

Supplementary Material

Perception of wildfire behaviour potential among Swedish incident commanders, and their fire suppression tactics revealed through tabletop exercises

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Appendix 1.

Initial questionnaire put to ICs [*Translated from Swedish*]

Personal experience with forest fire

1. On a scale from 1 to 5, how do you rate the degree of your experience with forest fires?
(1= little, 5= extensive) Answer:_____.
2. Roughly how many forest fire incidents have you participated in (in the field) during the last five years? Answer: _____. At how many of these did you function as IC? Answer:_____.
3. Have you ever seen helicopter used on a forest fire? Answer:_____.
4. How long have you been working in the rescue service? Answer:_____years.
5. How long have you worked as an IC? Answer:_____years.
6. How many days of **theoretical** teaching on forest fire did you have during your training as a firefighter/IC? Answer:_____days.
7. How many days **practical** teaching on forest fire? Answer:_____days.
8. Have you participated in any follow-up teaching in the area of forest fire?
Answer:_____. If the answer is yes, how many days during the last 5 years?
Answer:_____days. Was there any practical training in the field? Answer:_____.
If the answer is yes, was there any part where you were able to see actual fire propagate over the terrain? Answer:_____.
9. Have you, within the municipality rescue service, had any particular exercise (apart from the above) in the area of forest fire during the last five years?
Answer:_____. If yes, how many days in total? Answer:_____days.
10. Have you participated in or observed a prescribed fire? Answer:_____. If yes, roughly how many times? Answer:_____. Have you seen helicopter in action on prescribed fire? Answer: _____.
11. What maps do you have access to in the incident team (in the field) during forest fires? Mark the appropriate variants:
 - ☐ Paper maps
 - ☐ Maps in GPS units in vehicle
 - ☐ Maps in handheld GPS units

Appendix 2.

General rules for the tabletop exercise tests. These are not to be shown to the respondent, but relevant information is transmitted verbally. [*Translated from Swedish*]

As the interlocutor, you interact with the respondent, but you should not influence their considerations. However, in case of ambiguity, put follow-up questions. Also, make clear that you will supply the information they would normally obtain from supporting officers at the station. But give specific information only when the respondent asks for it.

Make a log on paper of all actions taken by the respondent, and their effect, with ‘time stamps’ in minutes after alarm. This is in addition to what the respondent notes or draws on the maps. Note particular comments that the respondents make, which can reveal their understanding of the situation.

Upon start of each case an ‘alarm’ is given to the IC, detailing correct information on position (on map), weather and fire danger class, as well as information from the alarm central as to how the caller described the smoke that was seen.

We assume, in all cases, that the alarm call came 10 minutes after ignition. Driving time from nearest fire station to the site (road closest to the point of ignition) is 30 minutes for all cases. All four cases (ignitions) occur east of the nearest fire station, implying access from the west on the map that is given to the respondent.

All fires occur at the end of June.

A fire observation airplane is patrolling the region only on days when fire danger is class 4 (high) or higher, i.e. case number 1 and 4. If the IC asks for observation-support from the plane, fire officers at the base can communicate with the plane and direct it to leave its pre-designed route and fly towards the fire.

Current weather and Fire danger class is given at start. Weather forecast and full set of indices can be given on demand from the IC.

When the crew arrives at the scene a picture of the smoke is shown to the IC. When the first crew member reaches the fire (in the forest) and can see it, information is given to the IC on approximate size of the fire (length, width) as well as flame lengths from the position where the person is at that moment (might be back, flank or head).

Resources to deploy are those available to the rescue service, within their own municipality and neighboring municipalities, MSB (State-operated) material depots, helicopter companies, landowners etc, similar to the true situation in their area.

The landowner in all scenarios is a larger forest company. If asked for, these can supply a work crew of 6 persons. If the IC asks, three of those have earlier experience from fire suppression/mop up. They have access to a trailer from the company with some fire equipment: 300 m 38 mm hose, 4 three-ways, three nozzles, a 5-bar two-stroke water pump, five water cans and five spades.

On a direct question, the IC has access to (shown) aerial photo of the same area as in the topographic map, which make it possible to gauge the fuel situation ahead of the fire.

Once people are on site, the IC has access to “eyes on the ground”, meaning that questions regarding fire behavior and suppression effects can be communicated to the IC (by the interlocutor), provided the IC has directed persons close-enough to the fire to see.

Instructions to the respondent, for the tabletop runs. [*Translated from Swedish*]

What resources do you deploy, and from which stations? At what time? Resources on site shall be booked from start and continuously until the mission is completed and the landowner has assumed responsibility.

When and where do the different vehicles stop? Explain verbally, in detail, how you plan to attack the fire?

All decisions are noted with running time since alarm.

All actions are to be drawn on the map with time and position.

Time when the first person is at the fire is registered.

Time when water reaches fire is registered. Exact position of first contact is illustrated. Draw hoseline in full, with indication which part has been watered.

Note when flames have been suppressed around the entire perimeter.

Carry on until the forest owner takes responsibility of the burnt area.

Draw the expected fire perimeter at completion of the incident.

Instructions to the interlocutor for running the Tabletop case #4, Åskedal fire. [*Translated from Swedish*]

Preconditions

‘Strong’ wind, 23.4 km h⁻¹ WNW. Low Rh (31%). Fire danger class 6 (FWI 35). Weather and danger class are given at start, but the full set of indices only if asked for by the IC (FWI, DMC, BUI, FFMC etc). Point of ignition is on a small clear-cut area, 300 m from the nearest road, and the head is running away from that road. If the IC asks for information on the forest fuels there is a mix of cut areas, young forest stands and older pine forest stands ahead of the fire. Ordinary moss/*Vaccinium* vegetation. Near to the second forest road there is a young, 8 m tall pine stand. The distance from point of ignition to the first road to the east is ca 1 km. Fire will reach it ca 50 min after alarm. Rate of spread in the head section is 18-27 m min⁻¹. Intermittent crowning occurs, even in older forests. Weather is assumed to be the same on day 2, resulting in only small changes in the fire danger indices.

We assume the following

When the crew arrives at the road west of the fire (the position likely to be chosen by the IC as staging point), the head has moved 700-900 m, nearly in contact with the first road ahead of the fire.

It will not be possible for the crew to reach the fire, suppress the flanks and reach the head before it arrives at the first road. Fire will jump that road by spotting, even if both sides have been watered.

It is unlikely that the head of the fire can be suppressed before the evening, reaching the second road to the east.

We let the head of the fire stop by the second road (SE of Oxgölen), provided watering has been done on both sides of the road. It will by that time be more revealing (for the exercise) to follow which actions the ICs employ on the flanks, if any.

Particular questions that are important for us to keep track of during the Åskedal tabletop case

Will the crew leave the back and flanks of the fire once it becomes obvious that the fire is escaping initial attack?

Will the crew fall back on roads or try to attack the fire in the forest? Do they work out of a secure anchor point?

Does the IC request helicopter? To which part of the fire perimeter are helicopter drops directed? How is communication set up with the helicopter pilot? How do helicopter and ground crew coordinate work at the fire perimeter? Is the helicopter used for reconnaissance?

Do ICs contemplate burning off fuels ahead of the fire (at road 1 or 2)? If so, how would that be done?

Do they bring in enough resources for the night shift to secure and mop-up at least the flanks during the evening/night?

Example of information presented to the respondents in the form of maps and pictures. These are from Tabletop exercise test #4, the Äskedal fire

Wind speed and direction were given directly on the map as shown. Other weather information and the fire danger level (scale 1-6) were given verbally at start. Weather forecasts and detailed fire danger indices (Canadian system) were given by the interlocutor if asked for by the IC (see Table 1 for details of weather and fire danger indices). Additional maps were presented as the exercise progressed, showing fire extent at arrival, ca 40 minutes after alarm, based on expected ROS, (allowing for acceleration from ignition). The fire had by then nearly breached the first road, ESE of the point of ignition.

Positioning of vehicles, people and actions on the ground (hoselines etc) were progressively drawn on the maps by the IC. Further, the interlocutor logged timing (minutes after alarm) and dimensions of all actions.

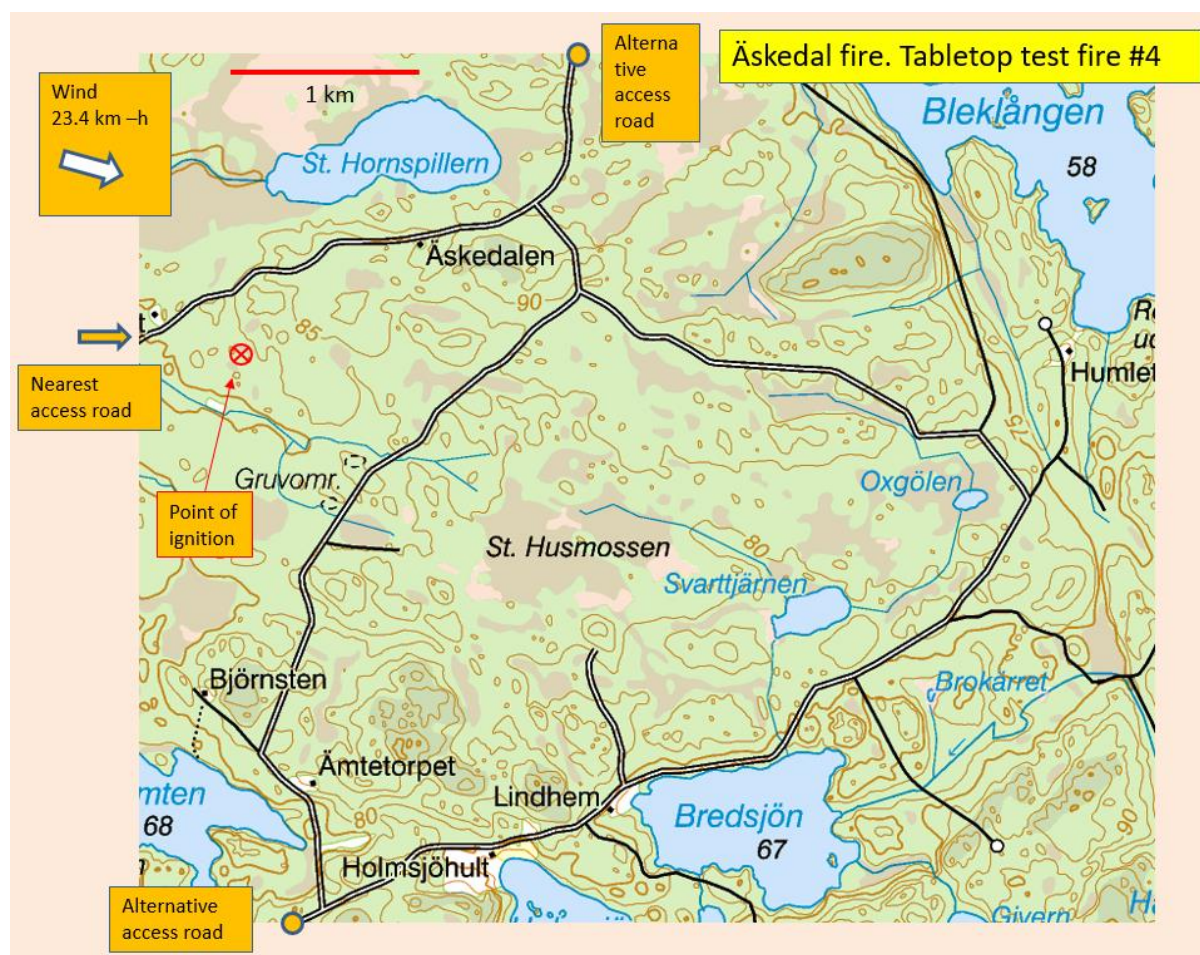


Figure A1. Map presented to the respondent at the start of tabletop scenario #4, The Äskedal fire [Translated from Swedish].

Below some of the photos shown to the IC as the Tabletop exercise progressed. These are from case number 4 (Table 1), called Äskedal fire.



Figure A2. photos shown to the IC as the Tabletop exercise progressed