

Trémoa Forest Fire in Central Portugal: A case study of fire behaviour prediction

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Introduction

In this study a forest fire that occurred on the 5th. September of 2001 in Trémoa, in the district of Coimbra, Portugal, is presented as a case study for the application of advanced fire detection and fire behaviour systems to support decision in the process of dispatching.

Description of Site and Meteorological conditions

Topography

This fire was initiated by arson at the base of a canyon and spread towards the top and to the other slope of the hill. The general layout of the topography in the area of the fire is shown in figure 1.

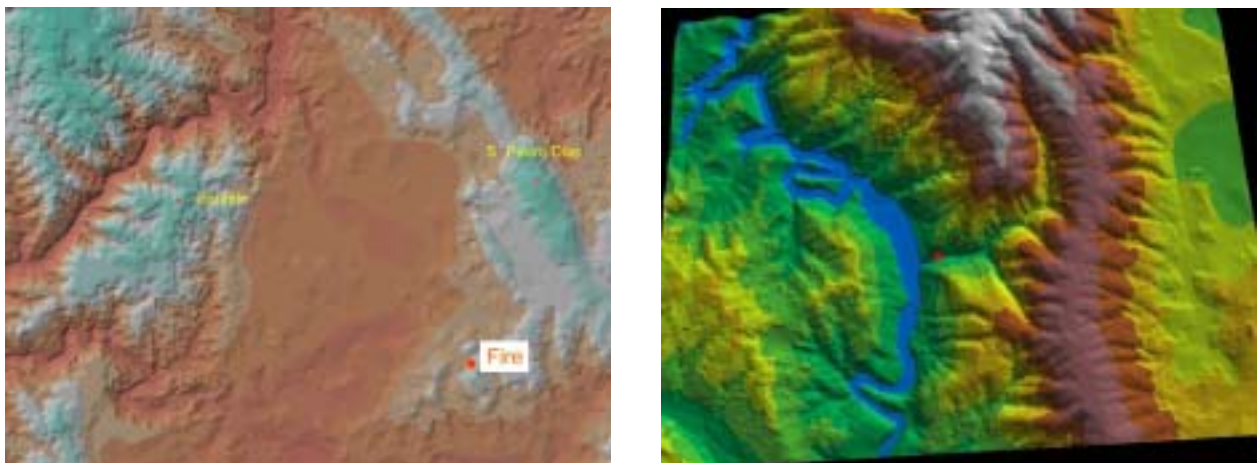


Figure 1 – Perspective view of the topography in the area of Trémoa fire. (a) General location of the fire; (b) Detail of the area of the fire.

Meteorology

Meteorological data from three nearby stations was available to the authors. After a preliminary evaluation it was found that their data was very consistent and therefore

only data from one of them is presented here. Air temperature, relative humidity, wind velocity and direction registered hourly at S. Pedro Dias on the 5th. September of 2001 are shown in figure 2.

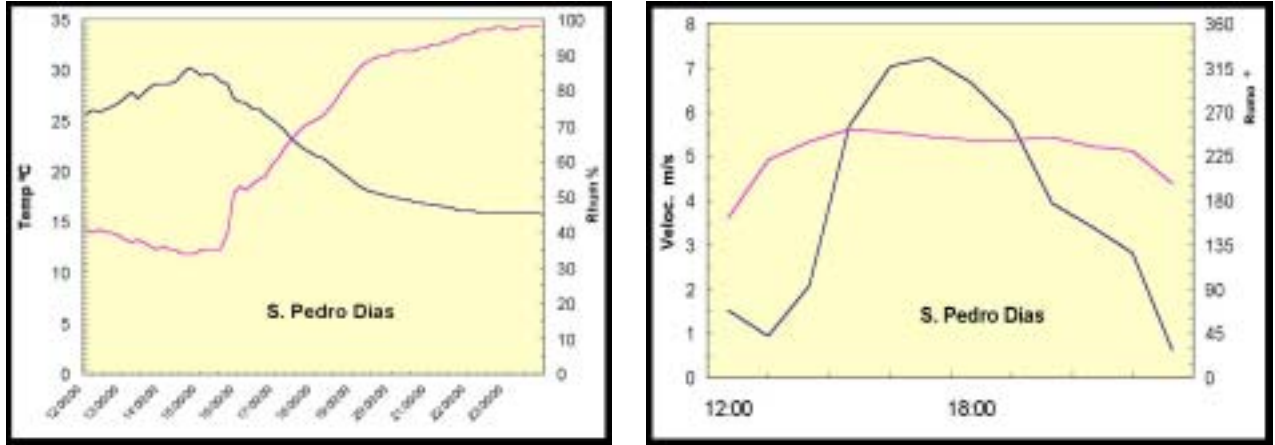


Figure 2 – Meteorological data registered at S. Pedro Dias on the 5th. September 2001.

Vegetation

From aerial photography of the region, complemented by field work carried out immediately after the fire the vegetation cover map of the zone was created. It is shown in figure 3, as a fuel map. The fuel models were developed by ADAI team specifically for the Central Region of Portugal. The vegetation in the area was essentially *Eucalyptus globulus*, *Pinus pinaster* and *Castanea sativa*. The latter existed in the water lines, as it is shown in figure 3.

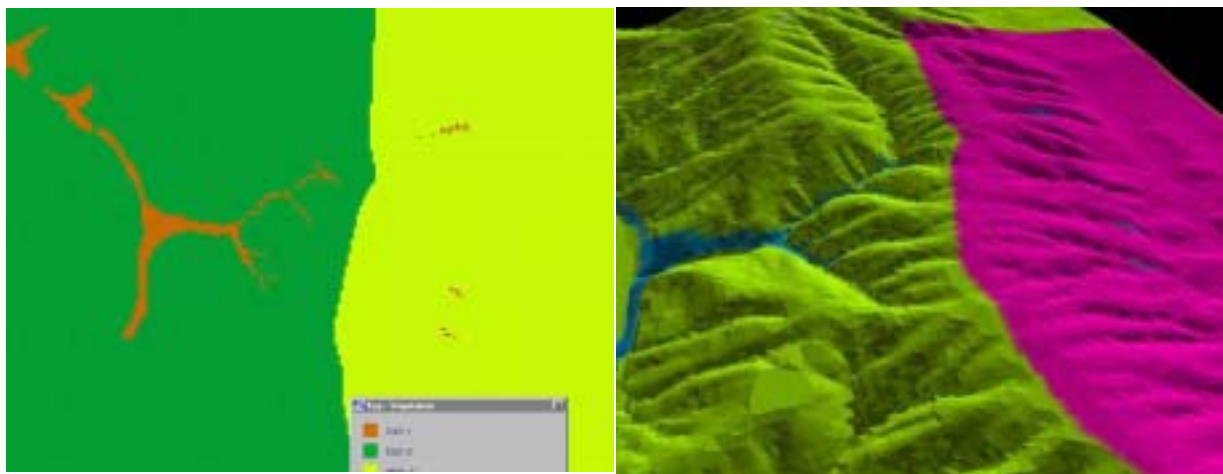


Figure 3 – Vegetation cover map of the area of the fire. (a) Plan view; (b) Perspective view.

Detection and initial attack

The fire was immediately detected by the automatic systems installed at S. Pedro Dias and at Soutelo and observed by the personnel at the Coordination Centre of Poiares.

In figure 4 the images produced by Bosque system video and infra-red cameras are shown. The latter in particular gave a very good indication of fire growth during the initial stages of the fire. Dispatch decisions to send two Dromader and two heavy helicopters to the fire were taken greatly based on these images.

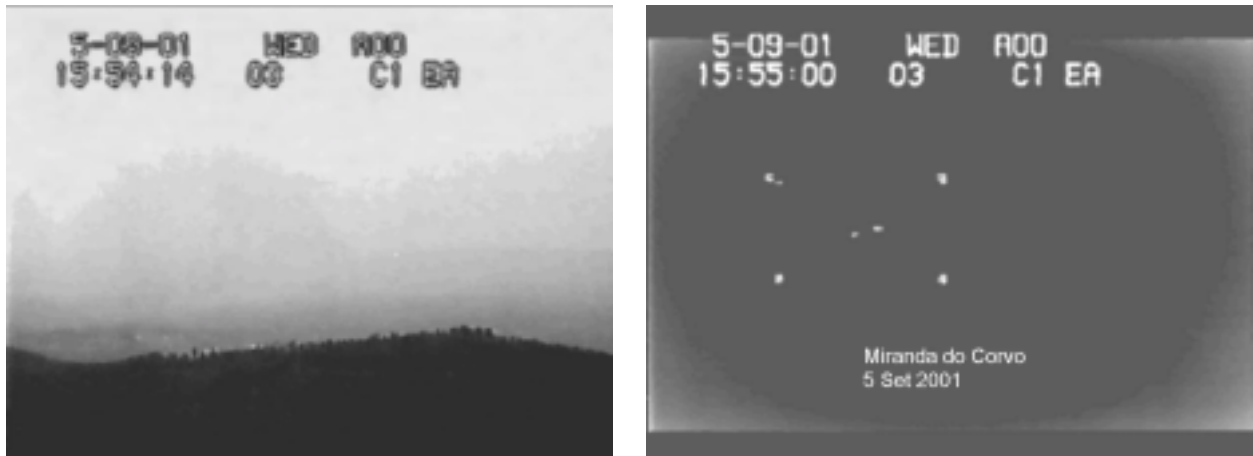


Figure 4 – Initial stages of fire development registered by Bosque System installed at S. Pedro Dias. (a) Video image; (b) Infra-red image.

Fire Behaviour Prediction

Using FireStation, a fire behaviour simulation system developed by ADAI (cf. Lopes et al 1998), a simulation of the fire behaviour was run. This study was performed a posteriori and the known wind data was given as an input to the system as dynamic data.

As the fire was started at both sides of the canyon at near the road two ignition points were considered, one in each slope of the canyon. The results of the simulation are shown in figure 5.

As can be seen the predicted spread of the fire seems to follow what must have been the real fire. In spite of the initial attacks to the flanks of the fire, especially to the right flank the simulated fire front remains inside the final limits of the fire, indicating that not much more could be done to suppress this fire.

The model predicts quite accurately a rapid acceleration of the fire when it reached the ridge of the hill, with the change of fuel and of wind flow. This fast spread surprised

the fire fighters that were attempting to fight the fire before it reached the village of Povoia. Given to a difficulty of the terrain and to the rapid advance of the fire two vehicles were abandoned by the fire fighters and burned completely. This event occurred at about 18:00 h which is not far from our predictions. The total area inside the final perimeter of the fire was burned at 22:30h, according to the model. This result also is not far from the observations.

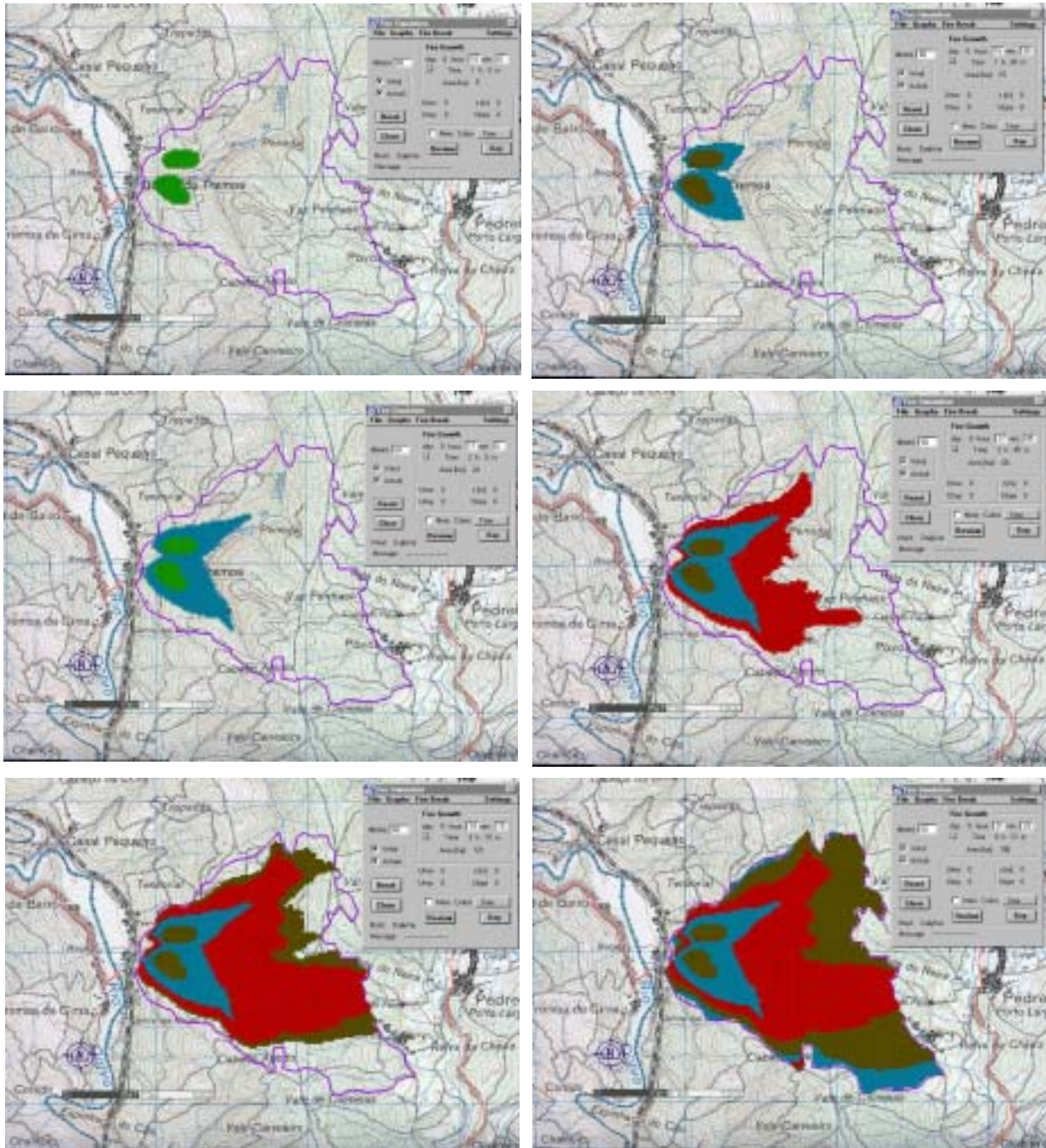


Figure 5 – Several stages of development of the fire as given by the fire behaviour simulator FireStation. The local time of each situation are: 16:00h; 16:30h; 17:00h; 17:45h; 18:15 and 22:23h. The final perimeter of the fire is shown as a blue line.

Conclusion

A forest fire that occurred in Central Portugal was used as a case study to assess the validation of the fire behaviour simulation system FireStation developed by ADAI. Using real data available for the present case realistic outputs were obtained.

This and similar cases can be used for training purposes to assess fire suppression tactics and fire safety. The use of advanced methods to monitor fire propagation was considered very effective in this case.

Acknowledgements

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References

Lopes AG, DX Viegas and MG Cruz, 1998. - FireStation - An integrated system for the simulation of fire spread and wind flow over complex topography spreading. In Proc. of III International Conf. on Forest Fire Research/14th Conf. on Fire and Forest Meteorology. Luso, 16/20 November 1998, Vol. I: 741-754.