Human Behaviour Associated to Fatal Accidents of 2003 in Portugal

D. X. Viegas and M. T. Viegas

Summary

During the summer of 2003 in Portugal 21 persons lost their lives in 18 different accidents related to forest fires. These accidents cover a broad range of circumstances both in terms of fire behaviour and of human response. These cases were the object of a detailed research by the authors (cf. Viegas, 2004). In this paper a survey of the accidents and of the human behaviour associated to them is analysed.

Most victims were civilians but four fire fighters also lost their lives in three separate accidents. Not a single victim was actually fighting the fire although in many cases they had been engaged in fire suppression activities. When the accidents occurred they were either preparing to attack or were trying to escape from the fire.

Most civilians were caught by the fire while they were visiting their properties to watch for the safety of their belongings. Not a single person died inside a house or a structure although some perished while fleeing from their houses or while attempting to protect them. Two of the victims died in the relatively small controlled burns that they initiated. In both cases the victims were quite old and lacked physical capacity to overcome the situation.

One victim was in his car trying to escape ahead of a fire spreading upslope when the flames surrounded him. One other victim that was driving a tractor running ahead of the fire hit a tree and having to continue on foot was overtaken by the advancing fire front. In one of the fatal accidents involving fire fighters the driver a fire truck that was going to a fire lost the control of the vehicle and was killed in the subsequent fall of the truck in a ravine.

Two experienced fire fighters lost their lives due to excess of confidence in the assessment of the threat posed by an advancing fire while they were walking from one fire assignment to another.

In at least two cases there are indications that the victims were caught by counter fires lit by the population.

Some rules and general recommendations are derived from these cases.

Introduction

The forest fires that occurred in Portugal in the summer of 2003 were the most serious of our history, in terms of burned area, intensity and in terms of human losses. The human fatalities in particular will remain in our memories as a terrible consequence of these fires, not only for the number and different type of accidents that occurred but also for the large number of civilian deaths.

With the help of his team and many other persons the author investigated each one of the 18 accidents involving the loss of 21 lives. A detailed analysis of these accidents was presented in a book that was addressed to the general public (cf. Viegas, 2004). The present text gives a very brief description of the circumstances in which each accident occurred.

D. X. Viegas and M. T. Viegas are researchers and professors at ADAI, Dep. Mechanical Engineering, Univ. of Coimbra, Portugal Xavier.viegas@dem.uc.pt

In: Butler, B.W and Alexander, M.E. Eds. 2005. Eighth International Wildland Firefighter Safety Summit: Human Factors - 10 Years Later; April 26-28, 2005 Missoula, MT. The International Association of Wildland Fire, Hot Springs, SD.

Some fire data of Portugal

The evolution of the number of forest fires in Portugal between 1970 and 2003 is shown in Figure 1. As can be seen this number has grown regularly, with an annual average of approximately 28000 fires in the recent five to ten years; nevertheless in the year of 2003 this number was significantly reduced. The author attributes this marked decrease in the number of fires to the generalized awareness of the population for the prevailing situation. Many persons refrained to make use of fire as they would do in more "normal" circumstances.

The annual burned areas, for the same period, are given in figure 2. There is a tendency for this parameter to increase since 1975. A large inter annual variation can be observed in this graph especially during the past twenty years. In the last five to ten years the average was approximately of 100 kHa but in 2003 the burned area was more than 430 kHa, which is more than four times the average value and more than the double of the worst year (1991) in the history of the forest fires in Portugal.

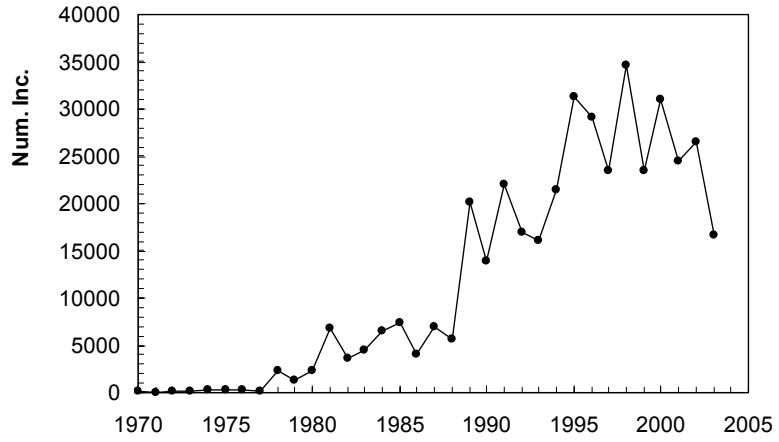

Figure 1 – Annual number of forest fires registered in Portugal between 1970 and 2003.

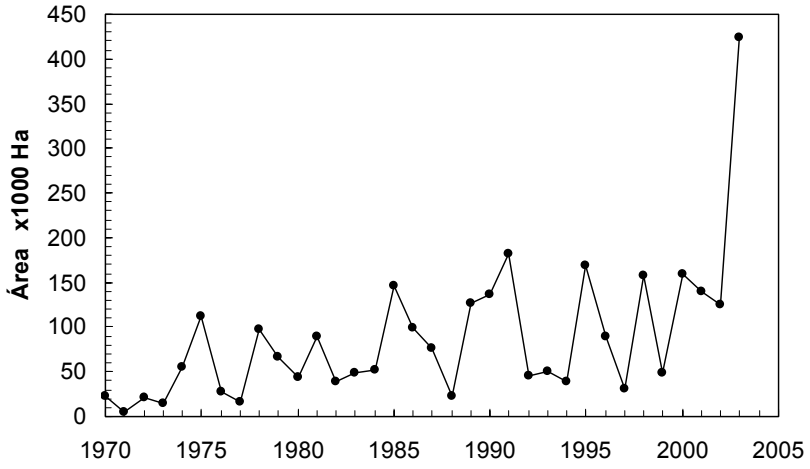

Figure 2 - Annual area burned by forest fires in Portugal between 1970 and 2003

This serious situation happened as a consequence of a very dry period that affected the East of Portugal, between the months of May to September, following a rainy winter and spring with a mean rainfall superior to the normal values in 50%. In August and September two hot waves occurred, with exceptionally high values of air temperature and very low values of the relative humidity.

The deaths occurred mainly as a consequence of the intensity and fast propagation of the fires. The geographical location of the 18 accidents is shown in figure 3.

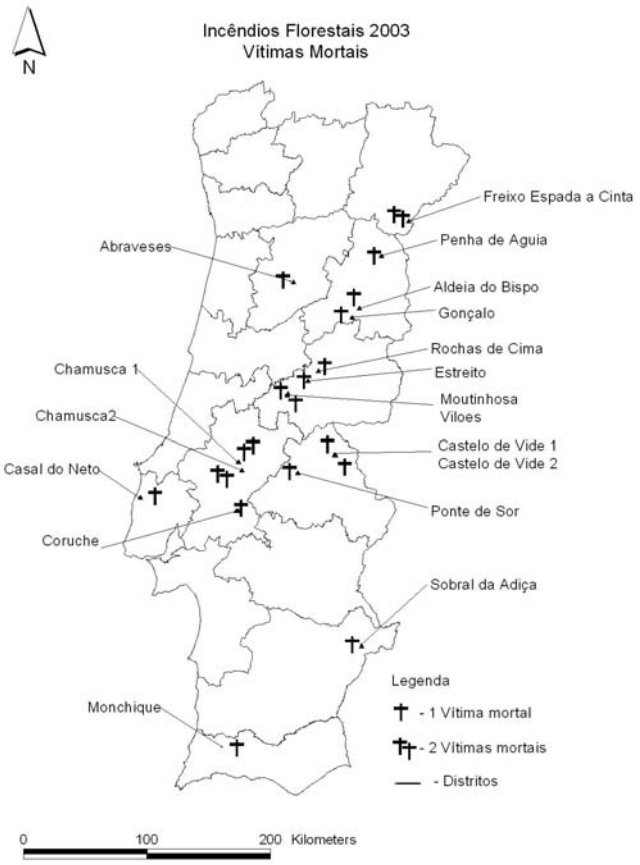

Figure 3 – Geographical distribution of the fatal accidents during the summer of 2003 in Portugal.

Brief description of the accidents

Coruche accident

This accident occurred on the 19th of June, in the district of Santarém. The victim was a Shepard of 83 years old that was looking after his sheep in the bottom of a small valley. Around 15:00 h a fire had started one kilometer far from that place but he was not aware as he was probably resting due to the heat. When he finally noticed the fire approaching he tried to remove the sheep but the fast spread of the fire in the grass vegetation reached him and he had no possibility to escape.

Rochas de Cima accident

This situation happened on the 29th of July, in the district of Castelo Branco. At about 18:00h, a man of 79 years old was watching the propagation of a fire near his pine stands. As he must have felt threatened by the fire in the middle of the forest he tried to reach an agriculture field, near the edge of the forest, where the fire was being fought by the firemen and a group of civilians. He was trapped by the fire some 100 m before reaching the agriculture field. It is not clear if he was caught by the main fire front, by a spot fire or by a backfire that may have been put by persons fighting the fire.

Estreito accident

This incident occurred on the 30th of July also in the district of Castelo Branco. At 18:00h, a man of 81 years old was passing by his property in his car as it was threatened by a fire, when the fire appeared on the other side of the valley. He decided to leave the

place and took a forest road in the direction of the main road. However the propagation of the fire up a canyon below the road was faster than he probably thought and he was stopped by the fire in front of him. Without possibility of escaping he stayed inside the car but it was completely destroyed by the fire.

Sobral da Adiça accident

This fatality happened on the 1st of August, in the district of Beja. A man of 67 years old was resting with a group of friends after a barbecue in a recreation area in the forest. At about 17:00h the group noticed the existence of a fire spreading relatively fast towards their direction and decided to run away. The man was not feeling well and was not completely aware of the danger. His physical condition did not allow him to walk and run away from the place without help. When their colleagues called him to leave the area, he did not follow them and stayed behind perhaps waiting for help. He was caught by the fire that had a very fast development in the grass and dry shrubs vegetation. When the other men returned to recover him he was already seriously burned and died on the 6th of August.

Gonçalo accident

This accident occurred in the district of Guarda, on the 2nd of August and the victim was a 71 years old lady. This lady was at home alone when she noticed a fire spreading at the bottom of the valley below the house. She decided to leave the house in the direction of her neighbours but she was surprised by the quick fire spread. She fell down probably due to the air blow created by the approaching fire. In the fall she was hurt and was not able to continue. Probably due to the heat exposure she was seriously burnt. When she was found some minutes later, she was transported to the hospital but in spite of the treatments she died on the 14th of August.

Pinheiro Grande accident

On the 2nd of August the lightning of a thunderstorm originated a large number of fires in the area of Chamusca, in the district of Santarém. One of those fires occurred in the

place of Pinheiro Grande where two ladies lived nearby. One was 35 years old and the other 67. In spite of the warnings that they received previously they decided to stay at their homes but when they saw the fire approaching they decided to escape and started to run along the road trying to get away from the fire. They were almost reaching one other house that was not destroyed by the fire when they were caught by the heat and by the fire and they died there.

Casal de Paires accident

In the same region and on the same day 2nd August, near Casal de Paires, two professional fire fighters from Chile lost their lives. One was 43 years old and the other was 29. They belonged to a Fire Brigade of a private forest agency working for a group of Portuguese pulp companies. This crew of ten men had been working in the protection of a *Eucalyptus* plantation when they were called to go to another assignment in a different region. In their way back to get the transportation they had to walk a distance of about 6 Km in the direction of Casal de Paires. When they were getting near that place they saw a fire that was spreading in their direction. The chief ordered the crew to hurry but two of them stayed behind the rest of the group as they did not realize the danger they were in. The first group of eight firefighters followed the order from the fire boss and actually ran during the last few hundreds of meters while the second group of two men continued at a walking pace. When these two men reached a certain point they found the road cut by the fire after the passage of the initial group. Then they decided to leave the main road and take another road that went down in the direction of a small valley. Unfortunately this road took them to a sort of basin that was completely surrounded by fire. They tried to go back but they were not able to climb a small slope and reach a water extension that could have given them protection.

Ponte de Sôr accident

This accident happened in the district of Santarém and on the same day of 2nd August. The person that died in this situation was a man 52 years old. In the presence of a nearby fire this man tried to create a fire break with a farm tractor on a small ridge. He was with is son in the tractor working, with the main fire front coming towards them. When they saw that they could not control the very fast spreading fire they tried to escape in the tractor

through a road but probably due to the heavy smoke they lost visibility and crashed the vehicle into a tree, damaging the right front wheel of the tractor. They continued on foot but probably the father was hurt due to the impact on the tree. For this reason he couldn't keep up with is son and stayed behind. He told his son to keep going to try to find some help and so he did. When he turned back in search of his father he was already severely burned in all his body.

Castelo de Vide accident 1

This fatality occurred on the 3rd of August in the district of Portalegre and the victim was a fireman 45 years old belonging to the Fire Brigade of Castelo de Vide. He was in a crew of five firemen that went with a fire truck to fight a fire in grass vegetation, in a small valley. When they were starting to fight the fire a sudden change in the wind direction made the fire spread in their direction with a very high velocity. They only had time to get back into the truck and run away but one of them could not climb on the car and he tried to find protection near some rocks. The proximity of the fire caused him severe burns that produced his death on the 14th of August.

Castelo de Vide accident 2

This accident happened during the same fire as the previous one. The two sites were actually less than one kilometre apart. The victim was a farmer of 48 years old that was driving his tractor by a main road in order to fight the fire in nearby properties. After passing a curve in the road he was caught by the fire and the tractor started to burn. He also suffered burns and decided to jump from the tractor in flames and started to run along the road trying to get away from the fire. After running some 200 meter a friend of him that was passing on the road saw him and gave him help. He was taken to the Hospital but due to the severe injuries that he had he died also on the 14th of August.

Vilões accident

In this accident that occurred in Vilões, in the district of Castelo Branco an old lady of 69 years died on the 3rd of August. The lady lived with her husband in an isolated house in the forest near the village. When the fire was close the lady went to catch some hoses that she had in an agricultural field close to the village. When she was coming back she was surprised by the fire at a distance of less then 200 m from her home. She dropped the hoses and tried to run away but she was caught by another fire front coming uphill.

Moutinhosa accident

This case occurred in Moutinhosa also in the district of Castelo Branco, on the same day and not far from the previous accident – less than two kilometres. The fatality reported refers to a forester owner of 53 years old. This man tried to organize and lead a group of men in the fight to stop the fire and protect the village. He went to the bottom of the valley below the village to try to stop the fire that was coming down slope. But the fire was coming on the other side of the slope with such a velocity that they had to give up. The small group of men decided to disperse and return to their houses. He must have tried to return to the village. When he was climbing the slope the fire overtook him and cut his way back to the village. He then tried to escape in another direction but another fire front caught him.

Penha de Águia accident

This accident occurred in the district of Guarda, on the 6th of August near the village of Penha de Águia, where a fire fighter from the Fire Brigade of Castelo Rodrigo died.

A five man group of fire fighters was going to fight a fire that was spreading near Penha de Águia. When the fire tank was entering a steep descent the driver lost the control of the truck in a left hand turn and the vehicle fell down a barrier. The driver died and the other fire fighters where injured.

Aldeia do Bispo accident

This fatality happened during a fire that occurred on the 7th August also in the district of Guarda. A lady 39 years old worked in a Social service Center looking after elder persons of the community. As a fire was approaching the village the persons in charge of the Center decided to evacuate the old persons. The lady helped on that action and then she went home to leave her motorbike in a safer place. After that she returned to help the firefighters to protect the village and in particular the Center building. The fire was approaching from the other side of a valley below the village with such a velocity that the group of fire fighters and the civilians that were supporting them had to run away from the place where they were. Seeing what happened the lady tried to go to protect her own house but on the way she was caught by another fire front from the other side of the slope. She died not far from a place where she could have find protection and being saved.

Freixo de Espada-à-Cinta accident

In this case that occurred in the district of Bragança and also on the 7th of August a couple of forest owners, of 50 and 40 years old, died when they went to observe a fire that was threatening their properties in mid afternoon.

The fire had started at about 15:00h in a slope in the margins of Douro River covered by patches of shrub, herbaceous and agriculture vegetation (mainly vineyards). The fire was being fought by the fire brigade of Freixo de Espada-à-Cinta and it was practically contained in the bottom of the slope, near the river when the fire blew up in a small canyon. Suddenly it developed a wide and very intense fire front that swept the entire slope and caught the couple that was more than one kilometer away from the origin of the blow up.

Santa Cruz accident

This event happened on the 23rd of August, in the district of Lisbon in which a 69 years old man died. This man was burning some debris on a relatively safe agricultural field covered with herbaceous vegetation and the remains of a maize crop. As this activity is forbidden during the fire season most probably he was performing the burn alone. When he was trying to control the flames he must have fallen into the fire area and died. The burned area was of the order of 30x50 square meters.

Monchique accident

This dramatic accident happened during the second heat wave that affected specially the South of the Country in the second week of September. It occurred near Monchique, in the district of Faro, in the Algarve region and a man of 58 years old lost his life during the night of 12th September.

He lived alone in a small village in the middle of the forest. His properties had already been affected by another fire that occurred in the summer of 1995. That fire had a very similar pattern as this year's and his car was burned then.

This time he had prepared everything in advance to leave the house in his car. At around 2:00h when the fire was approaching the village he started to run in the direction of his car that was some 300 meters away from his house. On his way to the car he found the road cut by the very fast and complex advance of the fire and decided to go downhill into a valley but the fire caught him there.

Abravezes accident

On the same day but on the North of Portugal, in the district of Viseu, another sort of accident happened. An old lady 78 years old was burning some debris that she had gathered at the border of a small pine stand near her house. She was doing this in the early morning as she knew that it was forbidden. Suddenly she saw two men passing in a road nearby and she decided to hide from them behind a group of pine trees not far from where she was burning the debris. The two men saw the starting fire and called the fire brigade using a mobile phone. As they did not see anyone near the fire they went away to avoid being accused of being the authors of the burn. In the meantime the fire had propagated through the shrubs in the direction of the pines and the old lady was caught by it. When the firefighters arrived the fire was easily extinguished and only a very small area of 20x50 m^2 had burned.

Conclusion

The fires occurred in Portugal in the summer of 2003 were the worst in our history and produced as a consequence twenty one fatalities. From each one of these situations we can extract lessons related to fire and human behaviour. Fire prevention and suppression agents as well as the rural population should consider these cases in order to improve personnel fire safety in our Country and elsewhere.

Acknowledgements

The author wishes to thank his collaborators and all the persons and institutions involved in the investigation of these accidents. The support given by the European Commission and the National Science Foundation to the research program that is being developed is also acknowledged.

Bibliography

D. X. Viegas 2004 – Cercados pelo Fogo, Editorial Minerva, Coimbra, 283 pp.

Biographical Sketch – Domingos Xavier Viegas

Domingos Xavier Viegas was Born in Goa (India) on 24 August 1950. He graduated in Mechanical Engineering from the *Instituto Superior Técnico* (Lisbon) in 1972 and obtained his PhD in Aerodynamics from the University of Coimbra in 1981. He has been full Professor of the Department of Mechanical Engineering, of the Faculty of Science and Technology of the University of Coimbra since 1992, where he has been head of the Fluid Mechanics Group since 1981.

Domingos was the founder of the Association for the Development of Industrial Aerodynamics (*ADAI*) and has been its President since 1990. He has been coordinator of the Centre for Studies on Forest Fires (*CEIF*) since its creation in 1986. Domingos has been a member of the Board of Directors of the *International Association of Wildland Fire* since 1998, and a member of the Editorial Advisory Board of the *International Journal of Wildland Fire* since 2002.

He has promoted four International Conferences on Fire Science, and has organised many other scientific meetings, training courses and seminars about forest fires. He has coordinated various research projects funded by Portuguese institutions and by the European Community. He has also authored many publications on the topic of forest fires.

Domingos' main area of interest is the study of physical aspects of forest fires and fire safety, with particular emphasis on the analysis of the effect of wind and slope on fire behaviour.