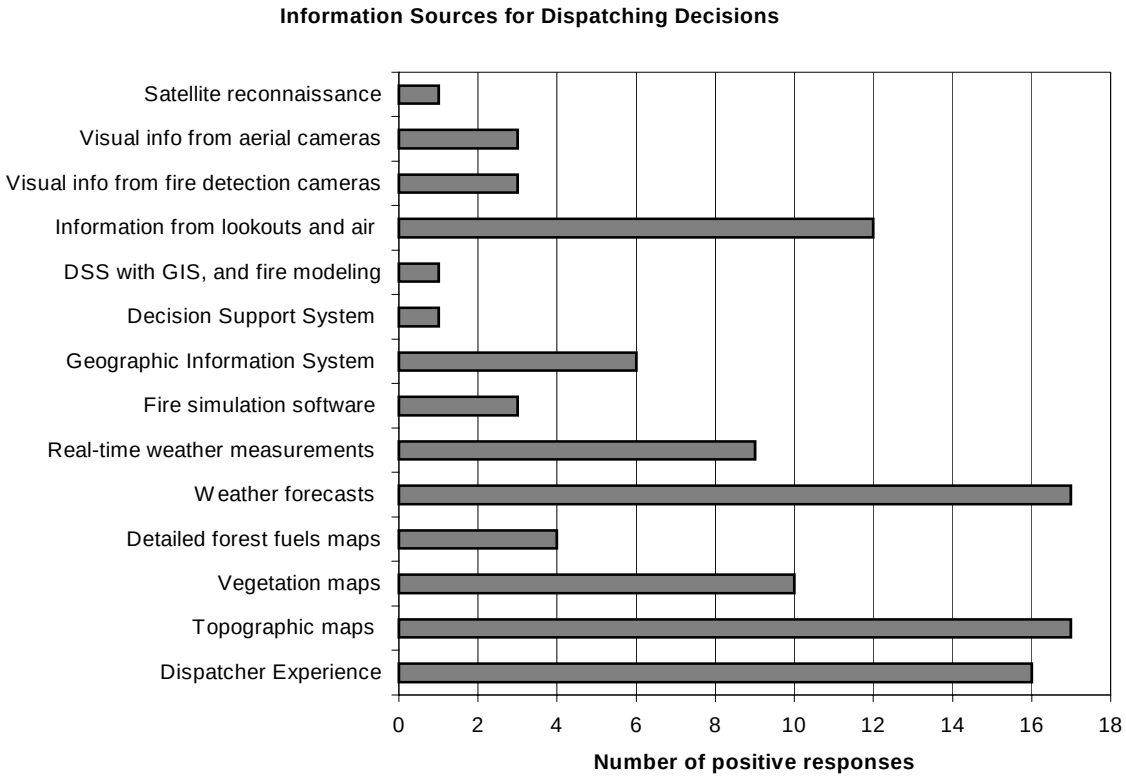

Figure 1. Sources of information in support of dispatching decisions

Comments

The replies to this question showed that three of the information sources listed, are used by nearly all dispatchers as tools on which to base their decisions. They are (Figure 1):

- Dispatcher's own experience (16/18 – i.e. 16 out of 18 replies)
- Topographic maps (17/18), and
- Weather forecasts at specific times (17/.18)

Three other sources of information are also used at many dispatching centers. They are:

- Verbal information from lookout towers and/or air surveillance (12/18)
- Vegetation maps (10/18)
- Real-time actual weather measurements and on-line forecasts (9/18)

Positive replies for the rest of the information sources and decision support tools were surprisingly low, indicating that actually the level of sophistication in dispatching is quite low and hence there is significant room for improvements. More specifically:

- It was surprising that there were only 4 positive replies about the use of detailed forest fuel maps by the dispatcher. Such maps require a system of classifying vegetation as forest fuels, plus extra work for mapping vegetation according to this classification. Lacking this tool, many dispatchers tend to use what is generally available (but much less informative) which is general vegetation maps. However, even that source of info is not used everywhere as shown above.
- Use of modern systems for decision support that take advantage of scientific advances (GIS, computerized DSS, fire simulation…) is uncommon.
- Also, there is very limited use of modern surveillance systems that can provide visual information to the dispatcher.
- Satellite data are only used for dispatching decisions in Finland.

6th question: Basis for dispatching decisions

Is dispatching decisions based on:

Experience of the dispatcher only (mental process) _____
Collective experience structured in written rules _____
Mathematical models produced through scientific research _____
Other (explain) _____
Combination of the above (explain) _____
_____

Comments

This very important point showed that in most countries the decision making process is based only on the experience and judgment of the dispatcher (14/18). In ten of the eighteen responses the existence of written rules was indicated, while there was only one positive response in regard to the use of mathematical models, produced through

scientific research, as the basis for dispatching decisions. In one country the answer was “combination of the above”

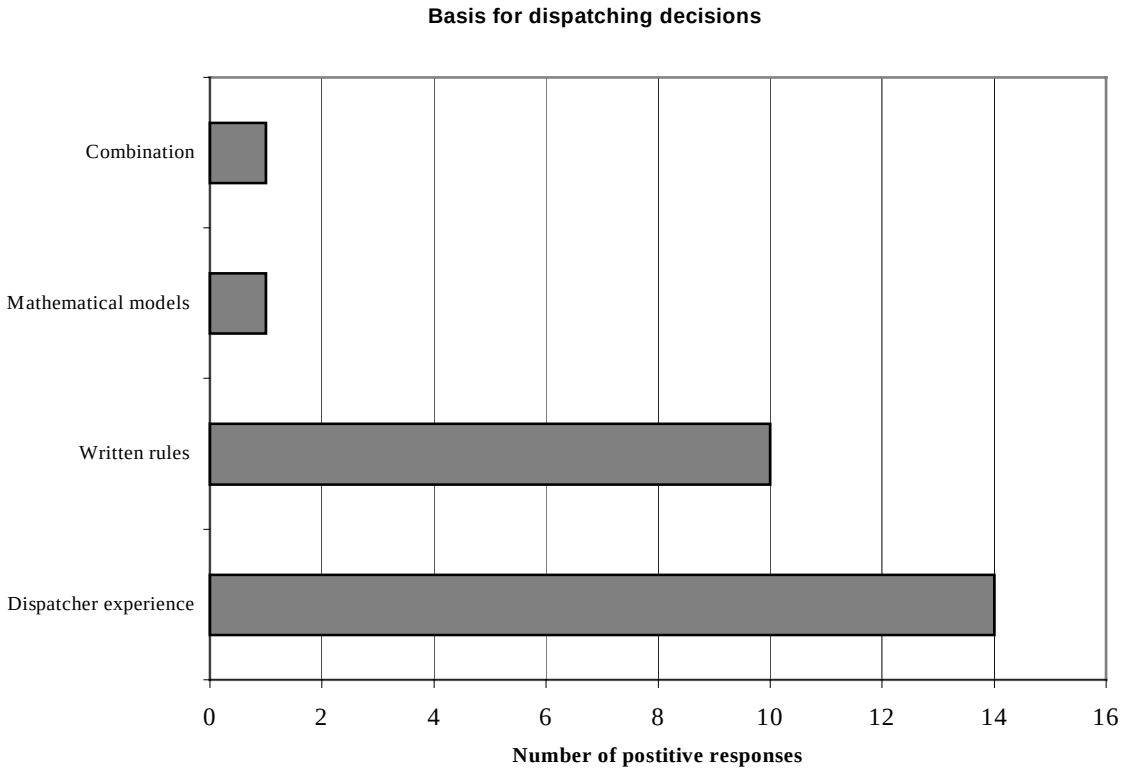

Figure 2. Basis for dispatching decisions.

7th question: Identification of the most important elements/variables for the size of dispatched forces.

*Please, identify the elements/variables in each category that you would consider most important for the size of forces to be dispatched for **initial attack** (select up to three variables per category):*

Values at Risk

Human life _____
A community at risk _____
Vacation houses _____
Other property (cars, etc.) _____
Forest values (timber, recreation, general value) _____
Special or protected area (e.g. National Park) _____
Agricultural areas (tree orchards, annual cultivations) _____
Powerlines, phone-lines, etc. _____
Roads on steep slopes _____
High erosion/flooding potential _____
Other (explain) _____

Forest Fuels

Vegetation type (species) _____
Presence of tree crowns (overstory) _____
Total biomass _____
Surface fuel biomass _____
Condition of the fuel (drought stressed, percent of live versus dead) _____
Fuel model (U.S. approach) _____
Other fuel characteristics (explain) _____

Weather

Wind speed _____
Wind direction _____
Expected change in wind direction (Cold front) _____
Relative humidity _____
Cloud coverage _____
Thunderstorms _____
Atmospheric stability _____
Other (explain) _____

Topography

General slope steepness _____
Canyon _____
Saddle _____
Ridge _____
Other topographic feature _____

Accessibility

Road network density _____
Specific road reaching the fire _____
Condition of roads (speed of travel) _____
Other (explain) _____

Firefighting considerations

Number and type of resources in the general area of the fire _____
Existence of other simultaneous fires _____
Probability of new fires starting (high fire risk) _____
Cost of aerial means intervention _____
Other (explain) _____

Other firefighting infrastructures, resources and knowledge

Proximity of water points for fire trucks _____
Proximity of airports, sea and/or reservoirs for aerial means refilling _____
Proximity of helispots (helicopter landing points) _____
Existence of a good presuppression plan _____
Existence of very effective or relatively ineffective resources in the area _____
Previous fire history in the area _____
Other (explain) _____
Other (explain) _____

Comments

In regard to "Values at risk" two responses were selected by nearly all respondents (17/18). They were "Human life" and "A community at risk". The (distant) third was "Vacation houses". It was selected by 6 respondents, the same number as "Special or protected area (e.g. National Park)". Interestingly, the response "Agricultural areas (tree orchards, annual cultivations)" was not selected as one of the priorities (Figure 3).

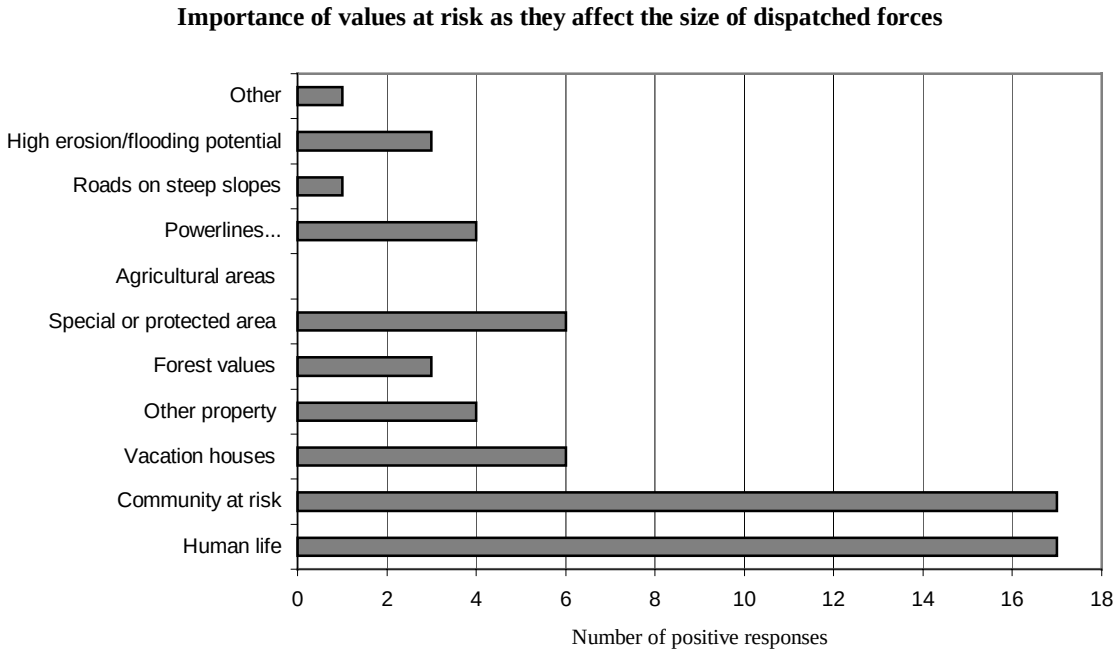

Figure 3. A ranking of the relative importance of "values at risk" as a factor affecting the size of dispatched forces.

In regard to "Forest Fuels", the "Vegetation type (species)" response was checked in fifteen out of eighteen questionnaires. This result is compatible with the earlier response, in reply of the 5th question, about the relatively high use of vegetation maps versus a limited use of forest fuel maps. Again, this preference shows a practical but not highly scientific approach, as it does not utilize the full potential of the advances in the field of forest fire science.

The second variable selected (11/18) was "Condition of the fuel" which is a dynamic variable changing with the weather through the fire season.

Among the weather variables "Wind speed" was clearly (and predictably) selected as the most important one (16/18), while "Wind direction" and "Relative humidity" followed in the second place (12/18).

"General slope steepness" was selected as the main topographic variable considered for dispatching, whereas relatively little importance was given to variables describing more specific topographic features. Given the fact that such features are important and

can easily be identified on topographic maps, this result can be considered as surprising.

In regard to accessibility, the existence of a "specific road reaching the fire" was selected as the most important variable (16/18), "road network density" was the second choice (15/18), while the "condition of roads" was checked by more than half of the respondents (12/18).

In regard to firefighting considerations, the size of the forces dispatched to a fire is mainly influenced by the number and type of resources in the general area of the fire (17/18). In many countries the existence of other simultaneous fires as well as the probability of new fires starting, also influence the decisions (10/18). The cost of the intervention of aerial means is not considered a major source of influence for this decision (7/18).

In the last question, relative to "other firefighting infrastructures, resources and knowledge", there was only one variable that stood out (13/18). It was "proximity of water points for fire trucks", an element with obvious importance. The rest of the reply options did not appear as very important to the respondents.

General Conclusions and Comments

The results of the questionnaire provide an interesting insight of the current situation in regard to forest firefighting, and more specifically in regard to dispatching of forces in the European Union. Some of the most striking points are summarized and generalized below:

- Nearly all the countries represented in the workshop devote significant effort and means to forest firefighting. More and heavier means are used in the Mediterranean countries. However, there is significant activity and preparation, in regard to forest fires in Northern European countries as well.
- There are significant differences in regard to the types of means used (small vs large helicopters and airplanes), the use of crews with handtools, and also in regard to the use of foam and retardants. While certain means such as "crews on firefighting trucks" have a universal application proving that they are essential, the differences in other means probably reflect the existing differences in the environmental, forest and geographical conditions, firefighting methodologies, history and mentalities of organization and, of course, levels of expenditures. Special mention must be made to the contrast between countries regarding the ways in which retardants and foam are used in forest firefighting (ground vs air application, use of retardants from Canadairs or not, helicopter application of retardants etc.). All these differences, in turn, are an indication that a well planned, in depth comparative analysis of the use of these means and tools and the reasons behind the choices made in each country (such as cost considerations, environmental conditions etc.), would be a well justified effort that might lead to improvements in the firefighting organizations of all countries.
- A general comment about coordination centers is that, regarding aerial forces, the existence of central coordination, at least for some of the means, appears as a nearly general rule. This is probably justified by the speed of the aircraft and

the need to share (some) resources between regions. On the other hand, the trend is opposite in regard to ground means where there is a tendency for lower level coordination taking advantage of the local knowledge of the forest and road conditions. This conclusion can be extrapolated and applied to discussions about creating international forces that would allow quick intervention (not initial attack) on forest fires across borders. If such an endeavour is pursued, it could only be done with aerial forces – at least at the time scale of intervention of a few hours, up to one or two days.

- The results of the analysis are extremely interesting in regard to the level of sophistication of dispatching in the majority of counties that were represented at the workshop. It is quite obvious that the sophistication is quite low, especially in regard to the use of computerized tools (GIS, DSS) indicating poor adoption of the results and the products of forest fire research, which has been both successful and productive through the 1990s in the European Union. This is true even in about elements that do not have to do with "modern technologies". Fuel mapping is one such example. The implication of this lack of sophistication is probably inefficient coordination, resulting in non-optimum utilization of resources. This may be one of the reasons of the ever-growing need for more means, more personnel, and more funds in many countries, in tandem with the worsening fire problem, in spite of the fact they already have much larger resources than in the recent past. It might be wise to divert a small part of the funds devoted to the firefighting forces to technology transfer efforts, which in turn could soon pay back with increased effectiveness of firefighting.
- The fact that most dispatching in Europe is based mainly on the experience of the dispatcher, is one more element in support of the comments above.
- In the same line as above, the lack of strong concern about the cost of firefighting is also evident in the responses to the last question.

In conclusion, the analysis of the questionnaire produced some interesting findings, which, although there are limitations regarding their representativeness for the whole of Europe, point out that there is much to be done in order to improve forest firefighting efficiency in Europe and more specifically to improve dispatching of forces. Adoption of new information technologies and of the current state-of-the-art in forest fire science is the way to achieve these improvements.