Case studies of large outdoor fires involving evacuations

Part 2

July 2022

Large Outdoor Fires & the Built Environment (LOF&BE) Working Group

Emergency Management & Evacuation (EME) Subgroup

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Cover Photo

The cover photo was taken during Shangri-La village fire of China southwest region in 2014. The buildings of the burning village are mostly wooden structures, and the fire engines cannot enter due to the inconvenient transportation, which brings great difficulty to fire-fighting. A total of 343 structures were destroyed in this large out door (informal settlement) fire. Photo taken by China News Service (http://www.china.com.cn/newphoto/2014-01/12/content_31162534_4.htm).

Case studies of large outdoor fires involving evacuation

Yu Wang, Rahul Wadhwani, Sayaka Suzuki, Maria Theodori, Eleni Asimakopoulou, Jacques Andre De Beer, Natalia Flores, M. Asim Ibrahim, Hahlin Johanna, Kamila Kempna, Samuel L. Manzello, Ankit Sharma, Jan Smolka, Amila Wickramasinghe, Chia Lung (Farian) Wu, Ting Xia

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Abstract. In this report, large outdoor fire cases from all over the world have been collected and demonstrated, to establish a large fire case study database. The case studies collected in this work do not cover all large outdoor fires, due to the wide space (worldwide), but these cases have unique advantages in exploring the common problems and differences of such events. Reviewing the fire development and fire rescue methods of past fires provides the lessons and information for decision makers to develop safety guidelines and suggestions for emergency management and evacuation planning.

This report is expanded based on the first report (Ronchi. et al. 2021), and also prepared within the scope of activities of the Emergency Management & Evacuation (EME) Subgroup of the Large Outdoor Fire & Building Environment (LOF&BE) working group of the International Association for Fire Safety Sciences (IAFSS). Different from the 28 case studies collected in the first report, most of which came from North America with wildfires/WUI fires, the cases in this report came from more diverse regions (6 continents) with different types of large outdoor fires, including wildland fires, wildland-urban interface (WUI) fires, urban fires and informal settlement fires.

Emergency Management & Evacuation (EME) Subgroup

Large Outdoor Fires & the Built Environment (LOF&BE) Working Group

International Association for Fire Safety Science

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About the International Association for Fire Safety Science (IAFSS)

IAFSS was founded with the primary objective of encouraging research into the science of preventing and mitigating the adverse effects of fires and of providing a forum for presenting the results of such research. The International Association for Fire Safety Science perceives its role to lie in the scientific bases for achieving progress in unsolved fire problems. It will seek cooperation with other organizations, be they concerned with application or with the sciences that are fundamental to our interests in fire. It will seek to promote high standards, to encourage and stimulate scientists to address fire problems, to provide the necessary scientific foundations and means to facilitate applications aimed at reducing life and property loss.

Table of Contents

1. Introduction

Large outdoor fires, including wildland fires, wildland-urban interface (WUI) fires, urban fires and informal settlement fires, have become a global fire safety issue [1]. Wildland fire is a fire occurring in peat, forests, scrublands, grasslands or rangelands, either of natural origin or caused by human intervention [2]. Wildland fires that spread into communities are known as WUI fires. WUI fire involved complex factors such as the vegetation, structures, weather and topography [3]. Once a WUI fire reaches a community, a large urban fire may develop [4]. Urban fire can be also caused by rapid structure-to-structure propagation. Informal settlement fires are a complex socio-technical phenomenon involving settlement topography and layout, social circumstances, community responses and associated factors [5-7]. About 2000 fires were reported in informal settlements in Cape Town, damaging nearly 5900 dwellings and resulting in 142 people losing their lives [8]. On November 18th 2017, a fire occurred in an urban village informal settlement in Daxing District, Beijing, which caused 19 deaths and 8 injuries [9]. These large outdoor fires are responsible for the destruction of vast amounts of infrastructure and the loss of human life. In order to ensure life safety and control the fires efficiently, it is essential to analyze and study the evacuation behavior.

Evacuation is a frequent response to disaster situations [10]. For wildland fire, evacuation will be influenced by vegetation, geography, community infrastructure, and the social context [10]. Considering the example of WUI fires, vulnerabilities often exist within WUI communities such as transportation infrastructure and services that can cause significant challenges during large scale evacuations [11]. To simulate and visualize human behavior and wildfire spread during the evacuation of WUI communities, a modelling platform, WUI-NITY, based on the Unity3D game engine was developed by coupling the fire, pedestrian and traffic movement [12-14]. Evacuations often need to take place in a short period of time, but the delayed dissemination of warnings or delays in implementation of evacuation advice could result in evacuees leaving areas at risk with only minutes to spare and in turn encountering dangerous conditions in the process [11]. What is more, individual behaviour, route choice, fire cues and smoke are the impact factors of the evacuation process [12-16]. In addition, a country's policies may affect the evacuation decision [17]. Therefore, the information on evacuation in large-scale outdoor fires in different regions needs to be collected to enhance the emergency preparedness and management of large outdoor fire incidents.

In order to make conclusions about large outdoor fires, it is essential to analyze relevant statistics on these fires. Basic information on fire events such as location, time, causes, losses, and other data is collected, especially the evacuation of large outdoor fires, including the time, type, location, and reason of evacuation, as well as the number of people evacuated and the management issues of evacuation. Therefore, the basic information on the global large-scale outdoor fires and their evacuation scenarios are obtained.

To achieve the diversification, globalization, and standardization of the database, large outdoor fire case studies around the world involving evacuation are currently being built within the Emergency Management and Evacuation (EME) subgroup within the Large Outdoor Fires and the Built Environment group of the International Association for Fire Safety Science (IAFSS). This case study report is based on a standardized template [18] to collect the wildland fires, WUI fires, urban fires and informal settlement fires around the world, and provide reliable data on evacuation behaviour. The first report with 28 case studies was published in 2021, most of which occurred in North America [19]. This report collects cases from more diverse regions to deepen the understanding of the problems that may be encountered in evacuation and management, and learn from the effective evacuations around the world, so as to better deal with the large outdoor fires and reduce the loss of personnel and property.

2. Aim and objectives

This report is an expanded version of report 1 by Enrico Ronchi. et al [19], most cases of which are wildfires or WUI fires mainly collected from North America. This new report aims to present detailed information of case studies from diverse countries and regions, including the basic information on fire events and evacuation, and provide a diverse database by collecting cases of four different types of large outdoor fires.
The specific objectives of this report include to:

- Collect details of fire incidents including evacuation from different continents;
- Provide a comprehensive fire evacuation scenario database for large outdoor fires;
- Strengthen the understanding of the evacuation process and policies in large outdoor fires;
- Provide lessons and references for subsequent evacuation management.

3. Methods

The case studies in this report are composed of information collected by members through news media, academic publications and official reports. In order to ensure the consistency and standardization of collected information, the large outdoor fire cases in this report were collected according to the template in Appendix A, which was modified based on a template of wildfire information [18]. The template of this report presents the basic fire information (time, location, cause, environmental characteristic, timeline), fire damage (casualties, burned area), and evacuation information.
The collected cases are those with comprehensive information in recent years. In addition, the cases in this report cover as many countries and regions as possible, and provide cases for each type of large outdoor fire to reflect the typicality, regional diversity and type diversity of the case study.

4. Case studies

This section presents the set of case studies of large outdoor fires involving evacuation which have been reviewed.

1. Ash Wednesday bush fire (Australia), 1983

On 16 February 1983,'Ash Wednesday', widespread, extreme fires fanned by winds gusting to over 100km/h (109 at Laverton, Vic and stronger on coast) and maximum temperature in Melbourne of 43.2 C with relative humidity readings of only 6%. Similar conditions across much of Vic and SA resulted in a deadly rapid spread of the bushfires. They destroyed approximately 2,500 homes or major buildings. In Victoria alone, these included 1719 houses (plus approx. 300 in SA), 82 commercial properties (hotels, restaurants, stores, etc.), and 23 dairies. Additionally, 1,238 farms were damaged in Vic contributing to a total of approximately 1,700 other (minor) buildings damaged in the two states, also a large number of vehicles were destroyed.

1	Where?	Australia (two states of Victoria and South Australia)
2	When?	16th Feb 1983 to 18th Feb 1983 (2 days)
3	How was the fire started?	• Sparks caused by clashing of electricity power lines, tree branches connecting with power lines, deliberately lit fires and other causes that were not identified (DSE, 1983) • Faulty powerlines, arson, and negligence after years of extreme drought (EMA, 2012).
4	Initial fire size	
5	Area affected	2,080 km^2 (513,979 acres) in South Australia and 9,954 km^2 (2,459,687 acres) in Victoria on one day (EMA, 2012).
6	Type/s of forest involved in wildfire	Bush fire
7	Did the fire spread inside the WUI	Yes
8	Average weather conditions	Hot 42°C and humidity 6%
9	Geographical highlights	
10	Was there any natural fire break?	
11	Did the Fire Service report extreme fire behavior	
12	Number of structures and infrastructures affected	Buildings: 1700 damaged and 2500 destroyed Motor vehicles: 1200 destroyed Farms: 1500 damaged Livestock: 300,000 died 9000 people were homeless Total 250,000 people effected (EMA, 2012)
13	Estimated direct and indirect economic damage	Total cost: 324,000,000.00 Moreover, a total of 4,540 insurance claims were paid totaling $176m and a total estimated cost of well over

		$400m (1983 values) for both states combined (EMA, 2012).
14	Did it occur in conjunction with multiple fires in the country?	A single fire expanded to two states.
15	Countries involved	Australia
16	Brief timeline of the events	
17	Time of initial order to evacuate and locations	- "A postfire survey found that the respondents "had little or no warning or information about where the fire was, the rate at which it was moving and the predicted wind change" (Kursel, 1983)
18	Time when evacuation was considered completed	
19	Deaths/Injuries	75 killed, 2700 injured
20	People Evacuated	8000
21	People threatened to be evacuated	-
22	Evacuation type	By road
23	Personnel involved in rescue operations	16000 firefighters, 1000 policeman, 500 defense force personnel, 11 helicopters, 14 fixed wing planes
24	Did the smoke hindered significantly the evacuation because of low visibility or health problems	Delaying evacuation till last minute
25	Possible causes of issues in management operations	It revealed that 25 of 37 people that died in the state of victoria were outside their homes, several of whom died in vehicles while attempting to escape the conflagration. It was found that delaying evacuation until the last minute was a common failing (Wikipedia, 2021)
26	References	DSE, 1983. Department of Sustainability and Environment, Ash Wednesday Bushfire, Available at: http://www.dse.vic.gov.au/fire-and-other-emergencies/major-bushfires-in-victoria/ash-wednesday-1983 EMA,2012, Disaster data base, Available at: https://web.archive.org/web/20090212131153/http://www.ema.gov.au/ema/emadisasters.nsf/c85916e930b93d50ca256d050020cb1f/76b9d4d54b20e8ffca256d3300057bd4?OpenDocument Kursel, N. 1983. A Study of Civilian Deaths In the 1983 Ash Wednesday Bushfires Victoria, Australia, CFA, Available at: http://royalcommission.vic.gov.au/getdoc/adec5bc7-6c36-4c66-a8f4-17f2bf7f285e/WIT.3004.003.0201.PDF Wikipedia, 2021. Ash Wednesday bushfires, Available at: https://en.wikipedia.org/wiki/Ash_Wednesday_bushfires#cite_note-34

27	Name/Surname/Email/Date of who filled in this template	M. Asim Ibrahim asim.ibrahim@lnu.se submitted on 18-06-2021

2. Balukhali campfire (Bangladesh), 2021

An enormous fire has spread through informal settlements of Rohingya people in the Balukhali camp in Cox's Bazar, Bangladesh. The informal settlement consists mainly of $1/10^{th}$ of ~1 million refugees. The UN's refugee agency says ~50,000 people have been displaced, at least 15 have died and 400 remain unaccounted for. The incidents thought to have begun when gas cylinders used for cooking exploded, 100 firemen fought the blaze, which burned for around eight hours until midnight. The site has previous histories of fire many of them used to be of small scale involving few structures, the present case was 3^{rd} fire in the last 4 days (18-22 March 2021). In 2017 also the site experienced large-scale fire affecting thousands of people and many fatalities.

1	Where?	Balukhali refugee camp in Cox's Bazar, Bangladesh
2	When?	22 March 2021
3	How was the fire started?	The cause of the fire is still unknown. However, it is suspected it started due to the explosion of the LPG cylinder
4	Initial fire size	The fire started in one of the shelters
5	Area affected (burned area)	~250 acres
6	Fuels involved in the fire	LPG, Informal settlement structures with most of them constructed from bamboo and tarpaulin
7	WUI, urban, wildland or informal settlement fires?	Informal settlements
8	Average weather conditions	A strong wind was observed by residents and firefighters as it fanned the fire progression
9	Geographical highlights	Home to an estimated $1/10^{th}$ of the one million ethnic Rohingya refugee in Bangladesh. The Cox's Bazar, in the south-east of Bangladesh, contains 34 neighbouring camps with thousands of makeshift homes packed so tightly into hilly terrain.
10	Was there any fire break? (natural or artificial)	No.
11	Did the Fire Service report extreme fire behavior?	The quick-fire spread expanding due to strong wind and cooking gas cylinders inside houses.
12	Number of structures and infrastructures affected (damaged)	At least 10,000 makeshift shelters are estimated to have been destroyed or damaged
13	Estimated direct and indirect economic damage	No information available
14	Did it occur in conjunction with multiple fires in the country?	No.
15	Countries involved	Local residents were the first responder to the incidents to douse the fires. Bangladesh firefighters were involved in dousing the fire. International aids to assist authorities and affected people arrived from various countries with prominent ground support provided by United Nation High Commissioner for Refugees, International Red Cross, World Food Programme, UNICEF, etc.
16	Brief timeline of the key events	A fire that had started during the afternoon ~2 pm in the Balukhali refugee camp in Cox's Bazar, Bangladesh

		It was the middle of the afternoon when they saw the huge rolling billows of black smoke and yellow flames more than 2km The flames were reaching more than 100 feet (30m) into the air. Finally, around 4.30 pm local time, the fire engines arrived, and several ambulances also pulled up By sunset, with the fire largely under control and by midnight after roughly 8 hours it extinguished, many aid agencies began to address the needs of those who had lost everything.
17	Time of initial order to evacuate and locations	No evacuation order was released and people evacuated on their own.
18	Time when the evacuation was considered completed	No information available
19	Deaths/Injuries	15 deaths, more than 560 have been injured, an estimated 400 people are missing and ~50,000 displaced
20	The number of people evacuated	~50000
21	The location people initially evacuated	No information available however people took shelter in nearby informal settlements
22	Reasons why people decided to evacuate	Fire and thick smoke approaching their dwellings
23	Evacuation type	Not issued
24	Any drill/education/instructions on large outdoor fires provided beforehand?	No
25	Personnel involved in rescue operations	100 firemen and uncounted local residents were involved in dousing fires. Relief efforts reached from UNHCR, UNICEF, International Organization for Migration, and World Food Programme provided by the following day.
26	Did the smoke hindered significantly the evacuation because of low visibility or health problems	Firefighters were struggling to control the blaze and the thick black smoke covering the camp. Residents also report such issues when evacuating from their dwellings.
27	Possible causes of issues in management operations	Narrow roads, flammable makeshift structures mostly made of bamboo and tarpaulin, barbed wire fencing which blocked the entry of firefighters from other routes and evacuation of people (suspected to be a reason for higher fatalities)
28	References	https://www.bbc.com/news/world-asia-56493708 https://www.nytimes.com/2021/03/23/world/asia/bangladesh-rohingya-fire-

		refugees.html#:~:text=The%20fire%20started%20around%202,flames%20raced%20across%20the%20camp. https://en.wikipedia.org/wiki/March_2021_Rohingya_refugee-camp_fire https://www.iom.int/news/massive-fire-devastates-rohingya-refugee-camps-coxs-bazar#:~:text=Cox's%20Bazar%20%E2%80%93%20A%20massive%20fire,the%20world's%20largest%20refugee%20camp.
29	Name/Surname/Email/Date of who filled in this template	Rahul Wadhwani Rahul.wadhwani@live.vu.edu.au 15/05/2021

3. Bandra slum fire (India), 2011

The fire started in one of the slums (Garib Nagar) in Bandra (East), Mumbai which mainly accommodate people from lower economic background i.e. daily wagers, labourers, etc. The blaze broke out at around 8.30 pm and quickly spread through the dense hutments. Soon after the news spread, twenty-six fire engines, 10 water tankers and five ambulances were immediately rushed to the spot to douse the blaze and help the injured. The fire had affected the train services in the region to some extent and the Central Railway had partially curtailed operations on its Harbour Line as a precautionary measure. However, trains on the Western lines were still running.

1	Where?	Garib Nagar slum, Bandra (East), Mumbai, India
2	When?	4 March 2011
3	How was the fire started?	The cause of the fire is still unknown. However, initial investigation revealed that it started due to the explosion of the LPG cylinder
4	Initial fire size	The fire started in one of the shelters
5	Area affected (burned area)	No information available
6	Fuels involved in the fire	LPG, Informal settlement structures with most of them constructed from wood, asbestos and tarpaulin
7	WUI, urban, wildland or informal settlement fires?	Informal settlements
8	Average weather conditions	No information available however strong gust of wind could be involved in the initial phase of fire produced due to passage of local metro train near the slum (the train activities were suspended after an hour of ignition of fire to avoid fanning the propagation of fire). Local weather record shows temperature ~32 °C and wind speed of 11 km/hr
9	Geographical highlights	Home for many people belonging to lower economical background (daily wagers, labourer, etc.). Next to local metro line (Habour line).
10	Was there any fire break? (natural or artificial)	No.
11	Did the Fire Service report extreme fire behavior?	The quick-fire spread due to successive explosion of 5 cooking gas cylinders in nearby houses as the fire spread.
12	Number of structures and infrastructures affected (damaged)	At least 2,000 makeshift shelters (commonly called shanties) are estimated to have been damaged completely and many other sustained partial or less damages.
13	Estimated direct and indirect economic damage	No information available
14	Did it occur in conjunction with multiple fires in the country?	No.
15	Countries involved	Local residents were the first responder to the incidents to douse the fires. Mumbai fire brigade firefighters were involved in dousing the fire.
16	Brief timeline of the key events	The fire broke out at Garib Nagar in Bandra (East) at around 8.40 pm following which 26 fire engines

		and 16 jumbo water tankers were rushed to spot. Eyewitnesses said firemen were hampered by lack of space and policeman had a tough time controlling the milling crowd which showed sign to turn violent. The Harbour line was closed as a measure from 9.45 pm since the fire erupted close to the line which goes towards Bandra Marshalling yard (BDTS). The slab of overhead bridge collapsed of metro station adding chaos to already chaotic situation. After roughly 3 hours from the time of ignition the fire was doused. The site has experienced similar fire in 2009, 2015 and 2017. Thus, proving to be a fire vulnerable site.
17	Time of initial order to evacuate and locations	No evacuation order was released and people evacuated on their own.
18	Time when the evacuation was considered completed	No information available
19	Deaths/Injuries	21 injuries and 0 deaths
20	The number of people evacuated	~6000-8000
21	The location people initially evacuated	No information available however people took shelter in nearby area or informal settlements
22	Reasons why people decided to evacuate	Fire and smoke approaching their dwellings
23	Evacuation type	Not issued unorganised chaotic response which caused the collapse of slab of overhead bridge
24	Any drill/education/instructions on large outdoor fires provided beforehand?	No
25	Personnel involved in rescue operations	Unknown no. of firefighters and local police authorities were involved, including 26 fire trucks, 16 jumbo water tankers, and 5 ambulances
26	Did the smoke hindered significantly the evacuation because of low visibility or health problems	No information available
27	Possible causes of issues in management operations	Narrow roads, flammable makeshift structures mostly made of wood and tarpaulin, chaotic response of public, fanning gust due to local metro line
28	References	https://zeenews.india.com/news/nation/massive-fire-in-slum-near-bandra-station-in-mumbai_691297.html https://timesofindia.indiatimes.com/city/mumbai/mumbai-major-fire-guts-slum-in-bandra-11-injured/articleshow/7629096.cms https://www.ndtv.com/photos/news/mumbai-fire-at-slum-near-bandra-station-9287#photo-119289

		https://www.firstpost.com/india/repeated-fires-in-bandra-slum-raise-eyebrows-authorities-smell-conspiracy-to-deter-bmc-demolition-drive-4179387.html https://reliefweb.int/report/india/india-blaze-leaves-over-2000-homeless-indias-mumbai-city
29	Name/Surname/Email/Date of who filled in this template	Rahul Wadhwani Rahul.wadhwani@live.vu.edu.au 18/07/2021

4. Beppu City fire (Japan), 2010

A fire broke out in Beppu-city, Japan, on January 13th 2010 around 10 PM. Exact cause of the fire is unknown. Under strong wind, the fire spread quickly, burned almost a whole block and stopped at a 6-m-wide road.

1	Where?	Beppu-city, Oita Prefecture, Japan
2	When?	2010/January/13 around 10 PM
3	How the fire was started?	No information
4	Initial fire size	NA
5	Area affected (burned area)	2893.91 m^2
6	Fuels involved in the fire	Structures
7	WUI, urban, wildland or informal settlement fires?	Urban fires
8	Average weather conditions	Winter, no rain, RH 44-56 %, wind speed 6 – 13 m/s
9	Geographical highlights	NA
10	Was there any fire break? (natural or artificial)	No, fire finally stopped at a road (6 m wide).
11	Did the Fire Service report extreme fire behavior?	quick fire spreads due to strong wind, 2 spot fires
12	Number of structures and infrastructures affected (damaged)	22 burned buildings and 4 partially burned
13	Estimated direct and indirect economic damage	No information
14	Did it occur in conjunction with multiple fires in the country?	No
15	Countries involved	Japan
16	Brief timeline of the key events	2010/1/13 Around 10 pm – 10:20 pm A fire started in a 2-story wooden apartment, around 10:15-10:17 pm, the first fire propagation to an adjunct building (upwind) was observed/estimated Fire propagated to all adjunct buildings 10:20-10:30 Fire department arrived. Fire was slowly spreading. 10:30-11:00 Fire spread was at peak. It is estimated fire spreads to adjunct block around 10:55. after 11 pm Fires were getting under control 2010/1/14

		1:26 am fires under control, 3:41 am fires extinguished
17	Time of initial order to evacuate and locations	No information
18	Time when evacuation was considered completed	NA
19	Deaths/Injuries	1 death 1 injury
20	The number of people evacuated	At least 89 people affected by this fire
21	The location people initially evacuated	Nearby upwind location
22	Reasons why people decided to evacuate	evacuation advisory, people saw fire coming, fire department (professional or volunteer) or police visited, smoke,
23	Evacuation type	On foot, car
24	Any drill/education/instructions on large outdoor fires provided beforehand?	No information
25	Personnel involved in rescue operations	Firefighters (professional or volunteer) police
26	Did the smoke hindered significantly the evacuation because of low visibility or health problems	Smoke affected firefighting activities
27	Possible causes of issues in management operations	No information
28	References	http://nrifd.fdma.go.jp/publication/houkoku/081-120/files/shoho_113s.pdf http://www.arch.oita-u.ac.jp/urban/ppt/2010/B/iwaya.pdf (in Japanese)
29	Name/Surname/Email/Date of who filled in this template	Sayaka Suzuki/Samuel L. Manzello sayakas@fri.go.jp 2021/August/3rd

5. Black Forest (USA), 2013

The Black Forest Fire was the most destructive WUI fire in Colorado history, destroying over 600 structures and killing 2 people as they attempted to evacuate their home. Ignition was reported on June 11, 2013, during a period of drought and record-breaking heat; within two days the fire's destruction had surpassed the previous year's Waldo Canyon Fire. Approximately 48,000 people were ordered to evacuate or given voluntary warning for evacuation. Favorable changes in the weather on June 14 allowed firefighters to make containment progress over several days' time span.

1	Where?	Black Forest, Colorado, USA
2	When?	June 11, 2013 to June 21, 2013
3	How the fire was started?	Human-caused
4	Initial fire size	The fire was initially described to be 2-3 acres in size but less than 10 minutes following was reported at 15 acres.
5	Area affected (burned area)	14,280 acres
6	Fuels involved in the fire	Ponderosa pine, grasses and gamble oak brush with light dead and downed material. Structures
7	WUI, urban, wildland or informal settlement fires?	WUI
8	Average weather conditions	High heat, low relative humidity and gusty winds. During a period of drought.
9	Geographical highlights	Upward, hilly sloped conditions
10	Was there any fire break? (natural or artificial)	Roadways but the fire jumped these fuel breaks.
11	Did the Fire Service report extreme fire behavior?	Spot fire ignitions as far as a mile away from the head fire. "Aggressive" fire
12	Number of structures and infrastructures affected (damaged)	Residential structures: Several thousand damaged, 489 destroyed; Commercial structures: 1 destroyed; Detached Garages: 31 damaged, 8 destroyed; Out Buildings: 5 damaged out buildings and similar structures, 188 destroyed.
13	Estimated direct and indirect economic damage	Total market value loss: $116,308,348.00; Insured losses: $420,000,000; Suppression costs: $9,230,000
14	Did it occur in conjunction with multiple fires in the country?	At the time that the Black Forest Fire broke out there were several fires already burning throughout the state and nearby; crews were also finishing clean-up of a previous night's fire in the area. However, it is not distinguished that these concurrent events had an impact on availability of response resources for the Black Forest Fire.
15	Countries involved	US only – resources from state-wide fire districts were involved
16	Brief timeline of the key events	11:54 June 11, 2013 – Fire dispatch begins to receive citizen calls reporting haze and smoke smell. Reports of smoke received from various locations.

		13:50 June 11, 2013 – Units arrive to approximate location of the reported fire. Fire is located at 13:52 and initially described as 2-3 acres in size. 14:03 June 11, 2013 – Establishment of command voiced by Chief 700, who then reports 15 acres fire size. 14:27 June 11, 2013 – Instructions for evacuation given over the phone to dispatch. 14:28-14:48 June 11, 2013 – Fire jumps roadways and threatens structures in various areas. Electric company begins cutting power. Mandatory evacuations begin. Afternoon June 11, 2013 – Additional resources begin arriving to aid in response. June 12, 2013 – Firefighters continue constructing fire lines, suppressing hot spots around structures and general firefighting. More evacuations ordered as fire size increases. June 13-14, 2013 – Active fire days. Areas under evacuation remain unchanged. June 15-17, 2013 – Cooler temperatures, less wind and higher relative humidity allows firefighters to make progress on fire lines. Some evacuation orders lifted. 65% fire containment. June 18, 2013 – Influx of returning residents. June 20, 2013 – 95% fire containment. June 21, 2013 – Incident close-out.
17	Time of initial order to evacuate and locations	14:46 June 11, 2013
18	Time when evacuation was considered completed	June 13, 2013 – Exact time not identified.
19	Deaths/Injuries	2 fatalities, unknown injuries
20	The number of people evacuated	The evacuation area covered 94,000 acres, 13,000 homes and 38,000 people.
21	The location people initially evacuated	
22	Reasons why people decided to evacuate	Mandatory order, evacuation was recommended.
23	Evacuation type	Reverse emergency notifications sent to registered phone numbers and door-to-door contact for evacuations. Residents used vehicles to evacuate.

		The Geocast system worked as designed, allowing evacuations to be ordered based on pre-identified evacuation boundaries.
24	Any drill/education/instructions on large outdoor fires provided beforehand?	
25	Personnel involved in rescue operations	Over 100 agencies were involved with disaster response. For rescue operations this included The El Paso County Special Communications Unit (SCU), The El Paso County Search and Rescue (EPCSAR) team, South Central Region Volunteer Organizations Active in Disasters (SCRVOAD) agencies, Military crews from the Air Force and Army. Additionally, the Community Animal Response Team (CART) aided in evacuating, rescuing and sheltering approximately 1,200 animals in need.
26	Did the smoke hindered significantly the evacuation because of low visibility or health problems	Not determined
27	Possible causes of issues in management operations	The Black Forest Fire After Action Report [3] highlights several possible causes of issues in management operations. Notably, there was no pre-determined common operating picture, lack of information on water resources, limited trained staff for filing Incident Action Plan forms and other operations logs. The IT infrastructure and general communications was also identified as hinderance to operations and situational awareness. Increasing teamwork across agencies and neighboring counties is necessary to alleviate some issues in management ops.
28	References	Scientific literature: [1] Fan, Y., French, M., Stading, G., Bethke, S. (2015). Disaster Response: An Examination of Resource Management in the Early Hours. Journal of Applied Business and Economics Vol. 17(2). [2] Marzzolf, G., Sega, R. (2018). An Analysis of the Emergency Fire Response to the Colorado 2012 Waldo Canyon and 2013 Black Forest Fires. Journal of Homeland Security and Emergency Management. Websites: [3] Black Forest Fire 11-21 June 2013 After Action Report/Improvement Plan. (2014). El Paso County, Colorado, Sheriff's Office. https://wildfiretoday.com/documents/Black_Forest_Fire_EPSO_AA_Report.pdf

		[4] Black Forest Fire Investigation Executive Summary 13-7655. (2014). El Paso County, Colorado Sheriff's Office. https://wildfiretoday.com/documents/BFF_Exec_Summary.pdf
29	Name/Surname/Email/Date of who filled in this template	Maria Theodori theodori@berkeley.edu August 2019

6. Chowk Bazaar, Dhaka (Bangladesh), 2019

On 20 February 2019, a fire broke out in Dhaka, Bangladesh. The fire started in a road accident between a pickup van and a private car. After the collision, the car's gas cylinder exploded. The fire then spread to a group of buildings being used to store chemicals, and quickly expanded to nearby buildings in the densely packed historic district of Chowk Bazaar in Old Dhaka. The fire left at least 80 people dead and 50 others injured.

1	Where?	Chowk Bazaar, Dhaka Old City, Bangladesh
2	When?	20-21 February 2019
3	How was the fire started?	The fire was reported to have originated due to collision between two vehicles (pickup van and private vehicle). One of which contained natural gas cylinder that exploded and quickly triggered further fires in nearby buildings
4	Initial fire size	No information available however initially it was size of a vehicle
5	Area affected (burned area)	Approximately a dozen structures
6	Fuels involved in the fire	Compressed natural gas of the vehicle, plastics, cosmetics and perfumes in the warehouse, building flammable materials
7	WUI, urban, wildland or informal settlement fires?	Urban
8	Average weather conditions	Dry humid and windy
9	Geographical highlights	Dense congested alley including ongoing wedding reception
10	Was there any fire break? (natural or artificial)	The fire broke out in a four-storey building behind the Shahi Mosque at Churihatta around 10:30pm Wednesday. The blaze was highly difficult to control because of flammable chemicals that were stored in several buildings.
11	Did the Fire Service report extreme fire behavior?	No.
12	Number of structures and infrastructures affected (damaged)	No exact information available, however, minimum of 6 structures and a restaurant sustained significant damages. Apart from multiple vehicles, electric transformer which exploded and caused further damage.
13	Estimated direct and indirect economic damage	Estimated to be of 10-20 million Taka including compensation for the victims and injured.
14	Did it occur in conjunction with multiple fires in the country?	No
15	Countries involved	Bangladesh

16	Brief timeline of the key events	Wednesday: 10pm: Traffic jam leaves Nanda Kumar Lane congested 10:30pm: Fire erupts in Haji Wahid Mansion and starts spreading in nearby buildings 10:38pm: First reports of the fire come in 11:00 pm: 16 fire-fighting units reach the site. 21 other units join around midnight Thursday: 1:15 am: Fire service says it has managed to control the fire in the adjacent buildings 3:00 am: Total 39 fire-fighting units from 13 stations continue working as the volume of fire intensify 4:00am: Two Bangladesh Air Force helicopters join rescue efforts and spray water from above to douse the fire 9:30am: Fire service estimates at least 70 people were killed 12:45pm: Dhaka South City Corporation officially calls off the rescue mission for victims
17	Time of initial order to evacuate and locations	No information available
18	Time when evacuation was considered completed	No information available
19	Deaths/Injuries	80 people died whereas there were 50+ injuries
20	The number of people evacuated	No information available
21	The location people initially evacuated	No location available
22	Reasons why people decided to evacuate	First-hand experience of witnessing fire
23	Evacuation type	Unplanned and chaotic
24	Any drill/education/instructions on large outdoor fires provided beforehand?	No information available
25	Personnel involved in rescue operations	37 units of firefighters and two air force helicopters
26	Did the smoke hindered significantly the evacuation because of low visibility or health problems	Yes, victims involved in the fire claimed pungent smell due to chemicals burning and downwind smoke caused issue during their evacuation
27	Possible causes of issues in management operations	Narrow alleys and a shortage of water in the area were cited as major hurdles faced by the firefighters while dousing the flames. First responders were delayed in reaching the site in part because nearby roads were closed for national holiday commemorations on Thursday.
28	References	https://en.wikipedia.org/wiki/February_2019_Dhaka_fire#Financial_assistance https://bdnews24.com/bangladesh/2019/02/21/old-dhaka-fire-death-toll-jumps-to-70

		https://indianexpress.com/article/world/bangladesh-fire-live-updates-death-toll-in-old-dhaka-chawkbazar-5594032/
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7. Colorado Springs fire (USA), 2012

The Waldo Canyon Fire of 2012 affected three communities in the municipality of Colorado Springs, Colorado: Cedar Heights, Mountain Shadows and Peregrine. Visible smoke from the Pike National Forest was first reported on June 22, 2012 but the fire was not located until noon on June 23. A phased evacuation of almost 30,000 residents was conducted, beginning on June 23 and ending on June 26. The two people who perished did not have a landline and thus did not receive a reverse 9-11 call or another form of evacuation notice. All 346 structures that were destroyed were located within the Mountain Shadows Community. Overall firefighting efforts were effective and significantly reduced additional potential losses.

1	Where?	Colorado Springs, Colorado, USA
2	When?	June 22, 2012 - July 10, 2012
3	How the fire was started?	Human-caused
4	Initial fire size	Initial fire size unclear, reports of smoke in Pike National Forest indicate beginning of the Waldo Canyon Fire event.
5	Area affected (burned area)	18,247 acres
6	Fuels involved in the fire	Brush, mountain shrub, grass, and trees, including oak, Pinyon-juniper, ponderosa pine, Douglas-fir, spruce and limber pine.
7	WUI, urban, wildland or informal settlement fires?	WUI
8	Average weather conditions	Hot and dry with erratic winds
9	Geographical highlights	Forested/vegetated foothills on alluvial fans along narrow drainages and ridgelines with slopes up to 45 percent.
10	Was there any fire break? (natural or artificial)	Pre-existing 1,300 m long fire break that was further widened with bulldozers from 5 m to 10 m.
11	Did the Fire Service report extreme fire behavior?	Ember showers, some embers reported to be "fist" size
12	Number of structures and infrastructures affected (damaged)	346 homes destroyed - all in the Mountain Shadows Community (MSC). Infrastructure affected includes hydrant water pressure, automatic sprinkler pressure, downed power lines and watershed contamination.
13	Estimated direct and indirect economic damage	Public assistance costs - $1,432,126; Suppression activities - $1,280,384; Insurance losses - $453,700,000
14	Did it occur in conjunction with multiple fires in the country?	Simultaneous incidents were not identified as having had an effect on response capacity for the Waldo Canyon Fire.
15	Countries involved	US only - 2 counties and multiple municipalities
16	Brief timeline of the key events	Evening June 22, 2012 - Smoke observed in Pike National Forest. 12:00 June 23, 2012 - Fire located by firefighters. 13:05 June 23, 2012 - CSFD sends tweet that

		evacuation of Cedar Heights has begun. 22:00 June 23, 2012 - Fire reaches the Cedar Heights Community in Colorado Springs. Between 22:00 June 23 and 03:00 June 24, 2012 - Fire jumps the 10 m wide fuel break. No evacuation orders issued from June 24-25. 10:52-11:32 June 26, 2012 - Residents who had already fled MSC are permitted escorted re-entry to the area to retrieve personal items. 13:39 June 26, 2012 - Pre-evacuation notice given for Evacuation Zone 3 (which includes Northern MSC) 16:21 June 26, 2012 - Mayor announces mandatory evacuation for Evacuation Zone 3 at a press conference. Official evacuation notice given via ENS a few minutes later. Sometime before 17:00 June 26, 2012 - Fire crosses the topographic divide above MSC. 17:00-18:00 June 26, 2012 - Maximum wind gusts recorded up to 94 km/h. Fire plume lean observed and fire makes contact with MSC. 18:22 June 26, 2012 - Mandatory evacuation order for Evacuation Zone 4 given via ENS. Additional zones evacuated following. 21:46 June 26, 2012 - Final mandatory evacuation order for Evacuation Zone 8 was issued via the ENS. June 27, 2012 - Peregrine Community receives direct fire exposure but is adequately protected by firefighting efforts. July 2 - July 10, 2012 - Conditions became more favourable and containment of fire declared 100% at 20:00 on July 10 .
17	Time of initial order to evacuate and locations	13:05 June 23, 2012 - Evacuation of Cedar Heights begins.
18	Time when evacuation was considered completed	Midnight June 26, 2012. A total of approximately 26,000 residents were evacuated from the City limits between 16:00 and midnight on June 26.

19	Deaths/Injuries	2 deaths
20	The number of people evacuated	28,770 residents evacuated
21	The location people initially evacuated	
22	Reasons why people decided to evacuate	52,056 people were given evacuation or pre-evacuation orders. According to call system records, reverse 9-11 calls were placed attempting to reach 118,779 people.
23	Evacuation type	Phased evacuation using pre-designated Evacuation Zones. Reverse 9-11 calls were placed to alert residents of approaching fire. Official evacuation notices were given through the ENS. Alerts were also posted on the City of Colorado Springs' website and various social media accounts. Residents fled via roadways.
24	Any drill/education/instructions on large outdoor fires provided beforehand?	
25	Personnel involved in rescue operations	Organizations involved in response to the Waldo Canyon Fire include: ● 12 community organizations ● 22 governmental organizations ● 12 facilities ● 8 emergency management entities ● 42 fire departments ● 14 law enforcement agencies ● 20 medical/behavioral entities It is noted that for evacuation specifically, CSFD, CSPD, CSOEM developed evacuation zones and Management Action Points. American Red Cross and Medical Reserve Corps established shelters at local facilities.
26	Did the smoke hindered significantly the evacuation because of low visibility or health problems	Visibility was decreased in some areas during evacuation but did not hinder efforts significantly. Smoke inhalation was cited as a major concern for first responders. Rescue personnel were given face masks and general health reviews in smoke-filled evacuation zones, and they were required to fill out smoke-exposure reports following their shifts.
27	Possible causes of issues in management operations	Delayed evacuation orders by the Mayor. The evacuation plan had been drafted only the morning that orders were given, and was enacted minutes before the first homes burned. Additional possible causes of issues with management operations include: 1. Lack of a system/process to provide notification to first responders and key

		agency representatives as command decisions are made throughout the event. 2. Lack of real-time information documentation for record-keeping and to serve as communication links across locations. 3. Limited and sometimes inefficient logistics support. 4. Lack of appropriately trained personnel for the Incident Command System. Furthermore, the NIST Case Study identifies 13 primary recommendations for improving resiliency of WUI communities, including actions to be taken pre-fire, during fire, and post-fire. Those recommendations provided on page 7-8 of Reference [1] more broadly highlight the necessity of paradigm shift in WUI planning and response.
28	References	Scientific literature: [1] Maranghides, A., McNamara, D., Vihnanek, R., Restaino, J., and Leland, C. (2015). A Case Study of a Community Affected by the Waldo Fire – Event Timeline and Defensive Actions. National Institute of Standards and Technology. https://nvlpubs.nist.gov/nistpubs/technicalnotes/nist.tn.1910.pdf [2] Paz de Araujo, Maureen & Lupa, Mary & Casper, Craig & Waters, Bret. (2014). Wildfire Evacuation Scenario in Colorado: Comparison of Adapted Four-Step Metropolitan Planning Organization Modeling Results and Planning Process Findings with Actual Experience. Transportation Research Record: Journal of the Transportation Research Board. 2430. 133-144. 10.3141/2430-14. Websites: [3] Quarels, S., Leschak, P., Cowger, R., Worley, K., Brown, R., Iskowitz, C. (2018). Lessons Learned from Waldo Canyon: Fire Adapted Communities Mitigation Assessment Team. https://fireadapted.org/wp-content/uploads/2018/06/waldo-canyon-report.pdf [4] City of Colorado Springs, Waldo Canyon Fire: June 23, 2012 – July 10, 2012, Final After Action Report (2013). Colorado Springs, CO. https://cdpsdocs.state.co.us/coe/Website/Data_Repository/Waldo%20Canyon%20Fire%20Final

		%20After%20Action%20Report_City%20of%20Colorado%20Springs.pdf [5] Brown, J. (July 2012, Updated May 2016) Waldo Canyon fire evacuation warnings failed to reach thousands. The Denver Post. https://www.denverpost.com/2012/07/10/waldo-canyon-fire-evacuation-warnings-failed-to-reach-thousands/ [6] Rocky Mountain Insurance Information Association. Wildfire. http://www.rmiia.org/catastrophes_and_statistics/Wildfire.asp
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8. Dalarna, Jämtland and Gävlaborg fires (Sweden), 2018

During the summer of 2018, there was a large number of forest fires occurring in Sweden. During just two days, the 14th and 15th July, many uncontrolled fires started which resulted in an area of 180 km^2 got burned. These fires made about 300-500 residents in the counties of Jämtland and Gävleborg evacuate their home. The situation was a consequence of dryer weather conditions than normal for the time of year.

1	Where?	Mostly in the counties of Dalarna, Jämtland and Gävleborg in Sweden. Evacuation took place in the counties of Jämtland and Gävleborg.
2	When?	The fires broke out during the 14th to 15th of July and was under control during late July.
3	How the fire was started?	Prolonged heat and drought
4	Initial fire size	Many fires occurred at the same time with a fast fire spread speed due to the weather conditions.
5	Area affected (burned area)	A burnt area of 180 km^2 as a consequence of the fires which stared at the 14th and 15th of July.
6	Fuels involved in the fire	The ground was very dry as a consequence of the long-lasting drought. Most of the burned forest consist of pine and spruce.
7	WUI, urban, wildland or informal settlement fires?	WUI
8	Average weather conditions	During the beginning of the summer 2018, a long-lasting heat wave occurred in Sweden. In combination with less rainfall than usual, it made the ground very dry.
9	Geographical highlights	The worst affected areas are located approximately 400-500 meters above sea level.
10	Was there any fire break? (natural or artificial)	Roads, rivers, lakes and others were present as natural fire breaks.
11	Did the Fire Service report extreme fire behavior?	Due to the extreme weather conditions, the fire risk was set high and the fire spread risk was set extremely high. These weather conditions contributed to a high number of large, uncontrolled fires.
12	Number of structures and infrastructures affected (damaged)	A couple of houses and vehicles were destroyed as a result of the fires. Roads of a total length of 420 km needed to be reconstructed after the fires.
13	Estimated direct and indirect economic damage	Damage to an approximate forest area of a total worth of 900 000 000 Swedish crowns was burned down due to the fires. 300 000-400 000 Swedish crowns for volunteer work. The cost of reconstructing damaged roads due to the fires was estimated to 6 000 000 Swedish crowns excluding VAT. The increased stress on the road network to transport wood was estimated to 11 000 000

		Swedish crowns.
14	Did it occur in conjunction with multiple fires in the country?	Yes.
15	Countries involved	Sweden and EU Civil Protection mechanism.
16	Brief timeline of the key events	The risk for fire events in Sweden was set very high during the summer of 2018 due to the unusual, dry weather conditions. At the 14th and 15th of July many large fires broke out in the middle of Sweden. These fires caused a burned area of 180 km^2 (total burned area due to the fire season was 210 km^2). These fires required several resources and ERCC came to Sweden to help, The Swedish Red Cross coordinated volunteers. Due to the fires, residents of the counties of Jämtland, Gävleborg and Dalarna was threatened to evacuate their homes. Evacuation was performed in parts of the counties of Jämtland and Gävleborg. In late July, the fire risk was still extremely high, but the fire situation was stable, and the evacuated residents could return home.
17	Time of initial order to evacuate and locations	During week 29 (16th-22th of July), hundreds of people were given evacuation orders due to the large fires that started the 14th and 15th of July.
18	Time when evacuation was considered completed	When it was safe for evacuees to return home varied between the 22th and 30th of July depending on where they had evacuated from.
19	Deaths/Injuries	No one was seriously injured due to the fires.
20	The number of people evacuated	Between 300 and 500 people was evacuated.
21	The location people initially evacuated	Unknown
22	Reasons why people decided to evacuate	Mandatory order
23	Evacuation type	Mostly by cars on roads.
24	Any drill/education/instructions on large outdoor fires provided beforehand?	Unknown
25	Personnel involved in rescue operations	The Swedish Civil Contingencies Agency (MSB) was the organisation that had the overall responsibility for the rescue work. The special fire risk organisation had the responsibility to release resources due to working with ongoing happenings, coordinate and support actors and send updates about the current situation. The municipalities had the responsibility of their own fire fighters. Volunteers, mostly coordinated by the Swedish Red Cross, helped where there was a lack of resources. The county administration boards were reasonable for the cooperation between fighter fighters from different

		districts, volunteers and so on. The Emergency Response Coordination Centre (ERCC), provide a lot of resources from other countries. The EU Civil Protection Mechanism was activated.
26	Did the smoke hindered significantly the evacuation because of low visibility or health problems	Some roads were blocked.
27	Possible causes of issues in management operations	The county of Gävleborg encountered difficulties in the initial phase, since the fire situation was too extreme to handle with their own resources. The municipalities have limited knowledge about the systems that provided information on the ongoing crisis. On a local level, leader capacity was limited. Several recuse services had difficulties to get in touch with MSB in the initial phase.
28	References	Björklund, J.-Å. (2019). Skogsbränderna sommaren 2018 (SOU 2019:7). Stockholm, Sweden: Justiedepartementet. MSB. (2018). MSB:s arbete med skogsbränderna 2018 - Tillsammans kunde vi hantera en extrem skogsbrandssäsong. Karlstad: MSB.
29	Name/Surname/Email/Date of who filled in this template	Hahlin / Johanna bra14jfr@student.lu.se 2019-05-31

9. Formosa Fun Coast –Color Play Asia Party fire (Taiwan), 2015

An outdoor stage fire broke out in Bali District, New Taipei City, Taiwan, on June 27th 2015. The fire spread instantly to the entire swimming pool site and injured 499 people, resulting in 15 dead. A total of approximately 4000 people had been evacuated. People evacuated with panic until the Mass casualty incident (MCI) system was employed. All departments worked together to conduced medical evacuation after 4 hours after the start of the fire. This fire may be the only outdoor 'dust burning' that led to mass casualty in the world before 2021.

1	Where?	Bali District, New Taipei City
2	When?	2015/6/27 20:30-2015/6/28 00:00 (Until the final casualty sent to hospital)
3	How the fire was started?	Mass corn flour ignited by stage spotlight
4	Initial fire size	The northwest side of the stage in the Happy Great Barrier Reef area of Formosa Fun Coast
5	Area affected (burned area)	500 m^2
6	Fuels involved in the fire	Corn flour (Mass used for the color party)
7	WUI, urban, wildland or informal settlement fires?	Urban
8	Average weather conditions	Temperature 30℃ to 37℃, with humidity 58 to 67 %.; average wind speed 2.9m/s, maximum can be 10.9m/s.
9	Geographical highlights	Near coast, swimming pool without water.
10	Was there any fire break? (natural or artificial)	No.
11	Did the Fire Service report extreme fire behavior?	Quick fire spread, Mass casualty incident (MCI).
12	Number of structures and infrastructures affected (damaged)	A stage and empty swimming pool were engulfed by fire in 40 seconds.
13	Estimated direct and indirect economic damage	Estimated NTD 0.765 billion damage (US$24 million) for National Health Insurance, for the first year after the fire. The Formosa Fun Coast closed down permanently.
14	Did it occur in conjunction with multiple fires in the country?	No.
15	Countries/regions involved	Taiwan
16	Brief timeline of the key events	20:30 Fire started 20:33 reported to Emergency and Rescue Command Center, New Taipei City, dispatched adjacent fire brigades. 20:44 Incident Command Post was established and asked help from fire departments in the nearby area. 20:47 On-site triage classification for MCI

		21:30 Army arrived to evacuate the casualties. 23:58 the final patient was sent to hospitals for post fire care.
17	Time of initial order to evacuate and locations	No information.
18	Time when evacuation was considered completed	June 25 midnight, when the final casualty was sent to hospital.
19	Deaths/Injuries	15 deaths 484 injuries. Among the injuries, 41 people have burned and scald with an area of more than 80%, and 240 people with an area of 40-80%.
20	The number of people evacuated	On foot but most of them were sent to hospital.
21	The location people initially evacuated	Near site, observing a fire, shelter but the whole swimming pool and stage area were engulfed by fire immediately.
22	Reasons why people decided to evacuate	Fire approaching and realized that fire spread dramatically.
23	Evacuation type	On foot, ambulance of the fire brigade and hospitals nearby.
24	Any drill/education/instructions on large outdoor fires provided beforehand?	No. The corn flour induced outdoor fire was the first time ever in all the world, the outdoor parties were thought to be safe from fire, but the AHJs have established some measures for similar large outdoor events.
25	Personnel involved in rescue operations	Professional fire brigade, firefighters, armies, Emergency medical technicians (EMTs). (Including 144 ambulances, 88 emergency relief vehicles, 1,504 emergency relief personnel)
26	Did the smoke hindered significantly the evacuation because of low visibility or health problems	No. But the high density of people lowered the speed when the fire occurred.
27	Possible causes of issues in management operations	Disaster medical evacuation routes were not useful because the MCI condition was out of the assumed possible fire conditions. High density of personnel in the event (the area was designed for 1,000 people but more than 4,000 people in the fire incident) Use of CO_2 fire extinguishers to extinguish the corn flour fire was inadequate.
28	References	Clips or News of fire: https://www.youtube.com/watch?v=7CQx1N9-rgk https://www.youtube.com/watch?v=YdniSvXA3PU https://tw.appledaily.com/headline/20150628/LNTWQ3ZTKYBOQHC2S6LYSO5N5I/ Websites: https://www.mohw.gov.tw/cp-2628-19100-

		1.html https://www.nfa.gov.tw/cht/index.php?code=list&flag=detail&ids=21&article_id=2748
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10. Gatlinburg fire (USA), 2016

On the day of November 28, 2016 the City of Gatlinburg located in Sevier County, Tennessee was devastated by the Chimney Tops 2 Fire. A total of 2,545 structures and 14 lives were lost in the event, which posed unprecedented challenges for first responders beginning several days prior at the time of initial fire discovery in inaccessible terrain of the Great Smoky Mountains National Park. Strong winds allowed the fire to grow exponentially between November 27th and 28th, prompting mandatory evacuation of over 14,000 residents and tourists in Gatlinburg and neighbouring areas of Sevier County. Failure of communications systems caused several delays in messaging and confusion across responding agencies, however, lack of overall preparedness and extreme weather conditions are attributed as the main reasons for the high losses.

1	Where?	Gatlinburg, Tennessee, USA
2	When?	November 23, 2016 - December 5, 2016
3	How the fire was started?	Human-caused
4	Initial fire size	1.5 acres
5	Area affected (burned area)	Over 17,000 acres.
6	Fuels involved in the fire	Deciduous forest, pine stands
7	WUI, urban, wildland or informal settlement fires?	WUI
8	Average weather conditions	Extreme winds, unprecedented drought
9	Geographical highlights	Inaccessible and dangerous terrain. Vertical cliffs and narrow, rocky edges
10	Was there any fire break? (natural or artificial)	Natural and pre-existing park trails and drainage bottoms, creeks, rivers
11	Did the Fire Service report extreme fire behavior?	Firestorm, spotting, distinct smoke column visible from surrounding towns
12	Number of structures and infrastructures affected (damaged)	2,545 structures lost Infrastructure affected includes trails, roads, guard rails, signs, power lines and water resources.
13	Estimated direct and indirect economic damage	Initial estimates over $500,000,000 in damages, over $7,500,00 in suppression costs, also loss of tourism, jobs
14	Did it occur in conjunction with multiple fires in the country?	Yes, at approximately 18:00 on November 28 the fire escaped the Great Smoky Mountains National Park and merged with other fires, collectively known as the Sevier County Fires. Crews from various agencies involved struggled to contain the overall wildfire.
15	Countries involved	US only
16	Brief timeline of the key events	17:19 November 23, 2016 - Discovery of the fire. After evaluation by incident commander it is determined unsafe to take action at the time due to dangerous terrain. November 25, 2016 - Fire is still smouldering, around 2 acres in size. No direct attack on the fire but scoping of box suppression strategy. Public trails are closed.

		03:00 November 26, 2016 - Warning of high wind forecast comes in. Fire grows to approximately 8 acres and still no direct attack by fire crews. Afternoon November 27, 2016 - Increase in fire activity. Air resources ordered, helicopters make drops. Infrared Multi-Mission Aircraft shows fire is 35 acres. 07:30 November 28, 2016 - Spot fire jumps roadway - two spot fires ignited from as far as 0.5-1 mile away from the main fire. Fire size grows exponentially to 200+ acres due to strong winds over the previous night. 11:52 November 28, 2016 - Gatlinburg Fire Department activates a county-wide Wildland Task Force. 12:00 November 28, 2016 - Voluntary evacuation notices delivered to Mynatt Park subdivision of Gatlinburg. 15:46 November 28, 2019 - The City of Gatlinburg begins to experience power outages. 17:45 November 28, 2016 - A brush fire is reported inside the City of Gatlinburg. 18:00 November 28, 2016 - The fire leaves the Great Smoky Mountains National Park. Strong winds continue and are more onerous than initially predicted. 18:11 November 28, 2016 - Mandatory evacuations begin. 20:30 November 28, 2016 – A total evacuation of the Gatlinburg area was ordered but communication system outages cause delay of public broadcast. 21:00 November 28, 2016 – Evacuation notice sent to mobile devices and to the Emergency Alert System. Early morning November 29, 2016 - 3 people in Gatlinburg and 11 people in Sevier County reported dead. Conditions improved substantially with reduced winds and rain.

		December 5, 2016 - Firefighting operations end.
17	Time of initial order to evacuate and locations	12:00 November 28, 2016 – Voluntary evacuation notices 18:11 November 28, 2016 - Mandatory evacuations begin
18	Time when evacuation was considered completed	About 22:00 on November 28, 2016
19	Deaths/Injuries	14 deaths, over 100 injuries
20	The number of people evacuated	Over 14,000 people in Gatlinburg and neighbouring areas of Sevier County
21	The location people initially evacuated	
22	Reasons why people decided to evacuate	Unknown
23	Evacuation type	Evacuation teams conducted systematic door-to-door evacuation operations. Messages were attempted to be delivered via public broadcast and emergency notification systems but loss of communication infrastructure caused delays. Manual flood warning sirens system was utilized on two occasions to provide additional notification in the downtown area of Gatlinburg to evacuate. Mandatory evacuation notice was given via the sirens. Evacuees fled via roadways.
24	Any drill/education/instructions on large outdoor fires provided beforehand?	
25	Personnel involved in rescue operations	More than 35 deputies from police, fire and mass transit agencies assisted in coordinated evacuation efforts. Local public works and utility organizations also assisted in clearing roadways to aid in the evacuations.
26	Did the smoke hindered significantly the evacuation because of low visibility or health problems	There was heavy smoke which created "extreme threats" to the rescue personnel conducting the evacuation effort and caused continuous changes in evacuation routing. Visibility and breathing were impaired due to the smoke; hearing was also limited due to the high winds and the sound of the fire. Additionally, the smoke hindered aerial firefighting and surveillance operations.
27	Possible causes of issues in management operations	The following post-event findings indicate priority issues in event management operations that were most likely to have led to a different outcome of the event, had they been previously addressed. 1. Situational preparedness weaknesses at Great Smoky Mountains National Park as well as with its adjacent stakeholders

		2. Lack of a formal fire management officer mentoring/development program 3. Lack of an agency administrator mentoring/development program for managing wildland fire. 4. Inconsistencies between various entities' fire management programs.
28	References	Scientific literature: [1] Daniel, C.E., Rodrigues, A.M. (2017). Disaster Relief Logistics: An Academic Framework Evaluation of the 2016 Great Smoky Mountain Wildfires. University of Tennessee, Knoxville. https://trace.tennessee.edu/cgi/viewcontent.cgi?referer=https://www.google.com/&httpsredir=1&article=3176&context=utk_chanhonoproj Websites: [2] Guthrie, V., Finucane, M.J., Keith, P.E., Stinnett, D.B. (December 2017). After Action Review of the November 28, 2016, Firestorm. ABSG Consulting Inc. http://gatlinburgtn.gov/pdf/planning/Wildfire/AAR%20of%20the%20Nov%2028%202016%20Firestorm.pdf [3] Chimney Tops 2 Fire Review: Independent Fire Review Report. National Park Service. U.S. Department of the Interior, Division of Fire and Aviation. https://wildfiretoday.com/documents/ChimneyTops2Report.pdf [4] Chimney Tops 2 Fire. National Park Service. 2016. https://www.nps.gov/grsm/learn/chimney-tops-2-fire.htm [5] Barrett, K. Tennessee Wildfires: Now Is the Time to Plan. Headwaters Economics. https://headwaterseconomics.org/wildfire/homes-risk/wildfires-now-is-the-time-to-plan/ [6] Culver, A. (December 2016). Timeline: Gatlinburg wildfires. WATE Local News. https://www.wate.com/news/local-news/timeline-gatlinburg-wildfires/792912856
29	Name/Surname/Email/Date of who filled in this template	Maria Theodori maria.theodori@arup.com June 2019

11. Gosper's Mountain fire (Australia), 2019-2020

Gospers Mountain fire became famous as Australia's first "mega-blaze". It burned for 79 days and remains seared in the memory of all who feared and fought it. The statistics are staggering. Over a million hectares burned; a hundred homes destroyed on Sydney's doorstep. At 10:55am on October 26, lightning strike number 19,068, lasting just 518 milliseconds, fell on the eastern edge of the dying storm. That lightning bolt hit a stringybark tree deep in the park at Running Stream, 15 kilometers from the nearest road. Record dryness of fuel and wind gusts of more than 80kph fanned the flames, but as the blaze remained isolated, it was not deemed a priority while many other fires remained the priority. Afterwards, unfavorable weather condition, lack of resources due to other fire limits the containment which allowed this fire to become mega-fire.

1	Where?	Gosper's Mountain, New South Wales, Australia
2	When?	26/10/2019 – 12/01/2020
3	How was the fire started?	The Gospers Mountain fire started as a result of lightning strikes in a very remote bushland in the Wollemi National Park on 26 October 2019.
4	Initial fire size	It burnt about 65 ha in less than two and a half hours after it was ignited.
5	Area affected (burned area)	1,071,740 ha
6	Fuels involved in the fire	Eucalyptus stringybark
7	WUI, urban, wildland or informal settlement fires?	Wildland
8	Average weather conditions	A decade of below-average rainfall resulted in an extraordinarily dry landscape making eucalyptus gumtree vegetation susceptible to ignition. Wind gusts of more than 80kph fanned the flames.
9	Geographical highlights	The Wollemi park's craggy gullies and shady south-facing slopes.
10	Was there any fire break? (natural or artificial)	Natural firebreaks were present
11	Did the Fire Service report extreme fire behavior?	Yes, strong wind coupled with a dry landscape made the situation suited for megafires
12	Number of structures and infrastructures affected (damaged)	2400 destroyed, 945 homes have been damaged
13	Estimated direct and indirect economic damage	No accurate estimate is provided, however, the overall cost of various devastating wildfires in Australia for 2019-20 which included the current case is estimated to ~AUD 103 billion.
14	Did it occur in conjunction with multiple fires in the country?	Yes
15	Countries involved	Australia, New Zealand, Canada and the United States
16	A brief timeline of the key events	At 10:55 am on October 26, strike number 19,068, lasting just 518 milliseconds, fell on the eucalyptus stringybark tree which was at the eastern edge of the dying storm. That lightning bolt hit a stringybark tree deep in the park at Running Stream, 15 kilometers from the nearest road.

		NPWS dispatched a helicopter with a Remote Area Firefighting Team (RAFT), but strong winds stopped them winching down. It burnt about 65ha in less than two and a half hours after it was ignited. Wind gusts of more than 80kph fanned the flames, but as the blaze remained isolated, it was not deemed a priority. By the next morning, it had torn through 521ha of land and had a perimeter of 3km. On November 5, as firefighters were preparing for a long campaign against the remote blaze, the weather changed, and rain came down over the fire ground. Although falls totalled just 10 millimetres, "line scans" taken from surveillance aircraft detail the dramatic change. But on November 7, it began the first of two extraordinary runs, racing through 12km of bush in a day. On November 12, a "catastrophic" fire warning was issued for Greater Sydney, the Central Coast and other parts of the state. In late November, Superintendent Hodges and her team settled on a strategy to use the largely dry MacDonald River as a containment line 20km east of the fire front. By November 24, storm clouds again gathered over the Wollemi. Across November 25 and 26, lightning-sparked several new blazes beyond the containment line. December 6: Several small fires had already been swallowed up when five of the blazes merged. The Gospers Mountain fire merged with Little L Complex and Paddock Run fire. That afternoon, the fire connected with Three Mile and Thompsons Creek fire and the "Mega Blaze" was born. December 6: 6 pm NSWRFS received an emergency call about an abandoned car near Colo Heights and had to abandon their backburn in middle. The search and rescue with police lasted for 17 hours as a couple evacuated swimming on

		inflatable lilos through Colo River. However, after that wind changed and the backburn process became unfavourable. With catastrophic conditions again forecast for December 21, Premier Berejiklian declared the second State of Emergency. While December 21 was the peak of the blaze, the fire continued to burn, scorching an astonishing 1,071,740ha of land. Gospers Mountain was finally declared contained on January 12, but it still had a surprise in store. The site came under another extreme flooding event which eventually extinguished all minor blaze on February 10.
17	Time of initial order to evacuate and locations	No evacuation orders were declared in the public domain however emergency was declared with evacuation route and logistics to refuge centre were mapped out and provided to the community member who wished to evacuate. The fire was constrained due to the river and many people evacuated as per their perceptions of the ground situation. Extensive preparations were made to evacuate thousands of residents from Sydney's Hornsby and Hills districts.
18	Time when the evacuation was considered completed	Not applicable
19	Deaths/Injuries	26 deaths
20	The number of people evacuated	No information available
21	The location people initially evacuated	Refuge centres marked by NSW RFS and State Government. Details of refuge location not available publicly.
22	Reasons why people decided to evacuate	Based on Australia's "Stay and Defend or Leave early policy".
23	Evacuation type	Mostly road transport, however, a couple evacuated through river stream as their car was stuck between approaching fire and backburn process started by NSW RFS on Dec. 6.
24	Any drill/education/instructions on large outdoor fires provided beforehand?	NSW RFS personnel are experienced firefighting group, however, during peak fire day around 2500-3000 firefighters (including volunteer firefighters) were deployed who may lack sufficient knowledge.
25	Personnel involved in rescue operations	Personnel from NSW RFS, Fire and Rescue NSW and the National Interagency Fire Center. This massive campaign involved thousands of NSW RFS members both on the ground and in IMTs, as well as crews from FRNSW, NPWS and interstate and international agencies.

26	Did the smoke hindered significantly the evacuation because of low visibility or health problems	No, there is no concrete evidence available it affected the evacuation, however, it affected firefighters in containing the fire. A storm went through the area on the night of 25 November, dropping a bolt or two of lightning into North Black Range and Currowan. At about 1100hrs the next day, there was smoke sighting near North Black Range Fire Trail, a track on the Western side of the Tallaganda National Park. A significant smoke column noted and the campaign didn't have sufficient resources to make a meaningful early attack on the fire, as there were huge amounts of fuel on the ground and thick Lomandra grass everywhere.
27	Possible causes of issues in management operations	Less manpower to contain various fires erupted across the State and nearby States. Thus, the only fires which were closer to WUI were being targeted which resulted in the current case becoming humongous.
28	References	https://www.rfs.nsw.gov.au/__data/assets/pdf_file/0007/174823/Bush-Fire-Bulletin-Vol-42-No1.pdf https://www.abc.net.au/news/2020-07-27/gospers-mountain-mega-blaze-investigation/12472044?nw=0 https://www.centralwesterndaily.com.au/story/6578605/after-79-long-days-the-gospers-mountain-bushfire-is-finally-under-control/ https://www.smh.com.au/national/nsw/the-monster-a-short-history-of-australia-s-biggest-forest-fire-20191218-p53l4y.html https://www.thehindu.com/news/international/australia-fire-slideshow/article30468156.ece/photo/1/ https://www.abc.net.au/news/2020-07-28/gospers-mountain-mega-blaze-investigation-video/12494510
29	Name/Surname/Email/Date of who filled in this template	Rahul Wadhwani Rahul.wadhwani@live.vu.edu.au 27/03/2021

12. Kemerovo fire (Russia), 2018

The Winter Cherry Shopping complex of Kemerovo, Russia impacted by a huge fire event that happened on 25th March 2018. The evacuation and the rescue operations became extremely difficult for hours because of the dense smoke and the heat. The failures of the fire alarming system and the blockages of emergency exits made the situation more devastating causing 64 deaths including 41 children. The investigations suspect the initial fire source is a cigarette lighter that ignited foam rubber in the children play area of the complex.

1	Where?	Winter Cherry Complex, Kemerovo, Russia
2	When?	25/03/2018
3	How the fire was started?	Suspect that a cigarette lighter caused the initial ignition of foam rubber in a trampoline room
4	Initial fire size	Around the size of the children's play area of the complex
5	Area affected (burned area)	Approximately 1600 m^2
6	Fuels involved in the fire	Foam rubber, Structural materials
7	WUI, urban, wildland or informal settlement fires?	Urban
8	Average weather conditions	-2 ^{0}C to -4 ^{0}C temperature, Humidity 93%, Wind 10 km/h south. Snow flurries and passing clouds.
9	Geographical highlights	The city lies along the Tom river
10	Was there any fire break? (natural or artificial)	No
11	Did the Fire Service report extreme fire behavior?	Flame heat has risen to 700 ^{0}C. Firefighters could not enter the fire area for 12 hours because of the extreme heat and the smoke.
12	Number of structures and infrastructures affected (damaged)	Affected the 4th and 3rd floor of the Winter Cherry complex
13	Estimated direct and indirect economic damage	Indirect: The shopping complex company would pay $52 000 for each person killed The regional government would give $ 17 500 for each victim.
14	Did it occur in conjunction with multiple fires in the country?	No
15	Countries involved	Russia
16	Brief timeline of the key events	4.00 pm – the fire started at the children's play area on the 4th floor. 4.10 pm- Kemerovo emergency ministry received information about the smoke in the shopping mall. It took 12 hrs to firefighters enter the building due to smoke and the heat. No information about the time of the fire spread for areas such as cinema, play area etc. and time of the evacuation.
17	Time of initial order to evacuate and locations	No indication of a fire alarm or an order to evacuate
18	Time when evacuation was considered completed	No information available

19	Deaths/Injuries	64 died (41 children), 79 non-fatal injuries (12 were hospitalized) +200 animals died in a petting zoo at the complex. Approximately 30 people were stuck in the building not having the chance to survive
20	The number of people evacuated	129
21	The location people initially evacuated	No information available
22	Reasons why people decided to evacuate	Seeing the black pungent smoke
23	Evacuation type	On Foot, People used an alternate exit because of the blockage of fire exits.
24	Any drill/education/instructions on large outdoor fires provided beforehand?	No information available
25	Personnel involved in rescue operations	549 (86 units of equipment and two aircraft) from the Ministry of Emergency Situations (EMERCOM) of Russia.
26	Did the smoke hindered significantly the evacuation because of low visibility or health problems	Yes, people could not evacuate fastly because of the filling of smoke in the floors. A few jumped from windows to escape from the fire after seeing the blaze
27	Possible causes of issues in management operations	The fire alarm system had been switched off by a security guard for an unknown reason. There were 3 cinemas filled with children and parents. The doors of the cinemas were closed at that time and no one opened them for people to escape. There was not proper help from the staff and the guards of the shopping complex to the people who were trapped in the fire and smoke.
28	References	Academic: H. Daher, S. HoseinDoost, B. Zamani, and A. Fatemi, "A Novel Approach for Developing Emergency Evacuation Plans," in 2020 10th International Conference on Computer and Knowledge Engineering (ICCKE), 2020, pp. 035-041: IEEE. S. Svetlana, "Research methods of visual mass-media content," in Proceedings of the Sixth International Conference on Technological Ecosystems for Enhancing Multiculturality, 2018, pp. 574-579. Other: A. S. Anastasia Ptichkina, Victoria Koryakovskaya, Danil Zhikharev, Denis, Bernikov, Ekaterina

		Lokaeva, Maria Ustinova, Nadezhda Klenina, Natalya,Korotonozhkina, Rima Abu Zaalan, Tatyana Dobrovolskaya, Tatyana Saraseko "Transparency issues of shopping centers: Who is responsible for customers safety? ," no. Center for Anti-Corruption Research and Initiatives, Ministry of Justice of the Russian Federation, 2019. "Past Weather in Kemerovo, Russia — March 2018." "Emergency Plan of Action Final Report-Russia: Fire in Kemerovo Shopping Centre," no. Interational Federation of Red Cross and Red Crescent Societies, 9 Jan 2019 2019. S. Ayers, "Tell everyone that I loved them.' A message from one of at least 64 presumed dead in Siberian fire," Los Angelese Times, Newspaper 26 March 2018 2018. W. S. Moore-Bridger, "Kemerovo fire in Russia: Harrowing images show aftermath of 700C inferno which left 64 people dead, including children," Evening Standard Newspaper 26 March 2018 2018. M. I. Hilary Clarke, "Fire exits blocked in Russian shopping mall devastated by blaze," CNN 27 March 2018 2018.
29	Name/Surname/Email/Date of who filled in this template	Amila Wickramasinghe p.wickramasinghe@live.vu.edu.au 11/07/2021

13. Kincade fire (USA), 2019

1	Where?	Sonoma County, California, U.S.A.
2	When?	2019/10/23 21:27 – 2019/11/06 19:00
3	How the fire was started?	Under Investigation
4	Initial fire size	Electrical transmission line
5	Area affected (burned area)	31468 ha
6	Fuels involved in the fire	Vegetation, structures (Commercial & Residential)
7	WUI, urban, wildland or informal settlement fires?	WUI
8	Average weather conditions	Wind speeds up to 80 km/h with gust up to 122 km/h blowing in a NE direction. Humidity levels between 10 – 15% and average temperatures around 21 °C
9	Geographical highlights	Wildland mountainous area NE of Geyserville (urban settlement). Creeks with average widths of 50ft.
10	Was there any fire break? (natural or artificial)	Creeks ranging in width from 20 – 50 ft. Tar roads of 6 – 8 ft (2 lanes) and lakes in areas surrounding Geyerville.
11	Did the Fire Service report extreme fire behavior?	Firebrands Sustained winds of 49 mph and gusts to 75 mph on October 23 at the Healdsburg Hills Sustained winds of 50 mph and gusts to 71 mph on October 23 at Pine Flat Road Sustained winds of 61 mph and gusts to 68 mph on October 23 at Mt St. Helena Sustained winds of 78 mph and gusts to 103 mph on October 27 at Pine Flat Road Sustained winds of 67 mph and gusts to 85 mph on October 27 at Mt St. Helena Sustained winds of 38 mph and gusts to 65 mph on October 27 at the Healdsburg Hills Wind gusts of 55 mph at Pine Flat Road on October 30 and a relative humidity of 10% Wind gusts of 52 mph at Mt St. Helena on October 30 and a relative humidity of 13%
12	Number of structures and infrastructures affected (damaged)	374 structures destroyed 60 structures damaged
13	Estimated direct and indirect economic damage	$ 620 million
14	Did it occur in conjunction with multiple fires in the country?	No
15	Countries involved	United States of America
16	Brief timeline of the key events	10/23 21:24 – Fire started in northeast of Geyersville 21:57 – Fire first reported

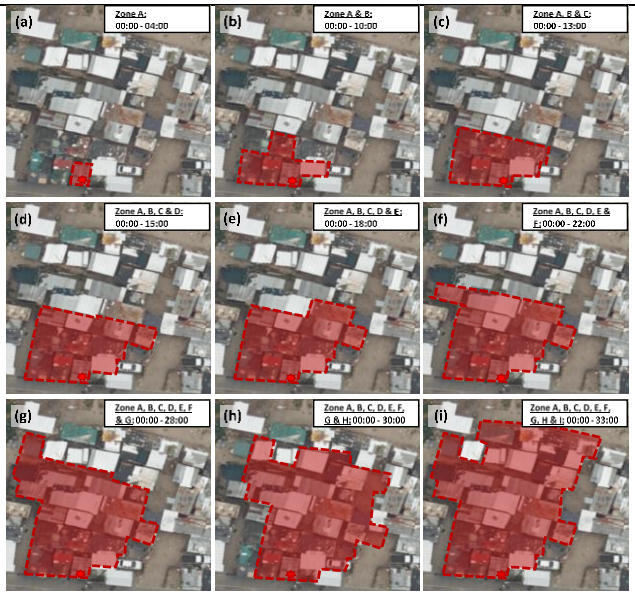
		Evacuations affecting 874 people 10/24 Local Emergency proclamation issued Evacuations affecting 1655 people Fire at 10000 acres (19:00) 10/26 1168 sheltered Evacuations affecting 83764 people 10/27 Evacuations affecting 186651 people 10/29 Evacuations affecting 135 485 people 3305 sheltered Fire at 74324 acres (02:00) 10/31 Evacuations affecting 3381 people Fire at 76825 acres
17	Time of initial order to evacuate and locations	23 October 2019 11: 34 pm Geysersville
18	Time when evacuation was considered completed	All ten zones in Sonoma County was evacuated but due to lack of communication between different emergency entities, complete evacuation is not known.
19	Deaths/Injuries	0 deaths 4 injuries
20	The number of people evacuated	186651
21	The location people initially evacuated	Geyersville
22	Reasons why people decided to evacuate	Mandatory order
23	Evacuation type	Not issued
24	Any drill/education/instructions on large outdoor fires provided beforehand?	Investments after 2017 Tubbs fire in the same area allowed for more rapid response and community awareness, making evacuations and firefighting operations easier. Routine alert and warning testing Fire strike teams positioned prior to fire
25	Personnel involved in rescue operations	2 firefighter crews (Butte Fire Center) 1 strike team 5 fire engines National guard
26	Did the smoke hindered significantly the evacuation because of low visibility or health problems	This is not specified but it is noted that smoke plumes made aerial suppression difficult.
27	Possible causes of issues in	Not issued

	management operations	
28	References	2019 Kincade Fire: After Action Report Sonoma Operational Area and the County of Sonoma Department of Emergency Management
29	Name/Surname/Email/Date of who filled in this template	Jacques Andre De Beer 6/7/2021

14. Langa fire (South Africa), 2019

A fire started at around 10:30 September 30 2019, in an informal settlement in Langa, Cape Town, South Africa. The fire was recorded by a CCTV camera capturing the entire fire event. The lack of water supply and the inherent conditions observed in informal settlements hindered the firefighters' operations. In 33 minutes, the fire spread to approximately 40 dwellings. Residents evacuated with their belongings as well as help others, and firefighting. The fire was extinguished approximately 1 hr after the fire started.

1	Where?	Langa, Cape Town, South Africa
2	When?	2019/ September /30 between 10:30-13:00
3	How the fire was started?	Power surge due to a faulty plug socket
4	Initial fire size	No information
5	Area affected (burned area)	550 m^2
6	Fuels involved in the fire	Structures (informal settlements)
7	WUI, urban, wildland or informal settlement fires?	Informal settlement fires
8	Average weather conditions	Wind speed 24 to 28 km/h at nearby weather station but wind around the fire may be different due to mountain. Wind direction shifted. Temperature between 15°C and 20°C, with humidity 49 to 56 %.
9	Geographical highlights	Informal settlement area, next to the highway, flat terrain
10	Was there any fire break? (natural or artificial)	Road at the south of the settlement and no presence of combustible material at the north of the settlement
11	Did the Fire Service report extreme fire behavior?	No. Average linear fire spread 1.2 m/min (0.4 to 2.3 m/min
12	Number of structures and infrastructures affected (damaged)	40
13	Estimated direct and indirect economic damage	R15.000 (USD 1020)
14	Did it occur in conjunction with multiple fires in the country?	No
15	Countries involved	South Africa
16	Brief timeline of the key events	September 30th 10:00-10:30 The fire started 10:35 Residents' bucket brigade 10:38 Phone call received 10:45 First fire engine at the scene 11:05 Fire reached the back of the settlement 11:23 Fire extinguished.

		
17	Time of initial order to evacuate and locations	No information
18	Time when evacuation was considered completed	No information as most of residents stayed at the site
19	Deaths/Injuries	0/0
20	The number of people evacuated	Around 90 displaced
21	The location people initially evacuated	Near site, observing the fire
22	Reasons why people decided to evacuate	Fire approaching their dwellings
23	Evacuation type	Not issued
24	Any drill/education/instructions on large outdoor fires provided beforehand?	No
25	Personnel involved in rescue operations	6 fire engines, 2 water tenders, 1 rescue vehicle
26	Did the smoke hindered significantly the evacuation because of low visibility or health problems	Black then grey smoke was seen
27	Possible causes of issues in management operations	Narrow roads, flammable dwellings, inadequate water supply
28	References	N. Flores Quiroz, R. Walls, A. Cicione, M. Smith, Fire incident analysis of a large-scale informal settlement fire based on video imagery, Int. J. Disaster Risk Reduct. 55 (2021). doi:10.1016/j.ijdrr.2021.102107.
29	Name/Surname/Email/Date of who filled in this template	Natalia Flores nataliaflores@sun.ac.za February

15. Lungeli fire (India), 2021

The fire is supposed to be ignited due to stubble burning practice by villagers which got out of control in one of the hills near Lungeli town, Mizoram, India. The fire spread quickly to 10 village council to reach Lawngtlai town which is ~30 km away Lungeli town in 48 hours. Approximately, 427.88 hectares of Lungeli town is burned by the fire. No information of affected/burned area is available for Lawngtlai town. Local residents were the first responder to the incidents to douse the fires. Then, Mizoram government firefighters supported by Assam Rifles and Border Security Forces including local volunteer group were involved. After receiving an SOS message from Mizoram Government i.e. after 36 hours Indian Air Force and Prime Minister Office (Central Government) was involved which included two Mi-17v5 helicopters to douse the fires.

1	Where?	One of the hills near Lungeli town in Mizoram, India
2	When?	24-27 April 2021
3	How was the fire started?	The investigation is still ongoing however it is suspected to start due to jhum cultivation (or stubble burning) practice
4	Initial fire size	The fire started in one of farm in the hill and quickly spread to nearby vegetation
5	Area affected (burned area)	No detailed information is available, however, the fire spread quickly to 10 village council to reach Lawngtlai town which is ~30 km away Lungeli town in 48 hours. Approximately, 427.88 hectares of Lungeli town is burned by the fire. No information of affected/burned area is available for Lawngtlai town.
6	Fuels involved in the fire	Crops, vegetation, structures
7	WUI, urban, wildland or informal settlement fires?	Wildland and WUI
8	Average weather conditions	Dry weather and strong winds were observed
9	Geographical highlights	Hilly terrain with mostly vegetative coverage including crops. The State of Mizoram has a vegetation coverage of ~86% area.
10	Was there any fire break? (natural or artificial)	Artificial. National Highway 2 and 302 are present.
11	Did the Fire Service report extreme fire behavior?	The quick-fire spread due to dry fuels and strong winds including presence of firebrands during fire propagation
12	Number of structures and infrastructures affected (damaged)	Some structures were burnt, most of the WUI structures were saved. However, many livestock's perished. In one of the locality, Bungtlang South, the fire completely destroyed fourteen houses, killed many livestock's with no injury to civilians. However, no exact count is available for other areas or combined fire.
13	Estimated direct and indirect economic damage	No information available
14	Did it occur in conjunction with multiple fires in the country?	No.

15	Countries involved	India.
16	Brief timeline of the key events	The fire sparked around 7 a.m. on Saturday (24/04/2021) and it is suspected that it was initiated while some villagers were trying to clear the hills near Lunglei town possibly for shifting cultivation which is a common practice. The fire went on to spread to Lunglei town and villages in the adjoining district of Lawngtlai late on Sunday night. The situation escalated as it transformed into a raging bushfire spreading to ten village council areas in and around Lunglei town. It then spread to three rural development blocks of the Lawngtlai district by Sunday night.
17	Time of initial order to evacuate and locations	No detailed information is available, however, when the fire approached WUI settlement, local and State administration carried out the evacuation
18	Time when the evacuation was considered completed	No information is available
19	Deaths/Injuries	21 injuries and 0 deaths
20	The number of people evacuated	~6000-8000
21	The location people initially evacuated	No information available however people took shelter in nearby area or government designated shelter location
22	Reasons why people decided to evacuate	Fire and smoke approaching their dwellings and evacuation order by local administration
23	Evacuation type	Partially chaotic and partially organised based on the input from video of news outlet and report
24	Any drill/education/instructions on large outdoor fires provided beforehand?	No information is available
25	Personnel involved in rescue operations	Local residents were the first responder to the incidents to douse the fires. Then, Mizoram government firefighters supported by Assam Rifles and Border Security Forces including local volunteer group were involved. After receiving an SOS message from Mizoram Government after 36 hours Indian Air Force was involved which included two Mi-17v5 helicopters to douse the fires.
26	Did the smoke hindered significantly the evacuation because of low visibility or health problems	No information is available
27	Possible causes of issues in management operations	Planning and resource availability
28	References	https://zeenews.india.com/photos/india/massive-fire-breaks-out-in-mizorams-forest-iaf-choppers-pressed-into-service-in-pics-2357818/people-

		trying-to-douse-fire-2357824 https://www.hindustantimes.com/india-news/48-hours-on-forest-fires-rage-across-mizoram-101619463394309.html https://news.abplive.com/news/india/explained-all-about-mizoram-forest-fire-raging-for-2-days-as-iaf-joins-local-efforts-to-douse-blaze-1454808 https://indianexpress.com/article/north-east-india/mizoram/forest-fire-rages-in-mizorams-lunglei-for-more-than-32-hours-7288547/ https://www.thehindu.com/news/national/mizoram-battles-forest-fires-assam-rifles-iaf-join-efforts/article34415689.ece https://www.downtoearth.org.in/news/natural-disasters/fires-rage-on-in-mizoram-s-lawngtlai-under-control-elsewhere-76701
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16. Manilla fire (Philippines), 2017

1	Where?	Tondo slum district, Manilla, Philippines
2	When?	07/02/2017-08/02/2017
3	How was the fire started?	Suspected to be initiated by faulty electric wiring or gas stove
4	Initial fire size	No information available
5	Area affected (burned area)	No information available
6	Fuels involved in the fire	Crops, vegetation, structures
7	WUI, urban, wildland or informal settlement fires?	Wildland and WUI
8	Average weather conditions	Dry weather and strong winds were observed
9	Geographical highlights	Hilly terrain with mostly vegetative coverage including crops. The State of Mizoram has a vegetation coverage of ~86% area.
10	Was there any fire break? (natural or artificial)	Artificial. National Highway 2 and 302 are present.
11	Did the Fire Service report extreme fire behaviour?	The quick-fire spread due to dry fuels and strong winds including presence of firebrands during fire propagation
12	Number of structures and infrastructures affected (damaged)	Some structures were burnt, most of the WUI structures were saved. However, many livestock's perished. In one of the locality, Bungtlang South, the fire completely destroyed fourteen houses, killed many livestock's with no injury to civilians. However, no exact count is available for other areas or combined fire.
13	Estimated direct and indirect economic damage	No information available
14	Did it occur in conjunction with multiple fires in the country?	No.
15	Countries involved	India. Local residents were the first responder to the incidents to douse the fires. Then, Mizoram government firefighters supported by Assam Rifles and Border Security Forces including local volunteer group were involved. After receiving an SOS message from Mizoram Government after 36 hours Indian Air Force was involved which included two Mi-17v5 helicopters to douse the fires.
16	Brief timeline of the key events	The fire sparked around 7 a.m. on Saturday (24/04/2021) and it is suspected that it was initiated while some villagers were trying to clear the hills near Lunglei town possibly for shifting cultivation as seen common practice. The fire went on to spread to Lunglei town and villages in the adjoining district of Lawngtlai late on Sunday night. The situation escalated as it transformed into a raging bushfire spreading to ten village council

		areas in and around Lunglei town. It then spread to three rural development blocks of the Lawngtlai district by Sunday night.
17	Time of initial order to evacuate and locations	No details are shared however when the fire approached WUI settlement, local and State administration carried out the evacuation
18	Time when the evacuation was considered completed	No information is available however they reported only few injuries and no casualty
19	Deaths/Injuries	21 injuries and 0 deaths
20	The number of people evacuated	~15,000
21	The location people initially evacuated	No information available however people took shelter in nearby area or informal settlements
22	Reasons why people decided to evacuate	Fire and smoke approaching their dwellings and evacuation order by local administration
23	Evacuation type	Partially chaotic and partially organised based on the input from video of news outlet and report
24	Any drill/education/instructions on large outdoor fires provided beforehand?	No information is available
25	Personnel involved in rescue operations	Local residents were the first responder to the incidents to douse the fires. Then, Mizoram government firefighters supported by Assam Rifles and Border Security Forces including local volunteer group were involved. After receiving an SOS message from Mizoram Government after 36 hours Indian Air Force was involved which included two Mi-17v5 helicopters to douse the fires.
26	Did the smoke hindered significantly the evacuation because of low visibility or health problems	No information is available
27	Possible causes of issues in management operations	Planning and resource availability
28	References	https://zeenews.india.com/photos/india/massive-fire-breaks-out-in-mizorams-forest-iaf-choppers-pressed-into-service-in-pics-2357818/people-trying-to-douse-fire-2357824 https://www.hindustantimes.com/india-news/48-hours-on-forest-fires-rage-across-mizoram-101619463394309.html https://news.abplive.com/news/india/explained-all-about-mizoram-forest-fire-raging-for-2-days-as-iaf-joins-local-efforts-to-douse-blaze-1454808 https://indianexpress.com/article/north-east-india/mizoram/forest-fire-rages-in-mizorams-lunglei-for-more-than-32-hours-7288547/

		https://www.thehindu.com/news/national/mizoram-battles-forest-fires-assam-rifles-iaf-join-efforts/article34415689.ece https://www.downtoearth.org.in/news/natural-disasters/fires-rage-on-in-mizoram-s-lawngtlai-under-control-elsewhere-76701
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17. Mati fire (Greece), 2018

The Mati Fire, a destructive wildfire in wildland urban interface that severely impacted villages of Mati, Kokkino Limanaki and Neos Voutzas in Coastal Attika was the worst fire in Europe and after Black Saturday Fires and the second-deadliest fire in 21st century.

Fire danger during the fire season in 2018 was characterized by high temperatures, high precipitation and wind levels corresponding to European heat wave in spring and summer. During this season, only two fires burned area larger than 500 ha, both fires happened at the first day assigned as class 4 in the range of 1-5 for fire danger, on 23rd of July. [1,5] The fire was started from allegedly ignited garden waste on open ground 3 and half hours after another fire in Kineta, 70 km away where firefighters and equipment from across Greece were deployed to deal with the blaze. The fire spread downslope towards the sea, driven by strong wind.
Great number of visitors, many of which were unaware of the geographical particularities of the area.
No evacuation was ordered in this case, people decided to evacuate by themselves after seeing the blaze. Many tourists not knowing the area and residents have fled toward the coastline to escape the fire but flames, hot smoke and firebrands were moving closer to the sea fast due to strong wind. Hundreds of residents have been evacuated or rescued, mainly from the seaside of the Village Mati nevertheless, the access to the beach by the people was difficult due to the rough slopes of the coast in the eastern part of the village. The very fast sideway transmission of the fire was probably the main reason for the fact that there was no warning in time, contributing to the large number of casualties. [1,2,7]

1	Where?	Villages of Mati, Kokkino Limanaki and Neos Voutzas, Greece
2	When?	23/7/2018-24/7/2018
3	How the fire was started?	According to the fire service, a 65-year-old resident of area near Mati was allegedly burning garden waste on open ground from which the fire started. [4]
4	Initial fire size	Ap. 20 sq. m
5	Area affected (burned area)	1,431 ha
6	Fuels involved in the fire	Mostly pine (Pinus halepensis) vegetation in small forest stands or around houses locally mixed Cypress trees and shrubby vegetation. Flammable parts of buildings, fences, pergolas, vehicles. The fire started from areas which had been burned in the past and transitioned to an area which was not recently burned with an increased concentration of fuel and, therefore, the fire behavior became much more extreme. Unpredicted fire behavior due to change in the type of plant fuel.
7	WUI, urban, wildland or informal settlement fires?	WUI fire
8	Average weather conditions	Prevailing wind was WNW (unusual for the area) with speeds ranging from 32 to 56 km/h for the first two hours after the fire start, with gusts of 50 to 89 km/h (measurements at the National Observatory of Athens on Mt. Penteli). Temperature did not exceed

		31℃ and relative humidity varied between 34% and 43% RH making the probability of spotting relatively low. Until that day, the season had been wetter than usual, and the vegetation was not water stressed. However, as the catabatic wind blew from Mt. Penteli towards the sea, through rough topography, meteorological conditions in the draws were affected by higher wind velocities, higher temperatures, and lower relative humidity. At the Hellenic National Meteorological Service station at Rafina, near the sea, temperature reached 38°C and RH dropped to 17% at 16:45. Wind gusts occasionally reached 120 km/h. [5]
9	Geographical highlights	Fire started in rural area on Mount Penteli and continued downhill through grassed hilly terrain towards rocky and steep coastline.
10	Was there any fire break? (natural or artificial)	Marathon Avenue was assumed as a fire break, however, fire managed to pass it due to strong wind. The fire stopped at the sea.
11	Did the Fire Service report extreme fire behavior?	Fire danger rating was at "very high" (class 4 in the 1-5 range) due to extreme wind from unusual direction was issued by General Secretariat for Civil Protection. Uncontrollable fire behavior was reported by firefighters. Firefighters reported a rapid change in the direction of wind, picking up speed.
12	Number of structures and infrastructures affected (damaged)	1,220 structures and 430 damaged structures and 305 of vehicles ruined. [2,5]
13	Estimated direct and indirect economic damage	App. EUR 1.5 million in total. [8] Homeowners have received compensation cheques of up to €6,000 (£5,400) each.
14	Did it occur in conjunction with multiple fires in the country?	Yes. Another wildfire started at 13:00 that day near the town of Kineta in west Attica, 50 km west of the center of Athens, spreading through the town after passing through 6 lines national road. There was also a separate brushfire which broke out near the refinery in the area of Agioi Theodori (60km from Athens and 10km after Kineta) which worried the fire service and threatened the largest refinery in the area. It was a fire that was separate from Kineta's fire. Therefore, a huge capacity of fire and rescue service was sent there (to both fires) from the area of Attika.
15	Countries involved	Greece, Aid was provided through EU Civil Mechanisms from Italy, Romania, Cyprus. Offers of assistance to Greece were also made by Spain, Bulgaria, Croatia, Portugal, Malta and Montenegro. [2,3]
16	Brief timeline of the key events	16:41 fire starts At 16:45 when first smoke was seen, person

		responsible for the summer camp started with evacuation. 16:57 Fire Service made aware of the fire ignition point 18:10-18:18 A firebreak Marathon Avenue reached 18:00 First flames seen in Mati 18:30 -18:40 Fire reaches coastline [2]
17	Time of initial order to evacuate and locations	There is no official time of initial order of evacuation. Evacuation operations took place at a church charity institution (Lyreion) and children summer camps of the area after the initiatives that were taken by the camp manager and the Lyreion staff. The summer camp in Mati started with evacuation immediately after responsible person saw smoke at 16:45. No evacuation was ordered in general for the whole area. A confusion between the mayor of Rafina-Pikermi, to which Mati belongs, other municipalities, regional officers and fire service occurred as to whose responsibility it was to order evacuation. [1] According to witness statements analyzed by University of Athens, people who were at the beach were informed about the fire not in the form of timely warning by an official body but by the people who were evacuating from the western part of the Mati settlement which was already affected. [2] This fact shows that there was almost zero warning and reaction time. During the event, there were no specific plans to be implemented based on the guidelines of civil protection for evacuation in Greece. [1,7] (The Civil Protection guidelines are given and each area is expected to implement/adjust the guidelines based on the special specifications that each area has). It seems that, in this case, the municipalities and the prefecture had not moved forward to the planning of evacuation plans in cases of emergency.
18	Time when evacuation was considered completed	Last child from the summer camp got to its family at 4 am 24th of July [6].
19	Deaths/Injuries	102 fatalities, minimally 150 persons seriously injured
20	The number of people evacuated	Higher hundreds of habitants or visitors. 620 children were evacuated from a summer camp according to Major of Athens [6].
	The location people initially evacuated	Most people were there for a daily swim from other areas, tourists and escaped from the fire helped by other residents and services (police, fire), some went to buildings. Some people were able to leave and reach safety. Of the people who weren't able to leave on time and were still in the area when the fire

		arrived, some went to the beach and some others were able to escape danger through the help of emergency services and some were trapped in houses or remained in their houses and they were saved later on. Others lost their lives in their effort to escape. Hundreds of people escaped to nearby beaches to avoid fire and smoke. Access to the beach was difficult due to many narrow streets and dead ends and the steep slopes of the coast in the eastern part of the area. Many of those who managed to get to the beach jumped into the sea and spent hours in the water until they were picked up by tourist boats and fishing boats mostly. A considerable amount of the dead were people who drowned. [2,7]
21	Reasons why people decided to evacuate	Many of evacuated saw flames or smoke and debris in the air nearby. Many victims were alarmed from evacuees from the West. Only in a case of a summer camp full of children, a responsible guy decided to evacuate the children based on early signs of fire and smoke.
22	Evacuation type	On foot, by vehicles (cars, buses, boats).
	Any drill/education/instructions on large outdoor fires provided beforehand?	Regarding responsibilities and evacuation during forest fire, law is applied e. g. L.4249/2014, Government Gazette 73 A. Under Article 108 of the 4249/2015 Law it is mentioned that: The making of the decision on the organized evacuation of citizens is the responsibility of the Mayors of each area, of the Regional Governor or the Civil Protection General Secretary, who have the responsibility of the coordination of the work of civil protection for dealing with the crisis/disaster in a local, regional and central level after the recommendation of the authorities responsible.
23	Personnel involved in rescue operations	Professional and volunteer firefighters, owners local mayors. In total 300 of professionals and volunteers.
24	Did the smoke hindered significantly the evacuation because of low visibility or health problems	Yes, significantly. Dark smoke complicated orientation during evacuation. Victims in sea reported 'thick air'.
25	Possible causes of issues in management operations	Lack of communication between civilians and police and fire service. Lack of practical training. Firefighting mechanism inadequate, many gaps in management and coordination. Communities and citizens were not prepared. The authorities (Fire Service, Police, Port Police, Municipalities) made many serious mistakes during and immediately after the event, including slow response, lack of communication with each other, inadequate and inaccurate information to the public,

		denial of the size of the disaster for the first 24 hours… The arrival of the passenger ships at the port of Rafina and the disembarkation from the ship of a large amount of vehicles made traffic congestion worse at the local roads. Traffic congestion due to panic as well as the dense population concentration (residents but also visitors/tourists who probably did not know the geography of the area). [1,2,7]
26	References	[1] Report from The Independent Committee, formed on 10/9/2018 with ΥΑ 60/2018 (Government Gazette 3937 / B / 2018) [2] Lekkas, E. Et al. (2018). The July 2018 Attica (Central Greece) Wildfires –Scientific Report (Version 1.0). Newsletter of Environmental, Disaster, and Crisis Management Strategies, 8, ISSN 2653-9454. Kapodistrian University of Athens: The conclusions from the deadly fire in Eastern Attica. [3] "The Latest: Desperate Greeks Search for Missing After Fires". 24 July 2018. Retrieved 4 December 2020. [4] "20 charged over Mati wildfires that killed 100 people" https://greekcitytimes.com/2019/03/06/20-charged-over-mati-wildfires-that-killed-100-people. Retrieved 21 January 2021. [5] Xanthopoulos G. and Miltiadis A., Fire globe: Attica region, Greece (July 2018) [6] "Greece fires: 620 children EVACUATED near Athens as HUGE blaze raged across the country"https://www.express.co.uk/news/uk/993884/Greece-fires-Athens-2018-children-evacuated-wildfires-BBC-newsnight-mati-arson-fires-start. Retrieved 21 January 2021. [7] Interviews with Volunteer Firefighters [8] Goldammer, J.et al. Prospects for the Management of Forest and Landscape Fires in Greece; The Global Fire Monitoring Center (GFMC); Secretariat of the Global Wildland Fire Network; UNISDR Wildland Fire Advisory Group; International Wildfire Preparedness Mechanism; International Fire Aviation Working Group: Athens, Greece, 2019; p. 80 + Own observations
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At 12:03 that day, the first fire erupted on Mount Geraneia in western Attica, about 50 kilometers (31 miles) west of Athens near the town of Kineta, which is surrounded by forest. Fanned by the strong wind, it grew rapidly and swept through Kineta destroying many houses. It then spotted over the six-lane national road that connects Athens with Peloponnese, reaching the sea where it threatened a large oil refinery. It was the high risk to people and property in the Kineta wildland-urban interface (WUI), to the travelers on the national road (where traffic had to be stopped for hours), and to the oil refinery. Forest area of 1431 ha and 1000 buildings destroyed, 700 people were evacuated but most of people fail to evacuate and due to unpreparedness of governmental authorities. Greek officials were charged for their alleged failures to respond to the situation in a post incident investigation.

1	Where?	Attica, Greece
2	When?	23 July 2018 – 26 July 2018
3	How was the fire started?	Arson, A 65-year-old man from Penteli was arrested for causing the fire through negligence, by burning wood in his garden.
4	Initial fire size	
5	Area affected	670,000 acres (Dutta Gupta, 2019) 1,431 hectares (Xanthopoulos and Athanasiou, 2019)
6	Type/s of forest involved in wildfire	Aleppo pine was primary tree species and there were Eastern Mediterranean evergreen shrubs Kermes oak and lentisk (Xanthopoulos and Athanasiou, 2019)
7	Did the fire spread inside the WUI	
8	Average weather conditions	July 23rd was the first day of the 2018 season for which a "very high" fire danger rating (class 4 in the 1-5 range) had been assigned in the region of Attica, and to a large part of southeastern continental Greece, in the Fire Danger Prediction map issued daily by the General Secretariat for Civil Protection. This rating was due to a forecast of strong to extreme westerly winds (Xanthopoulos and Athanasiou, 2019).
9	Geographical highlights	 (Xanthopoulos and Athanasiou, 2019).
10	Was there any natural fire break?	
11	Did the Fire Service report extreme fire behavior	
12	Number of structures and infrastructures affected	1,000 buildings (Koukoumakas, 2018)
13	Estimated direct and indirect economic damage	Information is missing but Albania gave €100,000, Cyprus € 10,000,000 and Macedonia gave €100,000 of aid and several other countries provided aircrafts for firefighting

		and logistic support. (Wikipedia, 2018)
14	Did it occur in conjunction with multiple fires in the country?	Yes Two towns Rafina and Mati, experienced fire simultaneously.
15	Countries involved	Greece
16	Brief timeline of the events	On 23 July 2018 at 13:00 Eastern European Time, a wildfire started west of Athens near Kineta. A few hours later, a second wildfire started burning at the north of Athens near Penteli. Due to very strong wind gusts in the area both wildfires spread quickly. The fire in Kineta burned houses in the area, while the fire in Penteli headed east towards the beach, where it started burning parts of Neos Voutzas, Mati and Kokkino Limanaki just north of the town of Rafina and as far as its northern fringes.
17	Time of initial order to evacuate and locations	-
18	Time when evacuation was considered completed	- Not completed, people did not follow
19	Deaths/Injuries	102 deaths, 172 injured, 1000 buildings destroyed,
20	People Evacuated	700 residents were evacuated
21	People threatened to be evacuated	4000 residents were effected by wildfire
22	Evacuation type	-
23	Personnel involved in rescue operations	An entire fleet of firefighting aircrafts, 250 fire engines, 600 firefighters (Wikiwand, 2018)
24	Did the smoke hindered significantly the evacuation because of low visibility or health problems	-
25	Possible causes of issues in management operations	The fire brigade recommended the evacuation of the area but had not been listened to. Moreover, the meteorological service had failed to predict winds of up to 124 km/h. This resulted in firefighting aircraft being grounded. "They simply couldn't take off in such winds. If the meteorological service had raised the danger level and issued a warning, the planes could have gone to a different airport," "And because they weren't foreseen our resources were scattered." (Smith, 2018)
26	References	Duttagupta, I. 2019. Scorched earth: Wildfires that have seared our conscience, The Economic Time, Available at: https://economictimes.indiatimes.com/news/international/world-news/scorched-earth-wildfires-that-have-seared-our-conscience/the-great-matheson-fire-ontario-canada/slideshow/70931617.cms Smith, H. 2018. Greek firefighters join public outcry at 'woeful' response to lethal wildfires, The Observer Greece, Available at: https://www.theguardian.com/world/2018/jul/28/greece-wildfires-firefighters-attack-government-response

		Koukoumakas, K. 2018. Greece wildfires: Dozens dead in Attica region, BBC News, Available at: https://www.bbc.com/news/world-europe-44932366 Xanthopoulos, G., Athanasiou, M. 2019. Wildland Fires, Available at: https://www.iawfonline.org/article/fire-globe-attica-region-greece-july-2018/ Wikiwand, 2018. 2018 Attica Wildfire, Available at: https://www.wikiwand.com/en/2018_Attica_wildfires Wikipedia, 2018. 2018 Attica Wildfire, Available at: https://en.wikipedia.org/wiki/2018_Attica_wildfires
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In the early afternoon of Monday, July 23, 2018 a wildfire broke out in the forest surrounding the settlement of Kallitechnoulopis on Penteli mountain., approx. 20 km northeast of Athens and 5 km to the west of the Eastern Attica coastline. It resulted in one of the words deadliest WUI fires as due to extreme weather conditions, approx. wind velocity of 90 km/h, fire spread swiftly to the east, affecting, as it travelled along, the settlements of Kallitechnoulopis, Neos Voutzas, Rafina and reached Mati, where it finally stopped right at the coastline. The wildfire, classified as a crown fire within 30-40 minutes crossed the main highway of the area (Marathonos Av.), and moved towards the settlement of Mati, where it reached the sea with a fire front of approximately 1 km, allowing for a minimal response time by the inhabitants and numerous visitors of the area. The difficult weather conditions, area morphology and town configuration resulted in the entrapment of a great number of people and tragic aftermath [1].

1	Where?	Attika, Greece
2	When?	23/07/2018, 13:55 - 23:30 EEST
3	How the fire was started?	The wildfire broke out in the forest surrounding the settlement of Kallitehnoupolis on Penteli Mt., approx. 20km northeast of Athens and 5 km to the west of the Eastern Attica coastline [1]. Expert report reveals negligent arson
4	Initial fire size	No information
5	Area affected (burned area)	12,759 ha [1], from them it is estimated that 6,934 ha of urban areas and 5,825 ha of wildland [2].
6	Fuels involved in the fire	Spreading through the wildland-urban interface (WUI) settlements east of the origin, initially it burned in previously burned areas (2005, 2009), fast but with medium intensity. The fire started rapidly in previously fire-affected areas of low-lying vegetation and spread to a non-affected area comprising a great fire fuel load. That lead to fire propagation and a higher energy release in the down-slope area between Neos Voutzas and the coastline. East of Marathonos Avenue, the fire, as a wind driven "wall of fire" swept both the low-lying vegetation and the high-standing trees (active crown fire). In eastern Attica on the 20th of July 2018, the older needles of the primary tree species, Aleppo pine, had a moisture content of 100% while new needles registered 133%. The leaves of the Eastern Mediterranean evergreen shrubs Kermes oak and lentisk were at 83% and 97% respectively. The dwarf, spiny, Pink Rock-Rose shrubs were at 112%, with Thyme at 80%. Even with this unusually high moisture content, and with relatively limited spotting, the intense winds were able to generate a high rate of spread (ROS) via surface or passive crown fire [6]. In addition, tens of firebrands were spread towards the coastline [1]. Then it entered previously unburned forest. Fuels involved were mostly pine (Pinus halepensis) vegetation in small forest stands

		or in the yards of houses [3] locally mixed with Cypress trees and shrubby vegetation [2]. It is possible that the change in fire behavior was caused by the change in vegetation type. Moving eastwards towards the settlement of Neos Voutzas, the fire spread through jumbled ravines and gorges and up several leeward, steep slopes. Fuels consisted of Mediterranean shrubs, a few scattered olive groves, and stands of Aleppo pine [6].
7	WUI, urban, wildland or informal settlement fires?	This is a typical case of wildland urban interface (WUI) fire, that spread as an active crown fire [1].
8	Average weather conditions	According to weather measurements at the National Observatory of Athens on Mt. Penteli, upwind of the fire, the prevailing wind was WNW with speeds ranging from 32 to 56 km/h for the first two hours after the fire start, with gusts of 50 to 89 km/h. Temperature didn't exceed 31℃ and relative humidity varied between 34% and 43% RH making the probability of spotting relatively low. However, as the catabatic wind blew from Mt. Penteli towards the sea, through rough topography, meteorological conditions in the draws were affected by higher wind velocities, higher temperatures, and lower relative humidity. At the Hellenic National Meteorological Service station at Rafina, near the sea, temperature reached 38oC and RH dropped to 17% at 16:45. Wind gusts occasionally reached 120 km/h [2,3,4]. Dramatic increase of the wind, of W and SW direction, at the break of the fire (17.00 of 23rd) until 21.00 the same day. This fact is believed to be crucial and contributed largely to the high velocity of the fire front and its quick movement towards Mati town. Timeline of wind direction and intensity, during the event. Strong western winds approach from Penteli Mt. and reach the area of N. Voutzas, Rafina and Mati between 17:00 and 17:30. From that time on, the wildfire had a rapid downslope spread towards the coast [1]. It is noteworthy that the wind gusts recorded on Monday 23rd by the meteorological stations of the NOA in Isthmos, Agioi Theodoroi, Kapareli Viotia, Parnitha, Penteli, Ano Liosia, Neos Cosmos were the highest recorded in the summer months over the last eight years -since they have been installed in many cases regardless of wind direction [1].
9	Geographical highlights	Topographic features include the Hymettus and Penteli mountains, being bound by shallow basins oriented in a northwest–southeast and northeast–southwest direction [5]. The elevation ranges between 0 and 940 m, having a mean value of

		227.8 m; steep slopes characterize the northern regions of the catchment while the relief is milder at the eastern part towards its outlet.
10	Was there any fire break? (natural or artificial)	Yes, there was a main highway of the area called Marathon Avenue. Due to very strong winds (approx. velocity of 90 m/s) the fire crossed the main highway within a very short time, estimated approximately 30 to 40 min depending on the location and moved towards the settlement of Mati where it reached the sea with a fire front of 1 km [1].
11	Did the Fire Service report extreme fire behavior?	Yes, but not solely from the Fire Services. In addition to the firefighting operations, a parallel emergency plan was employed by the Ministry of Interior and the Police, as well as the Ministries of Health, Transport, Defense, Shipping and Environment, as well as the Attica Region.
12	Number of structures and infrastructures affected (damaged)	Apart from the human casualties, the destruction included approximately 3,236 houses partially or totally burned and 305 burned vehicles [2,5].
13	Estimated direct and indirect economic damage	Apart from the direct losses, long term impacts involve health issues from impaired air quality due to the wildfire smoke and heavy metals melting, and a wide range of financial impacts such as a downturn in tourism, business and recreation revenue (ecological damage harmed the natural resource base from which the local community derived economic activity and employment), insurance costs and public funding for disaster assistance, legal costs, and impacts on property and housing values within or near the fire perimeter due to proximity with burned landscapes [9]. There is not an official cost analysis yet available, but initial costing as derived from the distributed governmental funds, donations and financial aid from other countries includes: • Relief fund of 40 million euros to help affected areas (by the Greek government) [10] as households received multi-purpose cash grants as relatives of someone who died and for affected properties [9] • Emergency Appeal funding750K euros [9] • Multiple private donations and through Red Cross, Desmos, AHEPA and Hellenic American Leadership Council exceeding 100 million euros [11] • SNF through a series of grants exceeding 19 million euros donated to support Greek fire services

		• Albania donated 100,000 euros in financial aid to deal with the emergency situation [13] • Cyprus donated 11 million euros for the recovering of Mati [13] • Republic of North Macedonia donated €100,000 in financial aid in dealing with the emergency situation [13]
14	Did it occur in conjunction with multiple fires in the country?	Yes Fires also broke out in the north of the country, as well as on some islands including Crete, however these fires were further from residential areas with no casualties reported. The main fire that really influenced the operations at Mati fire was the fire that erupted on Mount Geraneia in western Attica, about 50 kilometers (31 miles) west of Athens near the town of Kineta, which is surrounded by fores 12:03 that day. Fanned by the strong wind, it grew rapidly and swept through Kineta destroying many houses. It then spotted over the six-lane national road that connects Athens with Peloponnese, reaching the sea where it threatened a large oil refinery. It was the high risk to people and property in the Kineta wildland-urban interface (WUI), to the travelers on the national road (where traffic had to be stopped for hours), and to the oil refinery, that forced the Fire Service to dispatch a very large portion of ground and aerial firefighting resources in Attica to the affected area [6]. While attention and resources were concentrated in western Attica, a second wildfire (the Mati fire) erupted on Mount Penteli at 16:41 [6].
15	Countries involved	Greece appealed for help from other countries to help tackle the fires and deal with the emergency situation by submitting a request through the European Union Civil Protection Mechanism for international assistance with air and land assets. On 23/7/2018 evening Greece requested EU support through the EU Civil Protection Mechanism. In an immediate response, Cyprus, Spain and Bulgaria made swift offers of assistance, which included planes, firefighters, medics, and vehicles [1]. European Commissioner for Humanitarian Aid and Crisis Management arrived in Athens on 24 July to coordinate the EU assistance being provided to Greece through the EU Civil Protection Mechanism. The EU Civil Protection Mechanism helped mobilize planes, vehicles, medical personnel and firefighters from the EU countries. The EU's Copernicus satellite system has also been activated to provide the authorities with

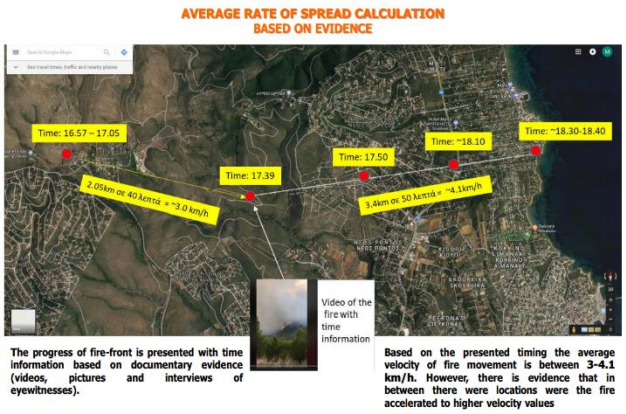
		highly specialized maps. The following countries responded: Albania, Australia, Austria, Armenia, Bulgari, Canada, Croatia (2 Canadair CL-415 water-tanker planes), Cyprus, Czech Republic, France, Georgia, Israel, Italy (2 Canadair CL-415 water-tanker planes), Germany, Hungary, Republic of North Macedonia, Malta, Montenegro, Poland (Two teams of the State Fire Service were provided to support the rescue and fire-fighting operation), Portugal (assistance of 50 firefighters, in the scope of the EU Civil Protection Mechanism), Romania (1 C-27 J Spartan airplane configured for firefighting and a C-130 Hercules aircraft for logistic support, as well as a total of 20 soldiers), Russia, Serbia, Spain (2 Canadair CL-415 water-tanker planes), Switzerland, Turkey, United States (surveillance of the wildfires with drones, to help spot and fight fires more quickly) [13].
16	Brief timeline of the key events	Information from [13],[14],[15]: 12:03 pm on July 23, 2018: A fire broke out in the area "Air" in the Geraneia Mountains (Kineta), from which a forest area of approximately 55,680 acres was destroyed. 12:48:11 pm: Fire Brigade (FB) 3823, patrol fire truck (water tanker) (5000 liters), with call code (MAKPH - 15), of the Nea Makri Police Station, which was based at the First Entrance of Neos Voutzas, on Marathonos Avenue, is ordered by UBCC/199 -(Unified Business Coordination Center) NCCBCM (National Coordination Center for Business and Crisis Management), to go for reinforcements in the fire of Kineta, while the time of his arrival in this area is not proven. This vehicle is one of the two patrol vehicles that were closest to the starting point of the fire, which, if it had not moved to Kineta, would have arrived in 7' minutes, i.e. at 16:48 pm, where the fire would have started immediately and in time. fire suppression. Time 13:51:25 pm: FB 1475, patrol fire truck (water tanker) (2500 liters), with call code (12-30), of the 12th FB Athens and headquarters (parking point) the location "Patima" Vrilissia , is ordered by UBCC/199 - NCCBCM, to go for reinforcement to the fire of Kineta, where it arrived at 15:26:00 pm. Time 15:06:26 pm: FB 3527, patrol fire truck (water tanker) (5000 liters), with call code (12-15), of the 12th PS Athens and headquarters in the area Drafi - Dioni, is ordered by UBCC/199 - NCCBCM, to go for reinforcements to the fire in Kineta, where it arrived at 16:30:00 pm. This vehicle is one of the

		two patrol vehicles that were closest to the starting point of the fire, which if not moved to Kineta, would arrive in 5' minutes, i.e. at 16:46 pm, where the suppression of the fire would begin. Time 16:15 pm to 16:30 pm: The fire breaks out in Daou Pentelis. While the above fire was in full swing, a new fire broke out in the settlement of Daou Pentelis in an unenclosed plot of land on Androutsou Street, due to human negligent behavior. The time displayed as the most distant is the above, while the time displayed by document data is from 16:00 to 16:15 pm. Time 16:35 pm: An eyewitness, located in a plot of land next to his house and more specifically at the intersection of Plastira and Androutsou streets in Daou Pentelis, perceives the release of smoke near the starting point. Time 16:41 pm: The Coordinating Operational Operations Center of the Fire Brigade (199-SEKYPS) is announced (notified-informed) about the incident of the fire. Also, at the same time from video from security cameras of a house on Ioustinianou street no. 10 in Daou Pentelis visible smoke occurs at a distance of about 70 m from the starting point of the fire. Time 16:47 pm: The first three (3) fire trucks are mobilized. Therefore, there was a delay of UBCC/199 - NCCBCM in the mobilization of the first fire (water) vehicles by 6 minutes of the hour from 16:41 pm, when the incident was announced and by 17 minutes, from the least estimated start time of the fire. Also, at the same time, the 1st firefighting (water tanker) arrived at the wider area of the incident (Agios Andreas), with number FB 3211 (2,500 liters) of the Nea Makri Police Station. Time 16:48 pm: Another water tanker is mobilized. Time 16:50 pm: A diversion order of a heavy S-64 type helicopter is given from the Kinetta fire to the Daou Penteli fire. Time 16:51 pm: The First Fire Brigade of the 12th Athens Police Station is mobilized (with 2 firefighting water trucks) Time 16:54 pm: The Commander of Nea Makri Police Station arrived in Neos Voutzas, with a dial code (ARIS NEAS MAKRIS). Time 16:55 pm: Arrival at the scene of the Commander of the 12th FB Athens, with a dialing code (12-10). Time 16:56 pm: Arrival of the first fire truck in Daou Pentelis and the fire (intervention) of the fire actually begins.

		Time 17:04 pm: Arrival at the scene of the fire of another fire truck. At the scene of the incident in Daou Pentelis 2 fire trucks arrived. Time 17:05 pm: Arrival at the scene of the fire in Daou Pentelis, another firefighting water tanker and specifically the 1st vehicle of the First Fire Brigade of the 12th FB Athens. (At the scene a total of 3 fire trucks) Time 17:06 pm: Arrival at the scene of the fire in Daou Pentelis, another firefighting water truck and specifically the 2nd vehicle of the First Fire Brigade of the 12th FB Athens. (At the scene a total of 4 water trucks) Time 17:10 pm: The Leadership (physical and political) of the FB and the Director of the UBCC are informed by the S-64 type air fire brigade about the danger of fire. Time 17:15 pm: At the scene of the incident in Daou Pentelis, a total of 4 fire trucks. Time 17:18 pm: The Commander of the Athens Police Department arrived at the scene with a dialling code (ARIS ATHENS). Time 17:20 pm: The leadership of the PS and the Director of UBCC are informed by the FB officer who was riding in the coordinating Helicopter of the FB type BK-117, again about the danger of fire. Time 17:21 pm: Arrival at the scene of the incident by the Deputy Commander of the Athens Police, with a dial code (HERMES ATHENS). The window for evacuation was closed - organized evacuation of citizens Time 17:30 pm: The Leadership (physical and political) PS and the Director of UBCC are informed again, by helicopter, that the fire in Daou Pentelis is close to houses, is moving east and will threaten houses. Also, the initial fire front escapes from the area of Daou Pentelis and at the height of the Holy Monastery of Pantokratoros and splits into two (2) new fronts that are directed at high speed, one to Kallitechnoupoli - Kokkino Limanaki and the other to Neo Voutza - Mati. It is the longest period of time that a decision should have been made for the organized evacuation of residents and visitors to N. Voutza - Mati. Total number (5) of water fire trucks in Daou Pentelis. Time 17:35 pm: The coordinating helicopter of the FB (FLAME 1) leaves the fire for filling with fuel, without taking care of its succession by another similar coordinating helicopter. Time 17:45 pm: The FB leadership and the NCCBCM are again informed that the fire is in a

		pine forest, an inaccessible area with very dense smoke. Aircraft CL-415 (2054) takes off for Daou Pentelis. Time 17:45 pm: The FB leadership and the UBCC are again informed that the fire is in a pine forest, an inaccessible area with very dense smoke. Aircraft CL-415 (2054) takes off for Daou Pentelis. Time 17:57 pm: Arrival at N. Voutzas of the Commander of East Attica, with a dialing code (ARIS EAST ATTICA). Time 18:05 pm: The front of the fire enters N. Voutza and more specifically in Riga Fereou street no. 48, where due to the ionization of the Public Electricity Company SA substation at this point, there is a voltage drop of the electrical network supplying the above settlement. Time 18:12 pm: The first traffic police measures are taken on Marathonos Avenue, which initially closes at 2 points: a) Intersection with Fleming and b) Dionysos - N. Makri. Also, an order is given to the Commander of the Police and the Director of UBCC to take off the 2nd heavy S-64 type helicopter for the fire in Daou Pentelis. Time 18:13 pm: The fire front reaches the Lyreion Foundation. Time 18:28 pm: A 2nd heavy S-64 helicopter takes off, from Elefsina Police Station to Daou Pentelis. Time 18:30 pm: The total number of water firefighting vehicles of the FB operating are 13 vehicles. Of these, 9 are located at Daou Pentelis, 2 at Kallitechnoupoli, 1 at N. Voutza and 1 at Marathonos Avenue at the entrance to Kallitechnoupolis. The front of the fire crosses Marathonos Avenue and spreads to Mati at the height of its junction with Ismini, (N. Voutza) and Kyanis Aktis, (Mati) but also Tritonos (Mati) - Tavern "TO VASILIS". Time 18:31 pm: An order is given to evacuate the camps in Agios Andreas and Zoumberi, such as the Municipality of Athens, Police, etc. Time 18:32 pm: The front of the fire has spread to Mati, passing Marathonos Avenue at the height of the Mati near Myrto Hotel. Time 18:39 pm: The 1st heavy S-64 helicopter, which was operating at Daou Pentelis from 17:10 pm, lands at the Tatoiou Airport. Time 18:44 pm: The front of the fire spreads to Kokkino Limanaki, passing by Marathonos Avenue at the height of the Holy Temple of the Ascension - Rafina at the Rafina Crossroads. Time 18:45 pm: The front of the fire reaches the

		first point on Poseidonos Avenue no. 55 - 57, at the Hotel RAMADA ATTICA RIVIERA and destroys cars there. Time 18:50 pm: The front of the fire reaches at some point the shoreline at Mati. The Rafina Port Authority is informed by an individual about the danger of citizens at sea due to the fire. Time 19:00 pm: At the scene a total of (18) water trucks. Time 19:11 pm: The leadership of PS and the Director of UDCC are informed by Airplane CL - 415 (2054) regarding the fire in Daou Pentelis, that there is a large single front with very large flames of 10 - 20 meters, the fire is directed to the sea and that there are houses in this area. Time 19:17 pm: The front crosses Marathonos Avenue at the height of Agia Varvara and spreads to Kokkino Limanaki. Time 19:29 pm: An order is given by the Commander of FB and UDCC to take off from Police Station Elefsina a heavy S-64 helicopter to go to Daou Pentelis. Time 19:42 pm: The heavy S-64 helicopter takes off from Police Station Elefsina for Daou Pentelis. Time 19:51 pm: The 1st dead person on Dimokratias Avenue (Kokkino Limanaki) is located and confirmed by the Fire Brigade. Time 20:00 pm: At the scene a total of (22) water trucks. Time 20:30 pm: The Eastern Attica Coordinating Body of Civil Protection is convened and meets, while at 21:00 pm its meeting ended. Time 20:37 pm: At the scene of the incident a total of (33) water trucks. Finally, from 20:00 pm until sunset (20: 42 pm), 2 helicopters S-64 and 1 Super Puma helicopter operated with a bucket (Total of 3 flying helicopters firefighting vehicles operating). From the total number of (59) vehicles of the FB, recorded from the history of telematic data, i.e. the digital fingerprint of fire trucks (traffic history), detected by the program (application) Engage at the scene, during the period from at (fire announcement) 16:41 pm time to 22:37 pm, only (33) are fire trucks of the FB, while the remaining (26) vehicles were auxiliary vehicles of the FB, such as passenger jeeps, buses etc.

		 Figure 1: Picture takes from [1].
17	Time of initial order to evacuate and locations	Not available information.
18	Time when evacuation was considered completed	Not available information.
19	Deaths/Injuries	As of May 2019, 102 people were confirmed dead; the victims were identified as 48 females, 43 males, 11 children (one of whom an infant) in less than 3 hours. The youngest was 6 month and the oldest 93 years old [7]. The casualties were 97 Greeks, two Polish, an Irish, a Belgian and a Georgian nationals. At least 164 adults and 23 children were taken to hospital with injuries, including 11 adults in serious condition [7]. It was also reported that at least 15 of the injured later died in the hospital [8]. More than 600 injured
20	The number of people evacuated	700 people were rescued by the coast guard and the navy after fleeing to beaches to escape the flames. Residents in the coastal region in western Attica were requested to abandon their homes, and hundreds of people were evacuated. Almost 94 percent of the cities in Rafina and Marathonas were affected by recent wildfires and it is estimated that more than 4,000 people were affected in total, with about 3,200 hectares burned, including forests, residential areas, playgrounds, and significant social infrastructure. Around 3,2365 homes were damaged in the fires, with about one third of them (908 categorized as "red") assessed as irreparable by the Ministry of Infrastructure. In addition, electricity and water networks also suffered severe damage and were significantly disrupted for a period of about two months during of which intensive repair works of the Municipality workers managed to gradually restore them. 4,118 is the estimated number of people directly exposed, 3,260 is the number of people reached through IFRC multilateral funding, while 7,598 is the total number to be

		reached by the entire Red Cross movement intervention, including community based DRR activities led by the Hellenic Red Cross. The total number of people reached might include some double reporting, i.e. a person accessing PSS services and receiving cash assistance is counted as twice. Due to separate registration databases, there is currently no other possibility [9].
21	The location people initially evacuated	People evacuated towards the coast. The coastline morphology hindered the access to the sea (steep coastline). The access routes were limited and the lack of visibility due to the smoke greatly contributed to the entrapment of people. The first conclusions based on witnesses' accounts (still under systematic analysis) point to the fact that the escape attempt was uncontrolled and not an organized evacuation procedure. This resulted in a "traffic jam" caused by the large number of people trying to flee the area in a state of panic. In addition to the number of inhabitants, there was also a great number of visitors, many of which were unaware of the geographical particularities of the area [1].
22	Reasons why people decided to evacuate	From witnesses it is recorded that there had been no sirens, no warning system or evacuation plan. People said that they could hear the wind and then smell the smoke and eventually see the flames [10].
23	Evacuation type	The first conclusions based on witnesses' accounts (still under systematic analysis) point to the fact that the escape attempt was uncontrolled and not an organized evacuation procedure. This resulted in a "traffic jam" caused by the large number of people trying to flee the area in a state of panic. In addition to the number of inhabitants, there was also a great number of visitors, many of which were unaware of the geographical particularities of the area [1]. Organized evacuation operations took place at a church charity institution (Lyreion) and all children summer camps of the wider area [1].
24	Any drill/education/instructions on large outdoor fires provided beforehand?	A report from an Independent Committee in collaboration with the Global Fire Monitoring Center [12] highlighted the absence of strategic planning and local fire plans, and the absence of reliable fire risk indicators and early warning systems. In practice this means that there were no evacuation plans, no designated escape routes from high-risk areas, no shelters or first aid stations, and no systematic plan for managing the humanitarian needs in the aftermath of a catastrophic fire. There was instead a proliferation of bodies and agencies

		involved in different aspects of firefighting and prevention without rules of engagement or central coordination. There was a lack of any preparatory measures for fire protection, such as settlement fire plan, citizen education or home preparation [6].
25	Personnel involved in rescue operations	The Fire Service was made aware of the fire ignition point at 16.57 (local time) and responded by sending 190 persons on 96 vehicles, 12 vehicles belonging to registered volunteers, 2 ground forces teams, as well as 3 Canadair aircrafts and 2 helicopters [16]. Greece appealed for help from other countries to help tackle the fires and deal with the emergency situation by submitting a request through the European Union Civil Protection Mechanism for international assistance with air and land assets. 27 countries responded [14].
26	Did the smoke hindered significantly the evacuation because of low visibility or health problems	Witness reports and telecommunication logs revealed that people trying to escape by car were trapped in congestion near the shore inside the very few escape routes. The fast rate of spread surprised residents, motorists, and visitors who happened to be in the area. The smoke and hot gases being pushed ahead of the fire by the strong wind made it difficult to see and breathe, causing panic [6]. As a result, many of them were intoxicated by smoke and burned inside their cars, most of which were found charred in one street stuck in a deadly traffic jam 150-200 m long [14].
27	Possible causes of issues in management operations	• Downslope winds in the eastern regions of Attica resulted in significant temperature rise and low humidity [2]. • Fuel differences (type and amount of vegetation due to previous fires) could have led to alterations in fire behavior and the rate the front spread eastwards towards Mati [2]. • Poor spatial planning (houses built near or even within pine forest at random density incomplete road network with narrow streets and dead end. Some of the important features include narrow streets (2.7 m at some locations) numerous dead ends, particularly long roadblocks, no possibility of lateral escape, lack of concentration/refuge areas (e.g. sports fields, squares). A wide street parallel to the coastline could have played the role of escape route towards the adjacent settlements [1]. • Not a single street was designed to provide direct access to the sea [2].

		• Paths leading to the sea were blocked by fences rocky and steep seashores [2]. • Lack of public gathering places [2]. • Lack of firewalls (Marathon Avenue, given its 15 m width could have served as such, yet the un-precedented severity of the fire and the inadequate coordination measures led to its overcome) resulted in the entrapment of a significant number of people [2].
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29	Name/Surname/Email/Date of who filled in this template	Eleni Asimakopoulou Easimakopoulou@uclan.ac.uk 24/07/2021

18. Qinyuan fire (Mainland China), 2019

A forest fire broke out in a village in Qinyuan, Shanxi, China, Mar. 29 2019. Due to strong winds, the fire spread to other villages. A total of 9149 people had been evacuated, of which 2308 were resettled. All departments worked together to extinguish the fire on April 5th without causing casualties.

1	Where?	Qinyuan, Shanxi Province
2	When?	2019/3/29 13:10-2019/4/5 10:30
3	How the fire was started?	An electrical fire caused by wind
4	Initial fire size	No information
5	Area affected (burned area)	942 ha
6	Fuels involved in the fire	Vegetation
7	WUI, urban, wildland or informal settlement fires?	Wildfire
8	Average weather conditions	Temperature -7 ℃ -23 ℃ ; average wind speed 3.4m/s-5.4m/s, but maximum can be 17.2-20.7m/s
9	Geographical highlights	Cliff crisscross, steep mountain slope, many combustibles, forest coverage rate 56.7%
10	Was there any fire break? (natural or artificial)	No
11	Did the Fire Service report extreme fire behavior?	Wide range of combustion, long distance reinforcements
12	Number of structures and infrastructures affected (damaged)	942 hectares grassland
13	Estimated direct and indirect economic damage	No information
14	Did it occur in conjunction with multiple fires in the country?	Yes (But it didn't affect rescue efforts in Qinyuan)
15	Countries involved	China
16	Brief timeline of the key events	3/29 12:56 Fire started 13:00 Township cadres received evacuation orders 13:04 The Public Security Bureau received the report 13:30 The Ministry of Emergency Management received the report; Surrounding forests were ignited due to strong wind 3/30 2:00 Another village received evacuation order 3:00 The Department of Emergency Management Working Group arrived at the fire scene 5:30 4670 people evacuated 10:00 Fire was under control 10:40 Fire spread rapidly to the southeast due to

		the terrain and wind 3/31 In the morning, 9149 people evacuated 4/5 10:30 Flame was fully extinguished
17	Time of initial order to evacuate and locations	3/29 13:00
18	Time when evacuation was considered completed	3/31 (More villagers had to be evacuated as the fire spread)
19	Deaths/Injuries	No casualties, 9149 people affected
20	The number of people evacuated	9149
21	The location people initially evacuated	Near site
22	Reasons why people decided to evacuate	Mandatory order
23	Evacuation type	On foot, vehicles of fire department
24	Any drill/education/instructions on large outdoor fires provided beforehand?	Yes (As a forest fire occurred 15 days ago, the government had issued a ban on mountains and fires. When there was a fire, all the villagers who might be involved in the fire were evacuated in advance, and the fire was under control by the cooperation of various departments without causing casualties or damage to houses)
25	Personnel involved in rescue operations	Professional fire brigade, fire fighters, armies, cadres and the mass
26	Did the smoke hindered significantly the evacuation because of low visibility or health problems	No
27	Possible causes of issues in management operations	Previous experience in firefighting had greatly enhanced management capabilities. The organization of personnel was rapid, used a combination of firefighting methods, and the division of work was clear
28	References	Record of Qinyuan forest fire fighting: http://www.shanxi.gov.cn/yw/sxyw/201904/t20190406_525856.shtml http://www.yq.gov.cn/ywdt/snyw/201904/t20190405_855875.shtml http://www.aqsc.cn/anjian/201904/08/c103478.html http://www.shanxi.gov.cn/yw/zwlb/gsdt/201904/t20190402_525376.shtml https://m.chinanews.com/wap/detail/chs/zwsp/8796051.shtml

		http://www.sx.chinanews.com.cn/news/2019/0330/143809.html
29	Name/Surname/Email/Date of who filled in this template	Yu Wang, yuwang@ustc.edu.cn; Ting Xia, xiating2021@mail.ustc.edu.cn 2021/February


Qinyuan fire scene


Fire was controlled within a certain range

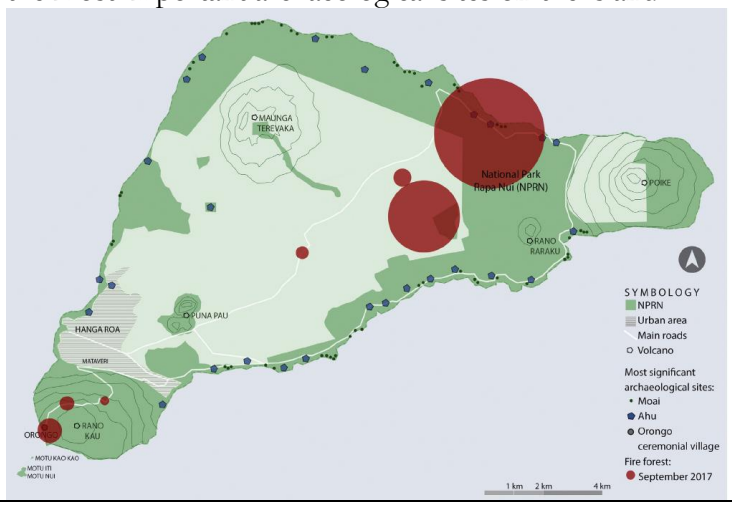
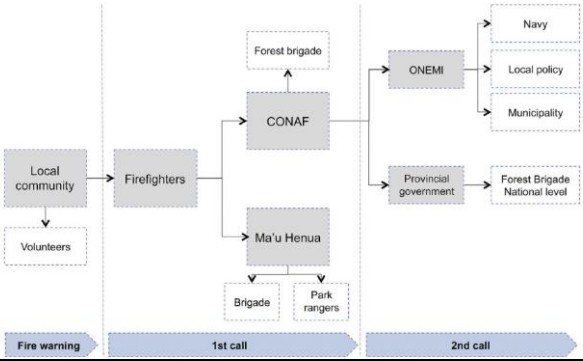
https://www.chinaxiaokang.com/chengshi/2019/0401/655326.html
http://news.163.com/photoview/00ap0001/2300742.html#p=EBHR9I9800AP0001NOS

19. Rapa Nui Island (Chile), 2017

Rapa Nui National Park (RNNP) is a national park and UNESCO World Heritage Site located on Easter Island, Chile. It is the most remote inhabited island on the planet located in the southeastern Pacific Ocean. It is 3,700 kilometers from the coast of continental Chile and has an area of 16,628 hectares.

According to the information provided by The National Forestry Corporation (CONAF), 175 fires were registered on the island between 2011 and 2017. The data obtained indicate that the number of hectares affected increased by more than 1000% (from 50 to 570 ha) of which nearly 300ha was consumed in 2017 fire. According to CONAF records, this increase in the number of forest fires on the island can be attributed to two factors related to climate change: the increase in temperature on the island and low rainfall. These wildfires on the island are of anthropic origin, occasionally associated with vandalism. In addition, the inhabitants practice the burning of pastures, part of an ancestral ritual that favors the growth of new grass for the animals.

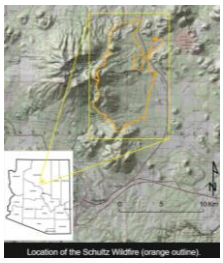
1	Where?	Rapa Nui National Park (RNNP), Easter Island, Chile
2	When?	September 2017
3	How was the fire started?	Different reasons contributed to these fires mainly social and cultural aspects: • It is observed that these fires are of anthropic origin, occasionally associated with vandalism. • An ancestral ritual of the burning of pastures followed by the inhabitants to favor the growth of new grass for the animals. • Intentional burning caused by ideological and political conflicts between the clans and families of the resident indigenous community
4	Initial fire size	No detailed information, residents claimed to see a spotlight and notified the firefighters
5	Area affected (burned area)	~300ha
6	Fuels involved in the fire	Vegetation, trees, grass (*Melinis minutiflora*)
7	WUI, urban, wildland or informal settlement fires?	Wildland, WUI
8	Average weather conditions	2017 was the second driest year with a 44% deficit in rainfall. The average high temperature was around 21 °C (70 °F).
9	Geographical highlights	It is the most remote inhabited island on the planet located in the southeastern Pacific Ocean. It is 3,700 kilometers from the coast of continental Chile. Topography of the island facilitates windy conditions.
10	Was there any fire break? (Natural or artificial)	No information
11	Did the Fire Service report extreme fire behavior?	Emergency was declared in the whole island after 48 h of activity as it was beyond the abilities of fire fighters to control the fire. Forest brigade had to be called from the continent.
12	Number of structures and infrastructures	Damage to the natural and cultural heritage sites, with pronounced effects on petroglyphs were reported.

	affected (damaged)	
13	Estimated direct and indirect economic damage	No information
14	Did it occur in conjunction with multiple fires in the country?	Multiple fires on the island near the Rapa Nui National Park in between 2011 and 2017 with a major event in September 2017. Figure below shows the location of the fires—inside and outside the boundaries of the RNNP—as well as the relationship with the most important archaeological sites on the island 
15	Countries involved	Chile
16	Brief timeline of the key events	1. Residents saw a spotlight and notified firefighters. 2. Firefighters were mainly responsible for combating urban fires over forest fires, so they alerted CONAF (National Forestry Corporation), and the site manager. 3. As fire started becoming out of control, CONAF alerted the ONEMI (National Office of Emergency of the Interior Ministry), who declared a red alert on the entire island. 4. The army, local police, local volunteers, the municipality also assisted. 5. After 48 h of activity, with more than six simultaneous outbreaks, the island was totally outnumbered in its ability to cope with the fire. 6. Due to forest emergency, the forest brigade from the main continent arrived on the island to combat the fire. Figure below highlights the sequence of the events: 
17	Time of initial order to evacuate and locations	After 48 h of activity, the island was totally outnumbered in its ability to cope with the fire and emergency was declared.

18	Time when evacuation was considered completed	No information
19	Deaths/Injuries	No information
20	The number of people evacuated	No information
21	The location people initially evacuated	No information
22	Reasons why people decided to evacuate	No information
23	Evacuation type	No information
24	Any drill/education/instructions on large outdoor fires provided beforehand?	Unknown
25	Personnel involved in rescue operations	CONAF (National Forestry Corporation), ONEMI (National Office of Emergency of the Interior Ministry), Army, Local police, Local volunteers, Municipality, Fire brigade from main continent
26	Did the smoke hindered significantly the evacuation because of low visibility or health problems	No information
27	Possible causes of issues in management operations	Lack of coordination between the different entities, Inefficient disaster risk management plan, No known protocols and drills
28	References	1. Espinoza-Valenzuela, Constanza, and Marcela Hurtado. "Risk management for forest fires at a world heritage site: Vulnerability and response capacity by Rapa Nui indigenous community." Understanding Disaster Risk. Elsevier, 2021. 257-277. https://doi.org/10.1016/B978-0-12-819047-0.00014-7 2. https://gfmc.online/media/2017/12-2017/news_20171231_cl.html 3. https://www.conaf.cl/comunidad-de-rapa-nui-asume-incendios-forestales-como-un-tema-social-y-cultural/ 4. https://www.wmf.org/sites/default/files/article/pdfs/Easter%20Island_The%20Heritage%20And%20Its%20Conservation.pdf 5. https://whc.unesco.org/en/list/715/ 6. https://www.resilient-coast.com/en/ 7. https://www.conaf.cl/incendios-forestales/ 8. https://weatherspark.com/m/150391/9/Average-Weather-in-September-in-Easter-Island-Chile 9. https://www.onemi.gov.cl/
29	Name/Surname/Email/Date of who filled in this template	Ankit Sharma ankit.sharma@case.edu 25 June, 2022

20. Schultz Fire (USA), 2010

The Schultz Fire was started from an abandoned campfire. The fire became a wind-driven event, burning in major part across moderate to very steep Ponderosa pine and mixed conifer covered slopes. Forty percent of the 15,051 acre fire area was mapped as high soil burn severity due to creation of hydrophobic conditions and complete loss of the protective and effective vegetative ground cover on the moderate to very steep slopes.

1	Where?	Coconino National Forest, Arizona
2	When?	20th June 2010 to 15th July 2010
3	How was the fire started?	Camp fire
4	Initial fire size	-
5	Area affected	15051 acres (6,100 ha)
6	Type/s of forest involved in wildfire	Vegetation involved was Ponderosa pine/Arizona fescue; Mixed conifer (White fir/Douglas-fir, Englemann spruce/Whitefir/Douglas-fir), Spruce-Fir)
7	Did the fire spread inside the WUI	Yes
8	Average weather conditions	Summer
9	Geographical highlights	Holocene to Middle Pliocene volcanic rocks; Holocene to Middle Pliocene basaltic rocks; Quaternary surficial deposits   (Koestner, 2011; USDA, 2010)
10	Was there any natural fire break?	-
11	Did the Fire Service report extreme fire behavior	-
12	Number of structures and infrastructures affected	No structure damaged,
13	Estimated direct and indirect economic damage	Total estimated treatment cost is USD 3,026,335 and fire supression cost is $9,400,000 (estimate) (BAER, 2010)
14	Did it occur in conjunction with multiple fires in the country?	Yes. There was another fire in that area started on 11th June 2010 by lightning. This initial fire was contained 90% on 25th June. In other words, this second fire started before extinguishment of the first fire in that area.
15	Countries involved	USA
16	Brief timeline of the events	The Schultz Fire began at 11:09 A.M. June 20 north of Flagstaff and grew rapidly due to high winds, requiring the Coconino County sheriff to close U.S. 89 and evacuate 748 homes, an animal shelter, Sunset Crater and Wupatki

		National Monument. On June 22, the fire was 20 percent contained and approximately one thousand people were allowed to return to their homes. By that time 14,000 acres (5,700 ha) had burned and 800 firefighters were fighting the blaze (Schultz Fire, 2018)
17	Time of initial order to evacuate	June 20th
18	Time when evacuation was considered completed	June 22nd
19	Deaths/Injuries	2 firefighters injured
20	The number of people evacuated	communities of Timberline, Hutchinson Acres, and Wupatki Trails, Second Chance Animal Shelter and Elden Horse Camp were evacuated (BAER, 2010). In total 748 homes evacuated (Schultz Fire, 2018).
21	People threatened to be evacuated	Yes, in total 748 homes evacuated.
22	Evacuation type	-
23	Personnel involved in rescue operations	Initially it was 300 and later 800 firefighters were involved (Schultz Fire, 2018)
24	Did the smoke hindered significantly the evacuation because of low visibility or health problems	-
25	Possible causes of issues in management operations	-
26	References	USDA, Schultz Fire, United States Department of Agriculture, Available at: https://www.fs.usda.gov/rmrs/2010-schultz-fire BAER, 2010. Schultz Fire, Coconino National Forest, Burned Area Emergency Response Report, USDA-FOREST SERVICE, FS-2500-8 (6/06), Available at: https://www.fs.fed.us/rm/boise/AWAE/labs/awae_flagstaff/Hot_Topics/SchultzWildfire2010/schultz_BAER_report.pdf Koestner, K.A; Youberg, A.; Neary, D.G. 2011. Field trip guide to the 2010 Schultz Fire burn area. Paper presented at the 24th Annual Symposium of the Arizona Hydrological Society; Watersheds near and far: Response to changes in climate and landscape; September 18-20, 2010; Flagstaff, AZ. 22p. Schultz Fire, 2018. Wikipedia, https://en.wikipedia.org/wiki/Schultz_Fire
27	Name/Surname/Email/Date of who filled in this template	M. Asim Ibrahim asim.ibrahim@lnu.se submitted on 18-06-2021

21. Shangri-La fire (Mainland China), 2014

A fire started at the heater in a building in Shangri-La County, Yunnan Province, China, Jan. 11 2014. The damaged and demolition of housing area was 59,980 m^2, which worth 89.84 million YUAN (about 13.89 million US dollars). Nearly 10 hours after, the fire was put out. The fire was classified as a major fire accident with no casualties.

1	Where?	Shangri-La County, Yunnan Province
2	When?	2014/1/11/1:10-2014/1/11/10:50
3	How the fire was started?	Misuse of heater
4	Initial fire size	Computer desk
5	Area affected (burned area)	59980.66 m^2
6	Fuels involved in the fire	Structures
7	WUI, urban, wildland or informal settlement fires?	Informal settlement
8	Average weather conditions	On the day of fire occurrence, temperature between -9℃ to 7℃, average wind speed 5.5-7.9 m/s but sometimes can be 10.8-13.8 m/s at the top of the mountain
9	Geographical highlights	High altitude of 3020 m, crisscross valleys, a gradient of about 60 degrees, rolling stones, low temperature, narrow roads, traditional settlement area
10	Was there any fire break? (natural or artificial)	No
11	Did the Fire Service report extreme fire behavior?	Major fire accident, a long-time fire
12	Number of structures and infrastructures affected (damaged)	343
13	Estimated direct and indirect economic damage	Direct: 89.8 million YUAN (about 13.89 million $) Indirect: over 100 million YUAN (about 15.46 million $) The fire seriously damaged the infrastructure of the traditional settlements, burned a large number of cultural relics, which cannot be put a price on.
14	Did it occur in conjunction with multiple fires in the country?	No
15	Countries involved	China
16	Brief timeline of the key events	1/11 1:10 am A fire started at the living room 1:22 am A team of local fire branch was dispatched to the fire site 1:37 am A fire brigade arrived at the site of the fire accident 1:41 am The firefighters immediately started to put the fire 1:43 am 124 policemen arrived at the fire site 1:56 am The fire was controlled within the

		burning building (Ruyi Inn) 2:10 am 250 police officers of county and state arrived at the fire site one after another after receiving instructions 2:20-4:00 am A total of 1,600 policemen and firefighters arrived at the fire site 5:00 am Excavators arrived at fire site 6:00 am 5 vehicles and 17 reinforcements arrived at the site 7:00 am Fire was under control 7:50 am 95 Firefighters arrived at the fire site 9:45 am Firefighting headquarters, firefighters and some equipments were dispatched to the fire site 10:50 am Flame was almost extinguished
17	Time of initial order to evacuate and locations	No exact time (Evacuate immediately after receiving the report)
18	Time when evacuation was considered completed	No information
19	Deaths/Injuries	No casualties, over 2600 affected
20	The number of people evacuated	Over 2600
21	The location people initially evacuated	Homes of friends and relatives, temporary settlements, hotels
22	Reasons why people decided to evacuate	Fire approaching their dwellings
23	Evacuation type	On foot
24	Any drill/education/instructions on large outdoor fires provided beforehand?	No (As it was mentioned in the Shangri-La fire accident investigation report: The fire hydrants lacked frost protection and water was inadequate, and the large fire trucks couldn't enter the buildings areas. The relevant organizations may not pay enough attention to fire safety issues and not organize special inspections very well)
25	Personnel involved in rescue operations	Firefighters, armies, residents
26	Did the smoke hindered significantly the evacuation because of low visibility or health problems	No
27	Possible causes of issues in management operations	Narrow roads, flammable dwellings, many combustibles and exploders, inadequate water (lacked frost protection, insufficient hydrants and water pressure), fire protection not satisfying the codes, inadequate monitoring
28	References	Shangri-La major fire accident investigation report: http://yjglt.yn.gov.cn/yingjigongzuo/guapaiduban/201406/t20140619_986734.html http://travel.people.com.cn/n/2014/0111/c41570-24090381.html http://www.nbd.com.cn/articles/2020-12-

		30/1584416.html
29	Name/Surname/Email/Date of who filled in this template	Yu Wang, yuwang@ustc.edu.cn; Ting Xia, xiating2021@mail.ustc.edu.cn 2021/January


Fire rescue site


Dukezong city after the fire

https://640life.com/2014-01-14-1099/
http://news.cnr.cn/native/city/201401/t20140111_514628818_2.shtml
https://new.qq.com/rain/a/20210627a03wgb00
http://www.chengtu.com/forum.php?mod=viewthread&tid=401385&page=1

22. Swinley fire (UK), 2011

A fire was ignited in Swinley forest, Berkshire on the 2nd May, 2011. The cause of ignition is suspected to be arson, but is otherwise unknown. Driven by wind speeds reaching 35km/h, the wildfire propagated across a mix of heathland and conifer forest in the southwest direction. This caused the evacuation of 13 local residences. Due to the collaboration of fire services and nearby roads acting as effective fire breaks, the fire spread was significantly limited to burning 1.65km^2 of the 3km^2 forest.

1	Where?	Swinley Forest, Berkshire, United Kingdom
2	When?	02/05/2011 – 08/05/2011
3	How the fire was started?	Suspected Arson (otherwise unknown)
4	Initial fire size	Unknown
5	Area affected (burned area)	3km^2 impacted, 1.65km^2 burnt
6	Fuels involved in the fire	Conifer forest and heathland
7	WUI, urban, wildland or informal settlement fires?	wildland
8	Average weather conditions	High wind speeds (initially above 35kmh^{-1}), low relative humidity (40%), and high temperatures (above 30 degrees Celsius).
9	Geographical highlights	Multiple paths and main roads
10	Was there any fire break? (natural or artificial)	Yes, main roads acted as effective fire breaks
11	Did the Fire Service report extreme fire behavior?	Considerably strong winds driving spread
12	Number of structures and infrastructures affected (damaged)	No residences affected, several roadways closed
13	Estimated direct and indirect economic damage	£1 million incurred to fire services and local area. Estimated 1.65 km^2 burnt
14	Did it occur in conjunction with multiple fires in the country?	No
15	Countries involved	United Kingdom
16	Brief timeline of the key events	2/05/2011 – fire detected in Swinley Forest 3/05/2011 – press release confirming evacuations and several road closures 8/05/2011, 17:43 – Stop message issued by fire services
17	Time of initial order to evacuate and locations	Unknown
18	Time when evacuation was considered completed	Unknown
19	Deaths/Injuries	None recorded
20	The number of people evacuated	13 local residences in Brookers Row
21	The location people initially evacuated	
22	Reasons why people decided to evacuate	Unknown
23	Evacuation type	Car
24	Any drill/education/instructions on	

	large outdoor fires provided beforehand?	
25	Personnel involved in rescue operations	Twelve national fire and rescue services
26	Did the smoke hindered significantly the evacuation because of low visibility or health problems	Unknown
27	Possible causes of issues in management operations	Unknown, evacuation and limitation of fire spread were successful
28	References	Scientific Literature: Thomas Smith. Modelling the Swinley Crowthorne forest fire. URL http://www.kfwf.org.uk/_assets/documents/swinleyforest/TELSMITH_SwinleyWildfire%20Seminar_Modelling_10April2015.pdf Fire Incident Reports: https://www.whatdotheyknow.com/request/incident_log_for_swinley_forest Weather data: https://www.metoffice.gov.uk/public/weather/fire-severity-index/documents/Spring_2011_fire_weather_conditions_tcm6-35277.pdf
29	Name/Surname/Email/Date of who filled in this template	Harry Mitchell HM2315@ic.ac.uk 11/06/2019

23. Tathra wildfire (Australia), 2018

The Bega Valley Shire on the New South Wales south coast in Australia was impacted by the Tathra wildfire that started on 18th March 2018. It destroyed 65 houses and caused the evacuation of approximately 700 residents, tourists, and visitors. A failure of electrical infrastructure in the Reedy swamp was the source of the fire that spread rapidly under extreme weather conditions. The confusion of assisting NSW rural fire service by the Fire and Rescue NSW delayed the control of the fire that led to destroying many properties. The power outage created a difficult environment of passing alerts to the people for evacuation.

1	Where?	Tathra, South Coast, New South Wales, Australia
2	When?	18/03/2018 – 19/03/2018
3	How the fire was started?	Electrical infrastructure failure
4	Initial fire size	Locally began in Reedy Swamp
5	Area affected (burned area)	3100 acres
6	Fuels involved in the fire	Structures, dry sclerophyll shrub forests, farmland and swamp vegetation
7	WUI, urban, wildland or informal settlement fires?	Urban, Residential, Farmland, Forest reserves
8	Average weather conditions	Extremely hot and windy. The temperature was over 37 ^{0}C and the wind gusts over 70 km/h. Low humidity and dry bush.
9	Geographical highlights	The fire started at Reddy swamp and spread towards the municipal area. Bega river flowing through the area. The area is close to the Tathra beach.
10	Was there any fire break? (natural or artificial)	Bega river Reedy swamp road
11	Did the Fire Service report extreme fire behavior?	Ministry of emergency services informed the public to prepare themselves for the upcoming fire season.
12	Number of structures and infrastructures affected (damaged)	65 houses destroyed, 48 damaged including 35 caravans and cabins.
13	Estimated direct and indirect economic damage	About $63.5 million.
14	Did it occur in conjunction with multiple fires in the country?	A series of 11 000 uncontrolled bushfires burnt 587 790 acres over NSW (Sydney, Hunter, Southern Tablelands, Mid Western, Jervis Bay, Hunter, Port Stephen, Pilliga, New England) from July 2017 to February 2018.
15	Countries involved	Australia
16	Brief timeline of the key events	<u>18/03/2018</u> 11.15 am- Local NSW Rural fire service received the first call about the fire near Tarraganda from a Tathra resident. 12.28 am-The first call received reporting the bushfire in the Reddy Swamp area. 12.33 pm-Firefighting units dispatched from the NSW Rural fire service and asked for assistance

		from fire and rescue NSW. 12.38 pm-Bega valley area could see the smoke column from the fire that is highly visible. 12.44 pm- the first arrival of the Rural fire service to the fire location. 12.54 pm- Reporting Tathra as a potential future thread after noticing the intensive burning by the firefighters. 12.58 pm- The NSW rural fire service decline a second offer of assistance from fire and rescue NSW. 01.22 pm-Fire crossed the Reedy swamp road 01.30 pm- Recorded at least 12 separate fires in the Bega Valley area. 02.56 pm-Fire ran towards Tathra after crossing the Bega river. 03.00 pm- Recorded at least 20 separate fires in the Bega Valley area. 03.22 pm-Houses in west Tathra and Thompson drive started to be impacted by the fire. 03.34 pm- Fire started to impact the main Tathra township. 03.56 pm- Firefighters on the ground from any unit were urgently requested to respond to Tathra. 04.16 pm- The ground crew reported at least 35 houses started to burn. 04.27 pm- Fire reached the beach after burning the township and stopped at the ocean. 05.29 pm- 50 houses were reported burning. 10.40 pm-At least 2500 acres were burnt before the fire was totally under control.
17	Time of initial order to evacuate and locations	The first evacuation message was received at 4 pm. The power outage led to operating phones and no warning was received to residents about the approaching fire before 4 pm. The people were brought to the evacuation centre in the Bega.
18	Time when evacuation was considered completed	No information available
19	Deaths/Injuries	It is believed four people in the Tathra region had been treated for smoke inhalation and one RFS volunteer had been injured. No missing or dead people.
20	The number of people evacuated	Approximately 700
21	The location people initially evacuated	The evacuation centre Bega. Residents huddled on the beach to try and escape from the flames before being evacuated.
22	Reasons why people decided to evacuate	Getting the evacuation call Seeing the smoke
23	Evacuation type	Predominantly ground transport like private vehicles, some people have walked towards the

		beach.
24	Any drill/education/instructions on large outdoor fires provided beforehand?	No information available
25	Personnel involved in rescue operations	NSW Rural Fire Service. Fire and Rescue NSW declined the requested support by NSW Rural fire twice. Total number: +150
26	Did the smoke hindered significantly the evacuation because of low visibility or health problems	Significant smoke and a blaze created difficulties for the evacuation: Up to 4 people had been hospitalized with smoke inhalation. Some people went down to the beach to escape the blaze with fume masks
27	Possible causes of issues in management operations	Firefighting: Declining the offer to assist to extinguish the fire by Fire and Rescue NSW was a major problem to delay the evacuation and saving properties. This decline happened at the early stage of the fire that affected the immediate fire suppression and cost more houses that could have been saved. Communication: The order to evacuate had not been passed on time to the people because of the power outage. Policies not followed on the day: The Deputy incident controller was not appointed. Delays in feeding information back to FRNSW ComCen. The 'Fires near me' app was not regularly updated. Issuing an emergency alert was too late. ABC radio prioritized normal broadcast over emergency updates.
28	References	Academic: J. Whittaker, K. Haynes, M. Tofa, C. Wilkinson, and M. J. R. f. t. N. R. F. S. Taylor, "Understanding bushfire risk, warnings and responses: a study of the 2018 reedy swamp fire," 2020. L. Hofeditz, C. Ehnis, D. Bunker, F. Brachten, and S. Stieglitz, "Meaningful Use of Social Bots? Possible Applications in Crisis Communication during Disasters," in ECIS, 2019. K. Haynes, M. Tofa, and J. Whittaker, "Sensing bushfire: Exploring shifting perspectives as hazard moves through the landscape," in Weather: Spaces, Mobilities and Affects: Routledge, 2020, pp. 171-185. Other:

		P. Duffin, "NSW bushfires: Tathra bushfire that incinerated homes likely the result of power lines and trees," The Daily Telegraph, 03 Aug 2020 2020. N. R. F. Services, "Initial assessment of fire affected area-Tathra," Media release, 19 March 2018 2018. B. Wylie, "Bushfire in Tathra wipes out 69 homes, residents still unable to return to NSW south coast town," ABC News, 19 March 2018 2018. O. o. e. management, " Bega Valley Fires Independent Review " no. Department of Justice, June 2018 2018. B. Smyth, "Tathra evacuated as out of control bushfire destroys property," The Canberra Times, 18 March 2018 2018. C. Knaus, "Tathra bushfire: NSW Rural Fire Service says power lines likely cause," The Guardian, 22 March 2018 2018.
29	Name/Surname/Email/Date of who filled in this template	Amila Wickramasinghe p.wickramasinghe@live.vu.edu.au 06/07/2021

24. Valparaiso fire (Chile), 2014

The fire started in a forest located in La Pólvora hill at 16:40 on April 12. It is considered the largest urban fire in Chilean history. The fire spread downhill helped by the strong wind (max wind speeds of 70 km/hr were registered) reaching La Cruz, El Vergel, San Roque, Las Cañas y Mariposas hills where thousands of families had built their homes in the hills' steep slopes.
The area had been affected by draught for several years, in addition unusual strong winds and high temperatures were registered. The week before the incident, several wildland fires were reported in the area.

1	Where?	Valparaíso, Chile
2	When?	April 12 -16, 2014
3	How was the fire started?	Electric failure due to birds interfering with power line
4	Initial fire size	No information
5	Area affected (burned area)	1070 ha
6	Fuels involved in the fire	Structures and trees
7	WUI, urban, wildland or informal settlement fires?	WUI
8	Average weather conditions	Wind speed >30 km/hr (SE wind) Temperature 30°C
9	Geographical highlights	Steep slopes and ravines
10	Was there any fire break? (natural or artificial)	Several roads are seen in Google maps
11	Did the Fire Service report extreme fire behavior?	
12	Number of structures and infrastructures affected (damaged)	2900
13	Estimated direct and indirect economic damage	USD 110M
14	Did it occur in conjunction with multiple fires in the country?	No
15	Countries involved	Chile
16	Brief timeline of the key events	April 12th 760 ha burnt (green area) April 13th 90ha burnt (red area), total 850ha burnt April 14th 220 ha burnt (yellow), total 1070 ha burnt

<table>
<tr><td></td><td></td><td> 
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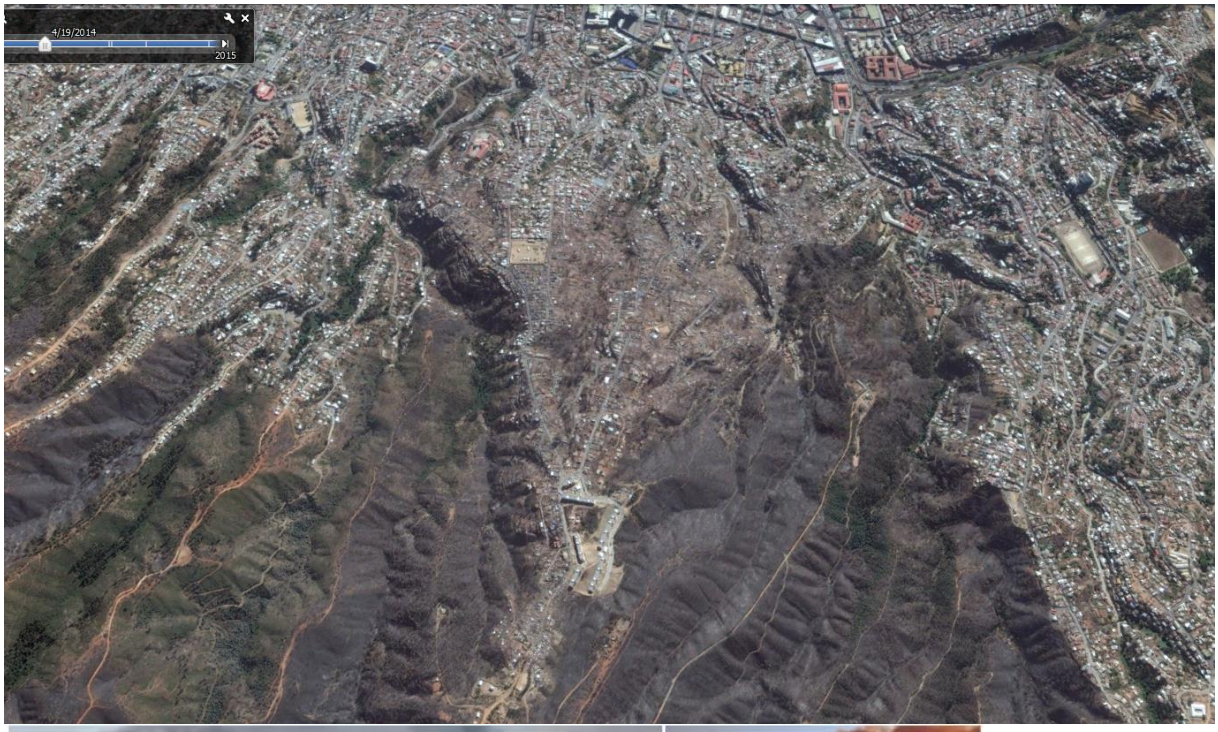
<tr><td>17</td><td>Time of initial order to evacuate and locations</td><td>There were 7 official refuges:
• 4 schools
• 1 church
• 2 sport centers (navy gym, O'Higgins stadium)
Additionally, 200 inmates were evacuated to a sport center in Playa Ancha, 9 inmates and their kids were sent to another prison in Quillota</td></tr>
<tr><td>18</td><td>Time when evacuation was considered completed</td><td></td></tr>
<tr><td>19</td><td>Deaths/Injuries</td><td>15/500</td></tr>
<tr><td>20</td><td>The number of people evacuated</td><td>12500, 940 inmates</td></tr>
<tr><td>21</td><td>The location people initially evacuated</td><td></td></tr>
<tr><td>22</td><td>Reasons why people decided to evacuate</td><td></td></tr>
<tr><td>23</td><td>Evacuation type</td><td></td></tr>
<tr><td>24</td><td>Any drill/education/instructions on large outdoor fires provided beforehand?</td><td>Unknown</td></tr>
<tr><td>25</td><td>Personnel involved in rescue operations</td><td><table>
<tr><th></th><th>April 12th</th><th>April 13th</th><th>April 14th</th><th>April 15th</th></tr>
<tr><td>Wildland firefighters brigade</td><td>7</td><td>14</td><td>12</td><td>13</td></tr>
<tr><td>Mobil commands</td><td>1</td><td>1</td><td>1</td><td>1</td></tr>
<tr><td>Aircrafts</td><td>2</td><td>7</td><td>6</td><td>13</td></tr>
<tr><td>Helicopters</td><td>-</td><td>13</td><td>11</td><td>18</td></tr>
<tr><td>Tanker truck</td><td>-</td><td>3</td><td>3</td><td>-</td></tr>
<tr><td>Military Wildland firefighters brigade</td><td>-</td><td>4</td><td>7</td><td>6</td></tr>
</table></td></tr>
<tr><td>26</td><td>Did the smoke hindered significantly the evacuation because of low visibility or health problems</td><td></td></tr>
<tr><td>27</td><td>Possible causes of issues in management operations</td><td>Narrow roads, flammable dwellings, inadequate water supply</td></tr>
<tr><td>28</td><td>References</td><td>P. Reszka, A. Fuentes, The Great Valparaiso Fire and Fire Safety Management in Chile, Fire Technol.</td></tr>
</table>

		51 (2015) 753–758. doi:10.1007/s10694-014-0427-0. https://emergenciaydesastres.mineduc.cl/incendio-valparaiso/ https://www.bbc.com/mundo/ultimas_noticias/2014/04/140412_ultnot_chile_incendio_valparaiso_jgc https://www.latercera.com/noticia/los-ineditos-detalles-del-peritaje-que-determino-la-causa-del-incendio-de-valparaiso/ https://www.dicyt.com/noticias/academicos-explican-causas-del-gran-incendio-en-valparaiso https://twitter.com/ministeriosalud/status/455806222831464449/photo/1 https://www.conaf.cl/wp-content/uploads/2014/04/IFvalpoGRANDE-15abr.jpg https://labrecha.me/?p=30125
29	Name/Surname/Email/Date of who filled in this template	Natalia Flores nataliaflores@sun.ac.za July


4/19/2014
2015

25. Wooroloo wildfire (Australia), 2021

The Shire of Mundaring, Chittering, Northam and, the City of Swan were impacted by the Wooroloo wildfire that started on the 1st of February 2021. It destroyed 86 buildings and caused 8 non-fatal injuries. The harsh daytime temperature and the strong wind increased the fire spread rate to burn approximately 27 000 acres costing $40 million. The rescue operation was difficult not only because of the harsh environment but the fire overlapped with the lockdown period of the covid-19 Pandemic in Western Australia.

1	Where?	Wooroloo, Shire in Mundering, Western Australia
2	When?	01/02/2021 – 07/02/2021
3	How the fire was started?	No information available
4	Initial fire size	No information is available.
5	Area affected (burned area)	27 0000 acres (10 900 hectares)
6	Fuels involved in the fire	Structures, Eucalyptus, Shrubs (Banksia)
7	WUI, urban, wildland or informal settlement fires?	Urban, Residential, Shrublands
8	Average weather conditions	Harsh with the daytime temperature at 38 ^{0}C and strong winds. The region had received a higher rainfall (137.8 mm) in November 2020 that helped the growth of a large amount of grass. In December the rainfall has dramatically decreased (5 mm) resulting in the grass and other vegetations drying up.
9	Geographical highlights	Hilly terrain in the north-westerly direction.
10	Was there any fire break? (natural or artificial)	Toodyay road
11	Did the Fire Service report extreme fire behavior?	Alert was issued for 69 suburbs including 13 of them as an immediate danger.
12	Number of structures and infrastructures affected (damaged)	86 houses and 2 fire trucks
13	Estimated direct and indirect economic damage	Over $40 million.
14	Did it occur in conjunction with multiple fires in the country?	No
15	Countries involved	Australia
16	Brief timeline of the key events	The fire continued for 7 days. 1st February: 12.02 pm- Reporting the fire started near Wooroloo. Bailup and Gidgegannup residents received the emergency warning to evacuate. 3.42 pm- 570 acres were reported burnt. The fire started to spread north-westerly direction. 6.00 pm- seven houses were reported as burnt. 11.00 pm- Department of fire and emergency services (DFES) reported 10 240 acres burnt. An emergency warning was issued to residents in Gidgegannup, Brigadoon, Upper swan, and

		Bullsbrook areas. 2nd February: 30 properties were reported as burnt. A smoke and ash falling alert was issued to residents in Joondalup and Fremantle. 4.00 pm- 18 000 acres were reported as burnt. 6.00 pm-20 000 acres were reported as burnt and 59 houses were destroyed. Six firefighters were reported as minorly injured. 3rd February Morning: 22 000 acres were reported as burnt and 71 houses were destroyed. Issued an evacuation notice to residents in Shady hill estate because of the change of the wind field. Evening: 25 000 acres were reported as burnt. 4th February 26 000 acres were reported as burnt. Reported the main fire was controlled by the firefighters and the aerial tankers that dropped 200 000 litres of retardants. Reported 81 houses were burnt. 5th February An emergency warning was reduced overnight. 27 000 acres were reported as burnt and 86 houses were burnt. 7th February Rainfall of 15 mm happened on the fire site.
17	Time of initial order to evacuate and locations	At 1.00 pm 1st February. The Brown park recreation complex (Swan View) Swan Active (Midland) Swan Active (Beechboro community hub)
18	Time when evacuation was considered completed	No information available
19	Deaths/Injuries	8 non-fatal injuries (including 6 firefighters with minor injuries).
20	The number of people evacuated	230 slept and 700 registered in the evacuation centre.
21	The location people initially evacuated	No information available
22	Reasons why people decided to evacuate	Getting the evacuation call
23	Evacuation type	No information available
24	Any drill/education/instructions on large outdoor fires provided	No information available

	beforehand?	
25	Personnel involved in rescue operations	500
26	Did the smoke hindered significantly the evacuation because of low visibility or health problems	A smoke alert was proceeded by DFES to the residents in Joondalup and Fremantle. One firefighter suffered from smoke inhalation. The aerial fire bombers experienced difficulty because of the smoke to drop fire retardants to assist firefighters and the evacuation.
27	Possible causes of issues in management operations	There had been a power outage around 1300 homes and, an outage of telephone signals because of the bushfire that made it difficult to communicate and access. There was confusion when following the evacuation orders. The bushfire was overlapped with the covid-19 lockdown 2021. People had been asked to stay at home before the bush fire started and they didn't know where to move for safety. Each firefighter had to wear a mask and maintained the physical distancing when participating in the operations due to the Covid-19.
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29	Name/Surname/Email/Date of who filled in this template	Amila Wickramasinghe p.wickramasinghe@live.vu.edu.au 07/07/2021

26. Wakkanai city fire (Japan), 2002

A fire broke out in Wakkanai-city, Hokkaido, Japan, around 6 pm, June 29th 2002. With strong winds and no initial suppression efforts, fire quickly spread. Firebrands were seen everywhere, resulting in 3 spot fires. As wind calmed down later that night, the fire was controlled and eventually extingushied.

1	Where?	Wakkanai-city, Hokkaido, Japan
2	When?	2002/June/29 around 6 PM
3	How the fire was started?	Started in a 2 story-wooden market building
4	Initial fire size	NA
5	Area affected (burned area)	8845 m^2
6	Fuels involved in the fire	Structures
7	WUI, urban, wildland or informal settlement fires?	Urban fires
8	Average weather conditions	9.1 m/s 17.7-18.6 C, RH 60-70 %
9	Geographical highlights	NA
10	Was there any fire break? (natural or artificial)	Roads, parking space
11	Did the Fire Service report extreme fire behavior?	quick fire spreads, at least 3 spot fires
12	Number of structures and infrastructures affected (damaged)	31 structures
13	Estimated direct and indirect economic damage	No information
14	Did it occur in conjunction with multiple fires in the country?	No
15	Countries involved	Japan
16	Brief timeline of the key events	6/29 6:17 PM A fire was reported. 6:20 PM Fire department arrived on site. Fire was well developed by this point due to the lack of initial suppression efforts. Initially fire spread quickly to north due to wind, then to east due to wind from west, then wind again changed direction fire spread to west around 7:30PM. Fire also spread over the 7 m road, a spot fire was observed around 8 PM. Fire spread quickly until 9 PM. 10:10 PM Firefighters destroyed 3 buildings to prevent fire spreads 6/30 0 AM

		Fire was under control 5:25 AM Fire was extinguished
17	Time of initial order to evacuate and locations	No information, 9:20 PM, evacuation order was issued to hotels in a downwind area (wakkanai-city, chou 2 chome)
18	Time when evacuation was considered completed	NA
19	Deaths/Injuries	0 death 19 injury (3 firefighters and 16 volunteer firefighters)
20	The number of people evacuated	77 (including 62 tourists)
21	The location people initially evacuated	Local shelter (elementary school)
22	Reasons why people decided to evacuate	Evacuation order was issued, fire was approaching
23	Evacuation type	On foot
24	Any drill/education/instructions on large outdoor fires provided beforehand?	No information
25	Personnel involved in rescue operations	Firefighters (professional or volunteer), army, airport personnel, police
26	Did the smoke hindered significantly the evacuation because of low visibility or health problems	No information
27	Possible causes of issues in management operations	No information
28	References	N. Abe, Outline of Spreading Fire in Wakkanai Urban Area, (2002) Kasai, vol. 52 No.4 pp.5-6 K. Kagiya & T. Iwami Report on City fire in Wakkanai-Part 1 Outline (2002) Kasai vol. 52, No. 5 pp. 47-50. https://www.giroj.or.jp/publication/risk/No_65-2.pdf http://www.nilim.go.jp/lab/bbg/saigai/wakkanai/wakkanai.pdf https://www.city.wakkanai.hokkaido.jp/kurashi/shobou/shokai/1-daikasai.html (in Japanese)
29	Name/Surname/Email/Date of who filled in this template	Sayaka Suzuki Samuel L. Manzello 2021/August/10th

5. Discussion

Twenty-five case studies are included in this report from 13 countries (i.e., Australia, Bangladesh, Chile, China, Greece, India, Japan, Philippines, Russia, South Africa, Sweden, UK and USA) as summarized in Table 1. The type of large outdoor fires covered were: wildfires/WUI fires (n = 15), urban fires (n = 7), informal settlement fires (n = 4).

These cases describe the fire process and evacuation in detail, which is helpful to understand and compare large outdoor fires in various regions of the world from the aspects of casualty losses, fire causes, evacuation methods and emergency management. Even though these cases can not represent all large outdoor fires, they provide a valuable reference for evacuation problems. Evacuations were not always ordered, in some case studies, people began to evacuate when the fire was approaching or when they saw the smoke. However, mandatory order of evacuation had not been listened to in Ash Wednesday bush fire, which led to 102 deaths, 172 injured and 1000 buildings destroyed. In these fires, the uncertainty of wind and improper evacuation may be the primary reasons for huge casualties. WUI fires often cause more casualties than other kinds of large-outdoor fires. According to the known information about informal settlement fires, narrow roads, flammable dwellings and inadequate water supply are common reasons for fire spread, and these factors also exist in some WUI and urban fires. What is more, due to the COVID-19, people had been asked to stay at home before the bush fire started and they didn't know where to move for safety, and the firefighters may have had to wear a mask and maintain the physical distancing, which brought challenges to fire rescue and evacuation. According to the available information of all case studies, economic losses caused by the fires ranged from 1,020 to 77 billion US Dollars, and more than 280,000 people were affected in different ways - injuries, deaths and displacements. The number of evacuated people ranged from 77 to 186,651 people. Across all case studies, 513 individuals were killed based on available information.

Table 1. The number of case studies in each country or region.

Continent	Country/Region	Number of case studies	Number of case studies
North America	USA	5	5
South America	Chile	2	2
Europe	Greece	1	4
	Russia	1	
	Sweden	1	
	UK	1	
Africa	South Africa	1	1
Asia	Bangladesh	2	10
	Mainland China	2	
	Taiwan	1	
	India	2	
	Japan	2	
	Philippines	1	
Oceania	Australia	4	4

This report is the expanded version of the first report, especially supplying more incidents from

Asia which is one of most rapid urbanizaition areas. Moreover, most of the case studies in this list relate to wildland fires or WUI fires, and there are urban fires and informal settlements fires as well. Therefore, the regions where fires occurred are diverse and the fire types are more representative. It should be noted that the case studies in the report were collected and collated by different researchers with different language or culture backgrounds from all over the world, so the way of expressing information will not be consistent, and although all the authors were trying best to collect the available information, there are still some information not available. If needed, please kindly reach out to the authors for more information.

6. Conclusions

This report is the expanded version of the first report published in 2021 [19], most of which occurred in North America; this report collects cases from more diverse regions and focuses on different types of large outdoor fires, including wildland fires, wildland-urban interface (WUI) fires, urban fires and informal settlement fires. These reports have preliminarily established a database of the global large outdoor fires involving evacuations, which provides an important basis and reference for future study.

The similar features in these fire events, the possible deficiencies in fire rescue, and the evacuation modes in these fire events can not only provide an important basis for exploring the common characteristics of such fires, but also provide the factual basis for formulating guidance at different stages of emergency management and evacuation planning for policymakers.

This work provides a good database for large outdoor fire evacuation and emergency management. Future detailed analysis of these cases would be conducted which may need more professionals involved in our fire safety community.

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Appendix A. Template for case studies

A template for a review of case study was developed and then presented in this report (Ronchi, E., Rein, G., Gwynne, S., Wadhwani, R., Intini, P., & Bergstedt, A. (2017). e-Sanctuary: Open Multi-Physics Framework for Modelling Wildfire Urban Evacuation. Quincy, MA (USA): Fire Protection Research Foundation). The template has been slightly modified in order to allow to build an IAFSS database on case studies involving evacuation in large outdoor fires.

Note: the template was slightly modified again 2019 December to expand case study collection and include all types of large outdoor fire evacuations. It should be noted that the template in cases 1, 17 and 19 has only 27 questions, but the basic information on fire characteristics and evacuation circumstances can obtained as well.

1	Where?	*Location of the incident*
2	When?	*Duration of the incident*
3	How was the fire started?	*Trigger event*
4	Initial fire size	*Scale of the initial fire*
5	Area affected (burned area)	*Area involved*
6	Fuels involved in the fire	*Vegetation, structures, etc.*
7	WUI, urban, wildland or informal settlement fires?	*Type of fire event*
8	Average weather conditions	*Environmental conditions during event*
9	Geographical highlights	*Landscape topography*
10	Was there any fire break? (natural or artificial)	*Constraints on the fire development*
11	Did the Fire Service report extreme fire behavior?	*Recognised fire conditions*
12	Number of structures and infrastructures affected (damaged)	*Scale of physical impact*
13	Estimated direct and indirect economic damage	*Scale of physical impact*
14	Did it occur in conjunction with multiple fires in the country?	*Coincidence with other events (leading to resource issues)*
15	Countries involved	*Either as the incident spanned a border or because aid was provided.*
16	Brief timeline of the key events	*High-level narrative of key events.*
17	Time of initial order to evacuate and locations	*Precise commencement time allows evacuation delays or exposure conditions to be established.*
18	Time when evacuation was considered completed	*Allows length of evacuation to be established.*
19	Deaths/Injuries	*Impact of incident on human population-well-being.*
20	The number of people evacuated	*Impact of incident on human population-location.*
21	The location people initially evacuated	*Where people tried to escape – just from fire or went to shelter or anything*
22	Reasons why people decided to evacuate	*mandatory order, evacuation was*

		recommended, they see the news or they see actual fire coming,
23	Evacuation type	*Mode of transport (car, on foot, public service)*
24	Any drill/education/instructions on large outdoor fires provided beforehand?	*People's preparedness to large outdoor fires*
25	Personnel involved in rescue operations	*Complexity of procedural response to emergency.*
26	Did the smoke hindered significantly the evacuation because of low visibility or health problems	*Interaction between environmental conditions and the evacuation.*
27	Possible causes of issues in management operations	*Underlying factors that affected efficiency and effectiveness of procedural response.*
28	References	*Information sources*
29	Name/Surname/Email/Date of who filled in this template	*Information on who filled in the template and when*