# Evacuation behaviour intentions based on the summer 2018 Swedish forest fire season

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Beteende och avsikter bland evakuerade under skogsbränderna i Sverige sommaren 2018

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**Abstract**
A large number of forest fires occurred in Sweden during the summer 2018 on a total area of 21 000 hectares. Between 300 and 500 residents were evacuated from their home due to these fires. This situation was unfamiliar in Sweden at the time, and the routines for dealing with such crisis were challenged. This thesis aimed to investigate the communication and information strategies, the evacuation process and change in risk perception due to these fires. To evaluate these issues, a survey was performed by sending questionnaires to residents in the affected areas and to personnel, such as volunteers, workers on the county administrative boards and rescue workers, involved in the crisis. Of the residential respondents, 12 % received information about how to prepare themselves for an eventual evacuation and none in this group received information about how to fire safe their property. In the personnel group 36 % got information about how to prepare themselves for an evacuation and 12 % received information about how to fire safe their property. The survey responses seem to suggest that the uncertainty about the situation contributed to the residents feeling more threatened by the fires. Considering those without previous experience of large forest fires, 94 % of those in the residential respondent group declared that their risk perception had changed because of the fires. The corresponding numbers for the personnel group are 100 %. The main conclusion of this study is survey respondents indicate the need for further improve evacuation planning and communication during large forest fire scenarios. Therefore, it is recommended to investigate the launch of a Swedish programme to implement more preventive measure.



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# Summary

During summer 2018, Sweden suffered from a large number of forest fires, which resulted in 21 000 hectares of burned area and 300-500 evacuees. The situation, with multiple fires taking place on different locations at the same time, required collaboration between several Swedish authorities, international help, volunteers, the general public, etc. In order to learn lessons from such a complex crisis and unfamiliar situation for Sweden, it is of interest to investigate and evaluate what worked well and what did not and take knowledge from the experiences. The work presented in this report aims to investigate what information reached the general public in the fire-affected areas and how the information was handed out. This in order to evaluate if the communication within as well as between authorities and between authorities and residents were satisfying. It also aims at investigating the decision-making process of the general public, with a special interest of those who evacuated their homes, and if the risk perception has changed among the residents and personnel, such as volunteers, workers on the county administrative boards and rescue workers, after the events.

The work with this thesis started with a literature study. This study focused on the history of forest fire in Sweden, how forest fires affect humans and what evacuation policies and behavioural intentions due to forest fires look like in different countries. It also brings up the differences between fire evacuation in buildings, in the wildland-urban interfaces and in the forests. The literature study was also used to analyse the sequence of events connected to the fires.

To get the general public and involved actors' opinions, two questionnaires were conducted, one for the residents and one for the personnel. In total the survey got 114 response, 48 from residents and 66 from personnel, which is the basis for the analyse of this thesis.

Of the residential respondents, 12 % received information about how to prepare themselves for an eventual evacuation and none in this group received information about how to fire safe their property. In the personnel group 36 % got information about how to prepare themselves for an evacuation and 12 % received information about how to fire safe their property. According to the free text answers to the questionnaires, the uncertainty about the situation contributed to the residents feeling more threatened by the fires. Therefore, the general comment from residents was a wish for the authorities to have more structure in how to communicate information and instruct on actions. Considering those without previous experience of large forest fires, 94 % of those in the residential respondent group declared that their risk perception had changed because of the fires. Corresponding numbers for the personnel group are 100 %. A general change in risk perception was showed as the respondents declared that they have now a better understanding of the threats associated with a forest fire (i.e. fire evolution) and what consequences they can bring. Considering the 35 % of the respondents who had previous experiences of forest fire, no overall change in risk perception was observed.

The main conclusion of this study is that survey respondents indicate the need for further improve evacuation planning and communication during large forest fire scenarios. Therefore, it is recommended to investigate the launch of a Swedish programme to implement more preventive measure.

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*Johanna Hahlin*

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# 1 Introduction

During the summer of 2018, there was a large number of forest fires occurring in Sweden. The largest fire areas were located in the county of Gävleborg, the county of Dalarna and the county of Jämtland (Eriksson, Frisk, Hansson, & Nilsson, 2018, p. 6) (Krisinformation, 2019b). In this unfamiliar situation, many authorities, international actors, personnel from rescue services and volunteers were involved to limit the devastation of the fires (Krisinformation, 2019b). Approximately 300-500 people got evacuated due to the fires, with most of the evacuations taking place in the counties of Gävleborg and Jämtland. Many of the evacuees might have felt worried and uncertain about how the fire situation would develop (Björklund, 2019, p. 251). Since this was a fairly new situation in Sweden, there is an interest in analysing the risk perception of the evacuated residents along with those that were threatened by the fires. It is also in interest to analysing how fast the information spread was. Regarding the actors working with the evacuees, e.g. the police, the county board administrations and media, it is also relevant to investigate if they experienced the circumstances in a different way. Their experience could be used to obtain lesson learnt for a similar situation in the future.

In a global perspective, the temperatures have increased by approximate 0.2 °C per decade over the last three decades (Jolly, et al., 2015, p. 2). Today records for high temperature are twice as common as records for low temperature in the United States (Huber & Gulledge, 2011, p. 4). Extreme heat increases the risk for forest fires, which can cause a large amount of life losses and huge economical losses. The extreme heatwave in western Russia in 2010 led to 56 000 deaths (Munich RE, 2011, p. 27). The forest fires in Siberia from 2019 were 3 000 000 hectares burned and the smoke spread all the way to Canada also cost many lives (Agence France-Presse, 2019) (NASA, 2019). The rise of the temperature has led to a longer fire weather season by almost 20 % during the last three decades (Jolly, et al., 2015, p. 2). The main problem with climate change is that a 500-year event might become a 100- or 10-year event (Huber & Gulledge, 2011, p. 7). This makes it more important than ever to have a well-functioning risk management plan for such events. A single event cannot be directly associated with climate change (Huber & Gulledge, 2011, p. 2), but it is important to earn experience of single events for future incidents to make better risk assessment and management (Huber & Gulledge, 2011, p. 2).

Since climate change is a global problem, it is affecting Sweden as well (Naturvårdsverket, 2019, p. 18) and during the last 160 years the average temperature has risen by 2 °C in Sweden (Naturskyddsföreningen, 2019). The number of heat waves has also become more frequent in Sweden during the last decades (Naturskyddsföreningen, 2019), which is partly leading to a higher frequency of droughts (Fink, et al., 2004, p. 214). Many of the forest fires in 2018 were a consequence of the long-lasting drought Sweden suffered from in that year (Eriksson, Frisk, Hansson, & Nilsson, 2018, p. 10). The increasing frequency of heat and drought indicate that large forest fires will not be as unique in Sweden as it has been previous (Andersson, 2015).

In the summer of 2014, Sweden was suffering from a large forest fire in Västmanland. Including the aftermath, the forest fire lasted for almost four months (JG Media 21, 2015, p. 4), had an area about 14 000 hectares, forced 1 000 persons of the public to

evacuate and about 6 000 persons was threatened to evacuate (JG Media 21, 2015, p. 29) (Uhr, et al., 2016, p. 3). A set of lessons were learnt from the incident. For example, during the first days there was a lot of ambiguity of how the fire would develop (JG Media 21, 2015, p. 9) and of who had the ownership of the command center (Uhr, et al., 2016, p. 4). Criticism has been directed from several investigations of the fire in Västmanland to the inadequate communication between and within organisations and how Swedish Civil Contingencies Agency (MSB) provided technical and information support to the response work (Uhr, et al., 2016, p. 6). It was a challenge to reach out fast enough to the general public about inaccessible roads and evacuation, therefore it is important to have a close collaboration with the media (JG Media 21, 2015, p. 28). It can also be hard to prepare the public for an evacuation, as in some cases the affected people thought they should evacuate and not just prepare for it (JG Media 21, 2015, p. 30).

The forest fire season 2018 included between 300 and 500 different fires on an area about 21 000 hectares (Eriksson, Frisk, Hansson, & Nilsson, 2018, p. 10) (MSB, 2018b, p. 5). It was not possible to control the fires with only national resources and help from other nations in the European Union, such as Italy and France, was sent to facilitate the firefighting operations (MSB, 2018a). It should be evaluated if Sweden should be able to handle similar situation by itself or if it should be standard to collaborate with other countries during those circumstances.

## 1.1 Objective and purpose

The objective of this work is to collect questionnaire data on the experience from the 2018 fires from the affected general public and involved actors, e.g. fire fighters and volunteers. The questionnaires ask about perception of the threat (including risk to be evacuated) and evaluate the communication strategies based on the summer 2018 forest fires in Sweden. This data will help to get a better understanding of how the perception of forest fire risk has changed in Sweden and what the decision-making process during forest fire evacuations looks like.

The purpose of collecting this data is to understand how people in Sweden experienced the information flow according to the current forest fire risk state and evacuation threat due to the forest fire season 2018. The data could be helpful for future similar situations and to improve recommendations of emergency management operations involving people evacuation threats.

The questions at issue in this thesis can be summarized as:

- What information about the current fire situation reached the affected residents? How did the information reach residents and from what sources?
- Was the communication within and between authorities and also between authorities and residents satisfying for all parties?
- How fast was the decision-making process of the evacuees after receiving an evacuation order? Was the information about the evacuation satisfying?
- How did the population exposed to forest fire evacuation threats respond and how has their risk perception change due to the experiences?

The actors involved in the work connected to the forest fires are also investigated. This point is to give a picture of the situation, but is not the main scope of the analysis.

## 1.2 Scope

This study only focused on the evacuation issues and risk perception of the fire season in Sweden 2018 in the most affected areas. The focus was on how the general public experienced the evacuation from their homes and the personnel's view of the situation. In addition, an analysis of the outcome of the communication strategies in use and compliance to evacuation orders was performed. The results from the survey can improve the evacuation routines for future similar situations. The study does not concern how the general public experienced other non-evacuation related issues associated with the rescue activities during the fires, such as extinguishing efforts or the collaboration between different actors involved in the rescue work.

## 1.3 Limitations

Besides the limitation of time and financial resources, there are a few issues that limited this work. For example, using questionnaires instead of interviews present some advantages and disadvantages, mostly linked to the number of respondents that could be reached and the level of details in the information obtained. It was a challenge to get in touch with people who were exposed to forest fire evacuation threats, and an increase in sample size would improve the reliability of the findings. People who felt very dissatisfied about how the situation was handle, are more likely to answer, which in turn can affect the result. The survey was performed approximately twelve months after the fires occurred. This issue gives all involved personnel and affected people time to reflect on their experiences, discuss with others but also forget information. When time passes by people process their memories, thus the answers may not be the same as if they had answered right after the incident (Uhr, et al., 2016, p. 9).This was a contributing factor for biases among the respondents of this survey. Biases from the writer of this report likely occurred. As a researcher it is good to reflect on leading question bias, question order bias, wording bias and other methodological pitfalls (Uhr, et al., 2016, p. 7). To be aware of people biases, both from participators and researchers, leads to an improved analysis of results for post-incident studies (Kinsey, Kuligowski, Gwynne, & Kinateder, 2018, p. 15).

In surveys response biases will occur among the answers (Larson, 2019, p. 534) (Furnham, 1986, p. 385). One common bias is desirability bias, when respondents changes their answers for impression management or self-deception, to look better to others or to feel better about themselves (Larson, 2019, p. 534) (Furnham, 1986, p. 385). To reduce the occurrence of desirability biases, a survey should have respondent anonymity and neutralized questions (Larson, 2019, p. 542). Another bias is that some people have a tendency to always choose the extreme options, others have a tendency to always choose an option in the middle, so-called extreme response set and mid-point response set (Furnham, 1986, p. 385). For biases that occur during the forest fire and eventual evacuation, see Section 3.2.

Misunderstandings of the questions can also be sources of errors. E.g. if a question was just supposed to be answered only if the respondents had answered yes to the previous question, some of those who answered no answered anyhow on the following question. Also, the part 3 and 4 for residents were answered by some people who did not receive an evacuation order. To come around these errors, it was necessary to look at every individual answer on this type of questions. Other questions that probably led to

misunderstanding was the ones with multiply choices in both columns and rows, e.g. question 2.3, where people answered that more of them got information from friends and/or family on a TV then from friends and/or family via social media, but to communicate via a TV with a relative or relatives does not seem to be that common.

# 2 Method

An initial literature review was conducted to identify the context in which forest fire evacuations occur in Sweden and in other parts of the world, especially considering areas that have been more exposed to forest fires than Sweden. Particularly interesting was the literature concerning the behaviour of populations more exposed to forest fires and how they act when they are threatened by fires. It was very relevant to investigate governmental emergency policies in exposed areas, especially concerning how to inform residents about forest fire evacuation. The literature review also aimed at getting an understanding of how forest fires affects humans, both physically and psychologically. The literature used to the foundation of theory in this thesis was collected mostly from scientific papers retrieved from the library of Lund University's joint search service LUBsearch. To find relevant papers to be used in the theory section, keywords such as "behaviour", "bushfire", "evacuation", "evacuation behaviour", "fires in Sweden 2018", "forest fire", "forest fire evacuation", "questionnaire", "survey", "wildfire", "wildfire evacuation" were used in different constellations.

Information was retrieved to reconstruct the course of events in the forest fire season of Sweden 2018. The most information about the sequence of events came from the summary from MSB about the work with the forest fires 2018 and from the investigation to evaluate the operational rescue efforts in connection with the forest fires in summer 2018 written by Jan-Åke Björklund (MSB, 2018b) (Björklund, 2019).

After the literature review, the next step was to perform a survey on how the evacuation threats and evacuations due to the fires were experienced by general public living in affected areas and personnel, such as volunteers, workers on the county administrative boards and rescue workers. It was also important to decide how this data of experiences would be collected, e.g. by interviews or by questionnaires. There are both advantages and disadvantages with these two approaches. An advantage with interviews is that they are more flexible since the interviewer can customize follow-up questions based on previous answers or explain the questions if the respondents do not understand (Harris & Brown, 2010, p. 2). On the other hand it is easier to reach out to a larger population with a questionnaire and it is not as time consuming as interviews (Harris & Brown, 2010, p. 1). Since time and the basis of relevant responders were limited, the chosen method for this thesis was the use of questionnaires.

To create the questionnaires used for this thesis, the first step was to study other questionnaires that have been developed to be used in similar fire situations. Two questionnaires appeared particularly relevant for this work. One that was developed to send out to evacuated residents associated to the fire in Haifa, Israel, 2016 where more than 75 000 people evacuated their homes (Toledo, 2017). The other questionnaire was made for residents that were affected and evacuated caused the October 2017 Northern California wildfires, the December 2017 Southern California wildfires and the Carr fire in California the summer 2018 (Wong & Shaheen, 2019). The fire in the U.S. addressed 150 000 evacuated people. Both questionnaires were made for much broader studies, covering a lot of different research fields connected to the evacuations. Both questionnaires did cover what this thesis is about, the information between evacuees and personnel, therefore they were deemed to be a good base to develop the current questionnaires.

The questions were designed to address what information was given to the general public about the current fire situation, how the information reached out and how the information affected the decision-making process. The questions also aimed to get an understanding of how the communication within and between authorities and also between authorities and residents. Another aim of the survey was to find out if the risk perception had changed due to the fire experiences.

The first thought was to create just one questionnaire, so all the respondents would receive the same set of questions. Soon the author realized that many questions would be relevant only for residents who lived in the fire affected areas, but also that some questions would be relevant just for the personnel. With this in mind, it seemed to be easiest to split the questionnaire into two separate surveys. With two separate questionnaires, it would also be easier to get a fast overview if the opinions of the situation differed between residents and personnel. The two questionnaires ended at two sections for personnel and four sections for residents, and a text answer. The sections for personnel and the first two sections for residents are called “About you” and “Information about the fire risk”. These questions were similar to both respondent groups, but with some differences to fit the target group. The last two sections for residents are called “Evacuation” and “Returning home”, which were only for those who evacuated their homes. To see the full questionnaires, go to Appendix B: Questionnaire for residents and Appendix C: Questionnaire for personnel.

To complete and refine the questionnaires for this report, Enrico Ronchi, Senior lecturer at Division of Safety Engineering at Lund University, and Stephen Wong, doctoral candidate at the University of California, Berkeley at the Capitalize Department of Civil and Environmental Engineering, provided feedback.

Before the respondents started with the questionnaires, they received information about the fact that their answers would be kept anonymous. This is assumed to contribute to a higher rate of respondents and more true answers. To guarantee the anonymity, the free text answers were removed and the quotes from the free text answers in this report have been inserted just if it is considered impossible to identify who wrote it.

The questionnaires were sent to rescue services, county administrative boards, volunteer organisations, several groups on Facebook for people living in the affected areas, etc.. To find potential responders, especially personnel respondents, Tove Frykmer, PhD Student at the Division of Risk Management at Lund University, Sweden, and Christian Uhr, Senior Lecture at the Division of Risk Management at Lund University, Sweden, were helpful with guidance of who to contact. For instance, they came with information that Frivilliga Resursgruppen (FRG) and the county administrative boards had potential respondents in their organisations.

Most responses from residents were collected from groups on Facebook. In total, the questionnaires were published in 12 groups on Facebook. The groups were all connected to one or several areas affected by the fires, some with 1 000s of members, but in most groups not all members were relevant respondents for the questionnaires. It was not unusual that one person was a member in several of these groups. In total, there was slightly over 23 000 members in all groups, which the group called “Vi som älskar härliga Härjedalen” stands for half om these members. Therefore, it was hard to know the response rate, even because it was difficult to know how many people were actually potential respondents.

Similarly, it was not possible to identify the frequency of responses among the personnel, since contact often was taken with one person who forwarded the questionnaires.

To optimise the number of respondents, the questionnaire was sent out in an electronic format as a google survey. The total number of answers collected was at 114, of which 48 filled questionnaires from residents and 66 from personnel.

The results from the questionnaires were compiled and analysed, including separate analysis of the different respondent groups and a comparison between these two. A discussion and a conclusion connected to future research and model development was also provided based on the survey results.

# 3 Forest fires, people and the built environment

A forest fire is a fire normally occurring in drought areas and can have a large impact on buildings, people and the environment (Antoni, et al., 2018, p. 2). The wildland urban interface (WUI) is where buildings meet or intermingle with wildland vegetation (Radeloff, R.B. Hammer, Fried, Holcomb, & McKeffry, 2005, p. 799). Due to urbanization in the WUI, there is a much greater risk for property damage and losses of lives due to forest fires (Radeloff, R.B. Hammer, Fried, Holcomb, & McKeffry, 2005, p. 800). Therefore, policies and guidelines are implemented how residents can protect themselves and their homes against forest fires. One of many examples of this is the North American "Are You FireWise" Program (Absher, Vaske, & Lyon, 2013, p. 5). This program was an information campaign that included a package of instructional materials that provided information to residents on how to be firewise when it comes to water, defensible spaces, what to do in case of emergency, etc. (Absher, Vaske, & Lyon, 2013, p. 5). For example, to be firewise can mean that you build your constructions so they are more resistant against fires (Absher, Vaske, & Lyon, 2013, p. 8) or residents attending community-based meetings related to wildland fires (Absher, Vaske, & Lyon, 2013, p. 7).

Large outdoor fires involving vegetation go under different names internationally, e.g. forest fires, wildfires, bushfires, grass fire or brushfires, mostly depending on where the occurring place is and the main type of vegetation (Price, 2019) (Tedim, Xanthopoulos, & Leone, 2015, p. 77). The whole world is facing a growing risk for forest fires, due to increasing population, changes in land-use patterns and climate changes (Tedim, Xanthopoulos, & Leone, 2015, p. 78). The terminology that is used in this thesis is forest fire, since forest are the most common type of vegetation in Sweden (Statistiska Centralbyrån, 2019).

## 3.1 History of forest fires in Sweden

In the north of Sweden, large forest fires normally have an incidence on 50 to 150 years (Hellberg & Granström, 1999, p. 13). In the south of Sweden, the incidence is approximately every 20 year (Hellberg & Granström, 1999, p. 13). During the 19$^{th}$ century, the forest fire frequency increased drastically (Niklasson & Granström, 2000, p. 1490). In some areas up to 12 times as in the 17$^{th}$ century (Enoksson, 2011, p. 6), as a consequence of the growing population in Sweden (Niklasson & Granström, 2000, p. 1487) (Niklasson, 2011, p. 2). This led to the population needed to expand the possibility to use the land for agriculture and therefore burned down the forests (Hellberg & Granström, 1999, p. 13) (Enoksson, 2011, p. 6).

During the 20$^{th}$ century, the forest fires frequency did decrease every decade (Hellberg & Granström, 1999, p. 13). Up to 40 % of the forest fires in Sweden start from an unknown reason, which is the biggest source of forest fires (MSB, 2019a). Figure 1 – An overview of percentage of the ignition source for forest fires between year 2009-2018. The data is collected from IDA . gives a more detailed view of the statistics over ignition sources of forest fires in Sweden collected from the statistics and analysis tool IDA from Swedish Civil Contingencies Agency (MSB). The only natural source to forest fires in Sweden is lightning ignition, which stands for 5 % of the total forest fires (Enoksson, 2011, p. 6) (MSB, 2019a).

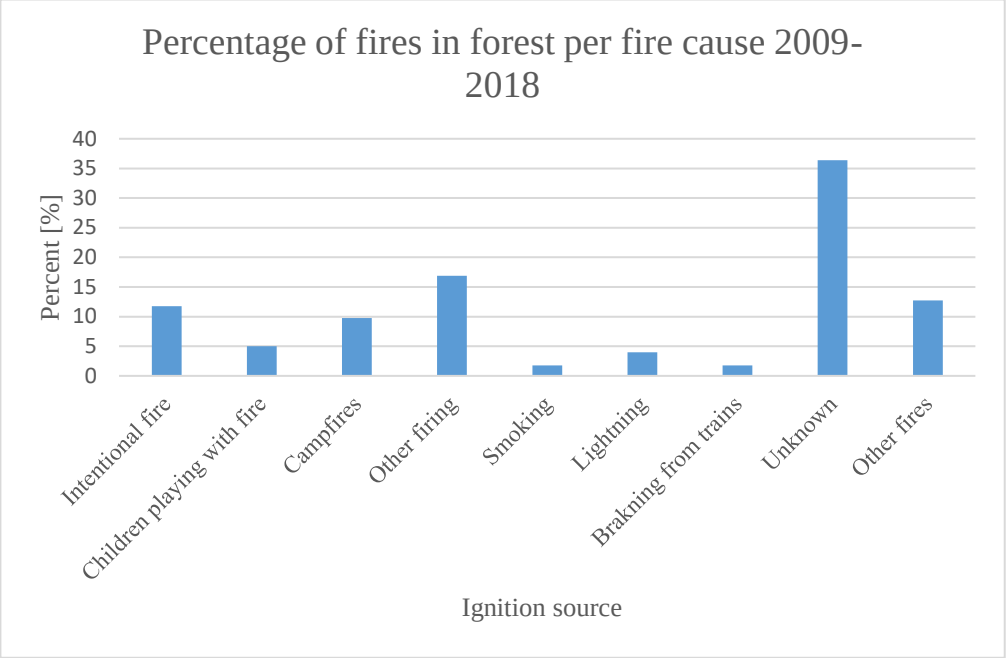


*Figure 1 – An overview of percentage of the ignition source for forest fires between year 2009-2018. The data is collected from IDA (MSB, 2019a). The average number of forest fires per year in Sweden during this time was just above 4 400 (MSB, 2019a).*

## 3.2 How forest fires affect humans

The interest in techniques and strategies to limit forest fires is rapidly growing around the world, particularly among policy makers, regulators and resource managers (Haverkamp, Swisher, & Hart, 2010, p. 269). Forest fires can have a considerable impact on the health of humans, both due to the immediate threat from flames as well as, the exposure from the smoke (Kaabi, et al., 2018, p. 1) (Vaidyanathan, Yip, & Garbe, 2017, p. 377) (Reid, et al., 2016, p. 1334). Health problems due to forest fire smoke can be irritations in eye, nose and throat, but also more serious problems like exacerbation of asthma, decreased lung function and premature death (Reid, et al., 2016, p. 1341) (Vaidyanathan, Yip, & Garbe, 2017, p. 377). Smoke from forest fires can have a very differ mixture of pollutants, vary over time and space and are therefore hard to predict (Vaidyanathan, Yip, & Garbe, 2017, p. 377). There has been research for developing tools to estimate the smoke detection and how much harm it potentially will cause the affected population (Kaabi, et al., 2018, p. 5) (Vaidyanathan, Yip, & Garbe, 2017, p. 381). Tools of this kind can be used to identify when evacuation is necessary or not. (Kaabi, et al., 2018, p. 5).

Cognitive biases are strongly linked to the decision-making-process during forest fire evacuation and should therefore be taken into account when doing modelling of evacuation behaviour due to these fires (Kinsey, Kuligowski, Gwynne, & Kinateder, 2018, p. 1). Studies have showed that residents do not anticipate forest fire evacuations before concrete signs, such as visible smoke, even if there have been many early signs, such as drought(McLennan, Ryan, Bearman, & Toh, 2019, p. 493). This is an example of anchor bias (Kinsey, Kuligowski, Gwynne, & Kinateder, 2018, p. 9). Studies have also

showed that residents can have trouble to interpret the information they receive, which makes it difficult to understand the situation and slow down their decision making-process (McLennan, Ryan, Bearman, & Toh, 2019, p. 493). The authorities often have a better understanding of the situation to anticipate the need for an evacuation since there usually are more information about the situation available to them. Evacuation orders is a balance of how often the public should be given warnings before a real threat is approaching (Rigos, Mohlin, & Ronchi, 2019, p. 3). Studies have also showed that resident are more likely to delay evacuation when it is voluntary and that women are often more willing to evacuate than males (McLennan, Ryan, Bearman, & Toh, 2019, p. 494). Different biases can be more prominent or dominant depending on what contextual variables are affecting the special case, e.g. what is the type of the evacuated building and if it is a public or a private space (Kinsey, Kuligowski, Gwynne, & Kinateder, 2018, pp. 15-16).

If a household threatened by a forest fire decides to evacuate or not is influenced by several factors. E.g. if a household owns a car or consists of both adult and children are factors that increase the probability of evacuation (Toledo, Marom, Grimberg, & Bekhor, 2018, pp. 4-5) (Roberson, Peterson, & Parsons, 2012, p. 345). If the household consists of elderly people or has pets are factors that will decrease the likelihood of evacuation (Toledo, Marom, Grimberg, & Bekhor, 2018, pp. 4-5) (Roberson, Peterson, & Parsons, 2012, p. 345). The decision to evacuate is often driven by concerns about the safety of the family and the decision to stay and defend the property is often based on some degree of risk acceptance of safety (McLennan, Paton, & Beatson, 2015, p. 43). Other factors that influence the decision about evacuation are the income and education level. People with higher education level and higher income people are more likely to evacuate (Toledo, Marom, Grimberg, & Bekhor, 2018, pp. 4-5).

Even if leaving very often is the safest option, many residents will stay (McLennan, Paton, & Beatson, 2015, p. 43). This fact requires agencies to motivate these households to do a systematic risk assessment for their property and family, but also give the households information about safe and effective defence (McLennan, Paton, & Beatson, 2015, p. 43). This is extra important since those who are planning to stay often are inadequately prepared for the fire danger (McLennan, Paton, & Beatson, 2015, p. 44). Governments also need to be aware of the situation that many residents choose to postpone the decision if they will leave or not if a fire occurs until a fire actually occurs (McNeill, Dunlop, Skinner, & Morrison, 2015, p. 153). This is problematic because the decision will be taken under pressure and is likely to be a delay evacuation if the residents choose to leave and a consequence of people getting a choice to evacuate or not (McNeill, Dunlop, Skinner, & Morrison, 2015, p. 153). People are more likely to prepare themselves for the situation if they do not have a choice of what to do if a fire is reaching their homes (McNeill, Dunlop, Skinner, & Morrison, 2015, p. 159).

If it is necessary to evacuate an area threatened by forest fire, people will get affected by the situation. After a forest fire the landscapes and environments usually have changed much compare to its previous conditions, which will have an impact on the returning residents' life and well-being (Eisenman, McCaffrey, Donatello, & Marshal, 2015, p. 5). These returning residents can show grief from the loss of forest and a strong desire to reconnect with their environment (Eisenman, McCaffrey, Donatello, & Marshal, 2015, p. 5). The population also often lose incomes, as consequences of when they evacuated, during and after the fire (Eisenman, McCaffrey, Donatello, & Marshal, 2015, p. 13).

It is not only people living in an area where a forest fire occurs who can be in danger, also those who just are passing by can be victims of the fire. It can be difficult for information to reach out to they who are just visiting the area (Anguelova, Stow, Kaiser, Dennison, & Cova, 2010, p. 230). Particularly vulnerable are those who are passing the area by foot, since their mobility and moving speed is limited (Anguelova, Stow, Kaiser, Dennison, & Cova, 2010, p. 230).

## 3.3 Evacuation policy and behavioural intentions due to forest fires in different countries

The forest fire season length is increasing across all vegetated continents except Australia (Jolly, et al., 2015, p. 4), which makes it more important than ever to work with mitigating measures and be well prepared to handle forest fires. When a population is threatened by a forest fire, people usually have three options; defending their properties, shelter in place or evacuate the threatened area (McLennan, Ryan, Bearman, & Toh, 2019, p. 488). Which alternative people choose depends on many factors, e.g. how prepared they are to defend their property (McLennan, Ryan, Bearman, & Toh, 2019), what attitude of evacuation the affected population have and how the residents understand the threat in the current area (Jacobsen, Monroe, & Marynowski, 2001, p. 930).

Different countries have different policies and strategies on how to tackle a forest fire and an eventual evacuation (Hellberg & Granström, 1999, p. 38). Decision makers who are making fire evacuation policies need to have an understanding for their citizens' attitude and knowledge to make good policies (Jacobsen, Monroe, & Marynowski, 2001, p. 930). If decision makers know their public, they can give public education, which leads to acceptance and participation among citizens in fire policy debates (Jacobsen, Monroe, & Marynowski, 2001, p. 930) and increase the effective capacity (Marynowski & Jacobson, 1999, p. 134). To get knowledge about fire and forest management, both for public and decision makers, it is important to make use of previous events and earn experience from them (Jacobsen, Monroe, & Marynowski, 2001, p. 934). It is also important to be aware of how mass media and social media can have an impact on how the information from a forest fire is perceived (Jacobsen, Monroe, & Marynowski, 2001, p. 930).

If people take the decision of evacuate from an area threatened by a forest fire differ based on the situation. Usually the decisions are collectively made in small groups, e.g. as households (Nguyen, Schlesinger, Han, Gür, & Carlson, 2019, p. 518). Personality and risk perception influence evacuation decision making and since entry of smartphones and social media, people have the opportunity to take in more information and opinions outside the group when making decisions (Nguyen, Schlesinger, Han, Gür, & Carlson, 2019, p. 519). What policy of evacuate due to forest fires there is in the area, such as if the authorities encourage evacuation or not in general, is another aspect that influences the decision of evacuation (McLennan, Ryan, Bearman, & Toh, 2019, p. 489).

### 3.3.1 Sweden

Since Sweden have had relatively limited experience with forest fires compared to other countries, e.g. Australia and the U.S. (Hellberg & Granström, 1999, pp. 38-42), evacuation guidelines and policies of Sweden are not as developed as places more exposed to forest fires. Still there are some laws connected to fires even in Sweden, but most of them is about how the municipality should do to mitigate a fire outbreak with controls

for chimney sweeping, the individual responsible to be careful handling fire and that the government can put up fire ban when it is required (SFS 2003:778) (SFS 1962:700) (SFS 1998:808).

In 2014 there was a large-scale forest fire in the middle of Sweden, which burned 14 000 hectares (JG Media 21, 2015, p. 29) and made approximately 1 000 residents evacuate and 6 000 residents to prepare for evacuation (Uhr, et al., 2016) (MSB, 2016b, p. 2). This was the largest fire in Sweden in modern times (JG Media 21, 2015, p. 8). The incident was addressed by a collaboration from the rescue service, MSB, volunteers and other involved actors (JG Media 21, 2015, p. 18). When people needed to be evacuated, it was clear that it was a large challenge to reach all the affected general public fast enough with the evacuation instructions and the need of the media to speed up the information spread (JG Media 21, 2015, p. 28) (MSB, 2016b, p. 26). It was also a challenge to prepare the public to be evacuated, as in some cases the affected residents thought they were just supposed to prepare for an eventual evacuation and not to evacuate for real (JG Media 21, 2015, p. 30). After the fire in Västmanland 2014 measures to strengthen crisis preparedness in Sweden were developed. Shortly, these measures were about increase the actors' competence and knowledge, make more effective use of the resources and improve cooperation with better communication (MSB, 2016b, p. 18).

Sweden does not have a strict policy on mandatory or recommended evacuation or stay and defend, and these measures did not evaluate if and how implement such policy.

### 3.3.2 Australia

Australia is one of the countries which most frequently suffer from natural disasters (Ladds, Keating, Handmer, & Magee, 2017, p. 419), where forest fires constitutes approximately 10-15 % of the total economical lost due to disasters (Ladds, Keating, Handmer, & Magee, 2017, p. 426). Given the large scale of the fire problem in the country, there has been a large interest to study forest fires compared to Sweden, and therefore there has been more research done. Nevertheless, since the end of World War II until year 2005, there was no nationally agreed approach to community bushfire safety (McLennan, Ryan, Bearman, & Toh, 2019, p. 491). In 2005 there was an official position, called 'prepare, stay and defend or leave early' published by the Australia Fire Authorities Council, suggesting residents to leave early or stay on their property so they could remain safe in their fire prepared homes (McLennan, Ryan, Bearman, & Toh, 2019, p. 491). The reason for this position was because in previous large fire events, people tended to die either as a consequence of the extreme heat or vehicle accident when leaving too late (McLennan, Ryan, Bearman, & Toh, 2019, p. 491) (Handmer & Tibbits, 2005, p. 85). In 2009, the Black Saturday bushfire occurred in Australia and costed 173 human lives (Pascoe, 2010, p. 392) (Venn & Quiggin, 2017, p. 483), and 111 of the deceased were staying on their property or nearby (McLennan, Ryan, Bearman, & Toh, 2019, p. 491). This disaster led to a change in recommendations, and nowadays no Australian fire agency recommends stay and defend; instead they promote early evacuation (McLennan, Ryan, Bearman, & Toh, 2019, p. 492) (Venn & Quiggin, 2017, p. 483).

Residents who did evacuate late during the Black Saturday bushfire took a large risk. Many of them did not make it during late evacuation (Venn & Quiggin, 2017, p. 485).anyhow, the risk of dying was twice as high among those who did not evacuate

compare to those who did late evacuation (Venn & Quiggin, 2017, p. 485). People who choose to stay at their properties during a forest fire threat are often residents of rural properties and have many vulnerable assets they want to protect (McLennan, Ryan, Bearman, & Toh, 2019, p. 497). People who evacuated late during the Black Saturday bushfire mostly did so due to the uncertainty if they were under imminent threat and uncertainty of safe destinations and evacuation routes (McLennan, Ryan, Bearman, & Toh, 2019, p. 498). After the Black Saturday bushfire, there was a change in residents' decisions to remain of their property or evacuate in the following large forest fire. A greater part decided to evacuate the next coming forest fires compared to the Black Saturday bushfire (McLennan, Ryan, Bearman, & Toh, 2019, p. 497). However, it is clear that there is no totally safe option when deciding what to do during a forest fire threat, but the safest option appears to be early evacuation (Haynes, Handmer, McAneney, Tibbits, & Coates, 2010, p. 192) (Venn & Quiggin, 2017, p. 483).

### 3.3.3 North America

During the last century, there has been a clear change in both number of forest fires, but also in area burned down by forest fires in the U.S (National Interagency Coordination Center, 2019). Both for the average number of forest fires per year and the average wildland area burned due to fires per year have decreased since 1926 (National Interagency Coordination Center, 2019). However, the lowest frequency occurred during the 80's and 90's and the last two decades the trend has turned to higher frequencies (National Interagency Coordination Center, 2019).

In Canada the average burned area due to wildland fires per year has been the same since year 1980, but in the same timerange the average number of forest fires per year has decreased from 7000 fires per year to less than 6000 fires per year (Canadian Wildland Fire Information System, 2019).

Since the end of World War II, evacuation of resident in areas threatened by forest fires has been seen as the safest option by the policy of authorities from the U.S. (McLennan, Ryan, Bearman, & Toh, 2019, p. 490). In many parts of the U.S. the authorities dictate mandatory evacuations of these areas when it is considered as needed (Haynes, Handmer, McAneney, Tibbits, & Coates, 2010, p. 185) (McLennan, Ryan, Bearman, & Toh, 2019, p. 490).

In Canada, evacuation is always recommended when the safety of the public is threatened by a forest fire and mandatory evacuation orders can be given by the Royal Canadian Mounted Police or other police service during these circumstances (McLennan, Ryan, Bearman, & Toh, 2019, p. 490).

Compared to the U.S., the Canadian residents seem more willing to stay and defend their property during forest fire threats (McLennan, Ryan, Bearman, & Toh, 2019, p. 495). The most residents who evacuate during these situations do it because of an evacuation order, but mostly they prefer to stay if they are given a choice (McLennan, Ryan, Bearman, & Toh, 2019, p. 495).

### 3.3.4 Other countries

25 % of the total area of forest in the world is located in Russia, which makes the country vulnerable to forest fires and therefore Russia has had collaborations with North America and Western Europe to exchange knowledge about forest fires (Hellberg & Granström, 1999, pp. 41-42). Nevertheless, Russia has a very rudimentary early-warning

system for fire threats, no structure for monitoring fires and no system for fast reaction to large forest fires (Munich RE, 2011, p. 26). Russia suffered from a large forest fire season in 2010, because of the extreme heat that occurred (Huber & Gulledge, 2011, p. 2). The lack of the prevention work for forest fires and the lack or undermanned fire brigades in the rural districts made residents defend their homes and village without any professional help from the authorities (Munich RE, 2011, p. 26). After this forest fire season, Russia was strongly criticised due to the decision to transfer the responsibility for firefighting from the Russian state to regional authorities (Bryanski, 2010) (Goble, 2010).

During the last 50 years, both the average numbers of fires and the average burned area have significant increased in Chile (Úbeda & Sarricolea, 2016, p. 154). This leads to a higher need of policies to promote the territorial planning of rural landscapes and the diversification of the forestry sector (Úbeda & Sarricolea, 2016, pp. 155, 159). Earlier the main focus of forest fire protection policies in Chile was firefighting strategies, but the focus is slightly shifting to prevention strategies (Úbeda & Sarricolea, 2016, p. 159). Residents in vulnerable areas in Chile tend to build their buildings in very low-quality constructions, in combination with the poor infrastructure and less logging of the forest in these areas make a low protection from forest fires (Úbeda & Sarricolea, 2016, p. 159). The residents tend to not be well informed about the service offered by the government in mitigation and preventing forest fire risks (Úbeda & Sarricolea, 2016, p. 160). This low level of knowledge is not just occurring in Chile, e.g. Spain and Greece has the same problem, which may be a consequence of all parties not having the same view of who is in charge for what part of the prevention work (Úbeda & Sarricolea, 2016, p. 160).

Forest fires are a serious and increasing threat in the Mediterranean, especially in Greece, Spain, France, Italy and Portugal (European Commission, 2018, p. 6) (San-Miguel-Ayanz & al., 2015, p. 87). Of the 400 000 hectares yearly burned area in Europe, 350 000 hectares is located in Greece, Spain, France, Italy and Portugal (European Commission, 2018, p. 10) (San-Miguel-Ayanz & al., 2015, p. 87). The Mediterranean countries have their own policies and law associated with forest fire protection, but as members of the European Union they are a part of the Emergency Response Coordination Centre (ERCC) (European Commission, 2019a, p. 1). ERCC monitors fire risk in the member states of the European Union and intervenes with extra resources when necessary in case of forest fire (European Commission, 2019a, pp. 1-2). Despite the high forest fire intensity in the Mediterranean, the general public in these countries are often not well informed about the services offered by the government in terms of management practices aimed at avoiding the risks of forest fires (Úbeda & Sarricolea, 2016, p. 160).

## 3.4 Evacuation due forest fires compared to evacuation in buildings due to fires

Sweden, through MSB, is working for a better fire safety in society by conduct research by put up policies and laws and support individual inhabitants' ability to prevent and protect themselves from fires (MSB, Brandskydd, 2019b). MSB has together with authorities, municipalities and other organisations developed a national strategy for Sweden as "No one in Sweden shall perish or be seriously injured as a result of fire" (MSB, Brandskydd, 2019b). To achieve the strategy, there are existing laws about how the municipality should do to mitigate a fire outbreak with controls for chimney

sweeping, the individual responsible to be careful handling fire and the government has the ability to put up fire ban when it is required (SFS 2003:778) (SFS 1962:700) (SFS 1998:808). There are also several existing building codes in Sweden which regulate fire safety (BFS 2011:6), but there are few guidelines on how to handle forest fires.

Every year approximately 120 people die in fires in Sweden, and that number has been stable since the 1960's (MSB, 2010, p. 7). Most of the deaths hit elderly people and is a consequence of smoking, alcohol in the body, no functional smoke detector or arson (MSB, 2010, p. 7). Most of the laws and recommendations in Sweden applies on public buildings, but in reality, most injuries and deaths due to building fires happens in homes (MSB, 2010, p. 7). Since forest fires are increasing and seem to be more frequently in the future (Jolly, et al., 2015, p. 4), the author of this report thinks it will be necessary to implement more extended regulations for how to handle forest fire in Sweden and not only focus on building fires.

After the large fire in Västmanland 2014, which forced about 1 000 residents to evacuate (JG Media 21, 2015, p. 29), it was clear that the evacuation procedure was inadequate (Asp, et al., 2015, p. 110). The community was unprepared and did not have tools to implement the evacuations, e.g. many decisions were made without a holistic picture, the cooperation between authorities was poor, the information spread about the need of evacuation did not reach the public as fast as it should, it was not always clear where the evacuation places where and how to register that you had evacuated (Asp, et al., 2015, p. 110). As a consequence of these shortcomings, the government of Sweden appointed an investigation of the fire, which, inter alia, resulted into the conclusion that both the municipalities and MSB did not live up to the goals to be prepared and organised, set in §LSO (SFS 2003:778) (Sjökvist, 2015, p. 152). There was also an investigation after the fire season 2018. It was not satisfying how the rescue work had been done in forest fires this time either, which led to suggestions for changes in §LSO (SFS 2003:778)E.g. clarify how to choose leader for the rescue work and how the government can take the responsibility from the municipalizes, which will be implemented January 1, 2020 (Björklund, 2019, pp. 21-23).

# 4 Sequence of events

In the summer of 2018, there was a large number of fires occurring in Sweden, which required several resources; hundreds of people were evacuated from their homes (Björklund, 2019, p. 13) (MSB, 2018b, p. 5). The forest fire season 2018 included between 300 and 500 different fires on an area about 21 000 hectares (Eriksson, Frisk, Hansson, & Nilsson, 2018, p. 10) (MSB, 2018b, p. 5) and lasted from May to August (Björklund, 2019, pp. 110-112) (MSB, 2018b, p. 5). Sweden may be seen as a country with not as much experience of large forest fires as other countries around the world (e.g. U.S. Australia, Canada). The situation in 2018 was much more complex than ever before in modern times because of its large number of fires occurring at the same time in different places (Björklund, 2019, p. 109). Almost all of Sweden was affected by the fires, but the largest fire areas were located in the county of Gävleborg, the county of Dalarna and the county of Jämtland (Eriksson, Frisk, Hansson, & Nilsson, 2018, p. 12) (Krisinformation, 2019b). Appendix A contains a summary of data from the fires.

## 4.1 Summary of important locations affected

The fire season 2018 hit Sweden very hard. Almost all parts of Sweden were affected by the fires, but the largest fire areas were located in the county of Gävleborg, the county of Dalarna and the county of Jämtland (Eriksson, Frisk, Hansson, & Nilsson, 2018, p. 12) (Krisinformation, 2019b). Of the total burned area of 21 000 hectares (Eriksson, Frisk, Hansson, & Nilsson, 2018, p. 10) 19 000 hectares were located in those counties mentioned above (Björklund, 2019, pp. 116, 123, 128). In total 300-500 people evacuated due to the fires, with most of the evacuations taking place in the counties of Gävleborg and Jämtland (Björklund, 2019, p. 251). Many of the evacuees felt worried and noncertainty about how the fire situation would develop (Björklund, 2019, p. 251).

### 4.1.1 The county of Jämtland

Between the 12th and 29th of July, the frequency of reported forest fires in the county of Jämtland drastically increased (Björklund, 2019, p. 113). An area of more than 6 000 hectares burned due to the fires (Björklund, 2019, p. 116), there the two fires located in Lillåsen – Fågelsjö and Storbrättan in the municipality of Härjedalen that covered almost 5 000 hectares (Björklund, 2019, pp. 116-117) (Eriksson, Frisk, Hansson, & Nilsson, 2018, p. 13).

### 4.1.2 The county of Gävleborg

Due to a lightning, a fire breakout occurred in the northwest parts of county of Gävleborg the 14th of July (Björklund, 2019, p. 124). This fire had a massive spread and soon was developed into several fires (Björklund, 2019, p. 124). The fires covered an area of 9 500 hectares and the rescue operations lasted 26 days (Björklund, 2019, p. 123). The dwelling place most affected was the village Kårböle, where 100 residents got evacuation orders (Björklund, 2019, p. 124) and in total 200 residents were evacuated due to these fires in the county of Gävleborg (Jansson, 2018).

### 4.1.3 The county of Dalarna

Between the 12th of July and 3d of August, about 50 firefighters struggled to defeat a fire started a few days earlier (Björklund, 2019, p. 128). The fire covered 3 700 hectares (Björklund, 2019, p. 128) (Jansson, 2018).

### 4.1.4 Other places affected by the fire season

Even if the counties mentioned above suffered most from the fires during the summer of 2018, fires occurred all over Sweden (Björklund, 2019, p. 109). In the beginning of the fire season, in May and June, actually the county of Västmanland was the county which suffered most from fires (Björklund, 2019, p. 110). E.g. 200 hectares were on fire in Broddbo and 500 hectares burned in Rörbo during this time. This resulted in 10 households needed to be evacuated (Björklund, 2019, p. 110).

## 4.2 Overall sequence of events as a timeline and description of involved actors

The most prominent actors in the rescue operation during the fire season 2018 in Sweden was MSB, the municipalities, county administrative boards, the Swedish government, Emergency Response Coordination Centre (ERCC), the special fire risk organisation, media and volunteers. Also, the public had a large impact on how the work was issued, mostly because of the evacuations and protection of properties, but the public also help to spread information.

MSB had the overall responsibility over the firefighting during the fires, but they have the biggest proactive responsibility for such event as well. MSB also sent out the Important Message to the Public (VMA) about the situation. VMA is a Swedish warning system used in accidents, serious incidents and disturbances in important social functions (Krisinformation, 2019c). From the 16th of July to the 29th of August, 15 VMA were sent out from Sveriges Radio (Radio Sweden) due to the forest fires (Björklund, 2019, p. 188). VMA is a warning system that is used when large accidents and disorders that affect functions in the society occur (Krisinformation, 2019c). Apart from Radio Sweden who reported to the public, several of other media were involved in information spreading. A special forest fire risk organisation was set up by MSB given the extreme situation and it had the responsibility to release resources due to working with ongoing events. This included coordinate and support actors and send updates about the current situation (MSB, 2018b, p. 10). The municipalities are responsible for the firefighters, which means that they have both a proactive and a reactive responsibility when a fire occurs, on a local basis. The county administrative boards had the responsibility to get fire fighters from different districts, local volunteers, etc. to cooperate (Björklund, 2019, p. 63). The responsibility over the national resources was addressed to the Swedish government. ERCC is the core of the EU Civil Protection Mechanism that is a supposed to step in when the national resources is not enough (European Commission, 2019b). ERCC played a large role during the firefighting by providing water bombing planes, helicopters, vehicles and personnel (European Commission, 2019b). Lastly, without strengthen the efforts with volunteers, e.g. from voluntary defence organizations, the devastation would have been much worse (Björklund, 2019, p. 56).

Figure 2 shows a timeline of the most crucial fire events during the summer of 2018 in Sweden. Figure 3 shows a timeline of the most crucial decisions taking to facilitate the fire situation.

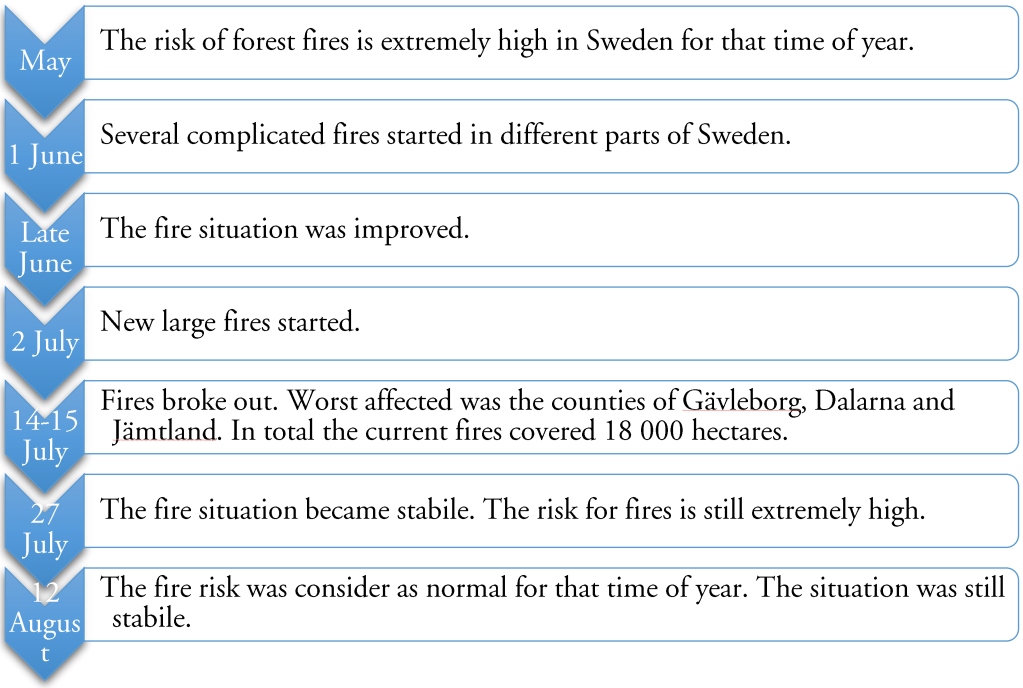


*Figure 2 – A timeline over the fire situation in Sweden during the summer of 2018.*

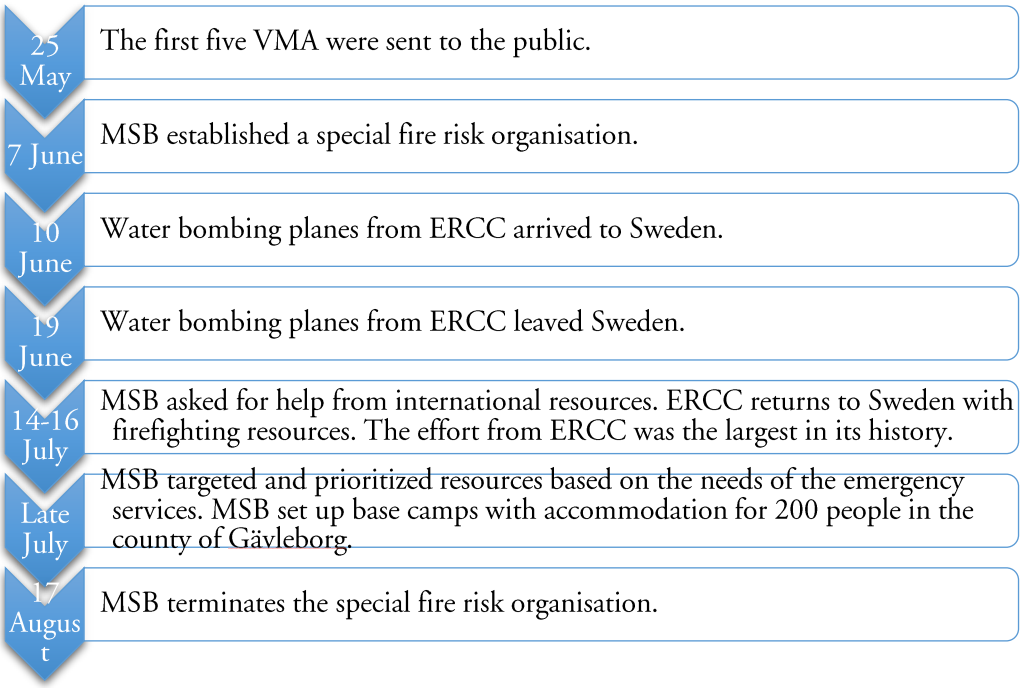


*Figure 3 – A timeline over the decision made in Sweden connected to the fires during the summer of 2018.*

### 4.2.1 Preparations

Before the summer, it was well-known that it would be very dry and the risk for forest fires would be larger than normal in Sweden (MSB, 2018b, p. 10). Emergency preparedness is the ability created in actors' daily activities and not done by a single actor (Björklund, 2019, p. 51). This includes residents preparing their homes for fire threats, volunteers arranging workshops to discuss such events and the government sending out preparatory information to the ones who risk being affected. According to § LSO (SFS 2003:778) the municipalities have responsibility to continuously work with preparations for fires (Björklund, 2019, p. 63) and the county boards has the responsibility to work with preventive measures, e.g. they should be able to coordinate a management function directly when a crisis occurs and they should have an employee who coordinate the initial work (Björklund, 2019, p. 55). MSB has developed five principles, which are: the principle of responsibility, the principle of proximity, the principle of similarity, geographical responsibility and sectoral responsibility (MSB, 2019c, p. 4). The principles mainly guide to clarify who is responsible in which situation and the duty of collaboration between actors (MSB, 2019c, p. 4). To manage the summer of 2018, there were several collaboration conferences to identify how to warn the public about the fire situation and Sweden chose, as the first country in EU, to proactively activate the Emergency Response Coordination Centre (ERCC) (MSB, 2018b, p. 10). To help actors to prepare themselves MSB has developed an application called BRANDRISK UTE, which gives the user a view of the current fire risk situation (MSB, 2016a, p. 48).

### 4.2.2 The situation in May

In May the forest fire season began, which was both early and intensive (Björklund, 2019, p. 110). The fires mainly started in Västmanland, Värmland and the county of Uppsala (Björklund, 2019, p. 110). Due to the extreme risk for fire spread in forest and vegetation, the eventual fires were predicted to be aggressive and difficult to extinguish, which made it very important to find the fires early and put extinguishing resources as early as possible (Björklund, 2019, p. 110). Due to the prevailing circumstances, the first fires collaboration conference took place in May (MSB, 2018b, p. 10) and the same month MSB announced the first of five national message from the authority to give a warning of the extreme fire risk (Björklund, 2019, p. 150).

### 4.2.3 The situation in June

In June, the fire situation worsened. MSB decided to activate ERCC support in form of water bombing planes from Italy (Björklund, 2019, p. 150). MSB also set up a special forest fire risk organisation, which had the responsibility to release resources due to working with ongoing events, coordinate and support actors and send updates about the current situation (MSB, 2018b, p. 10). Thanks to the anticipation and prevention measures and cooperation between fire rescue services, regional, national and international actors, the most fires occurring in June could successfully be extinguished without large losses (MSB, 2018b, p. 10). In the end of June, the risk for forest fires had been significantly reduced, which led to the water bombing planes from Italy returned back home and the special forest fire risk organisation scaled down (MSB, 2018b, p. 13) (Björklund, 2019, p. 150).

### 4.2.4 The situation in July

The fire situation worsened again during the beginning of July, with extreme drought and fire risk all around in Sweden, which led to the fire spread reaching its absolute peak

later in July (Björklund, 2019, p. 110). Due to the increasing fires, MSB decided to send out a message to the public about the critical situation, reactivate full capacity of the special forest fire risk organisation in the beginning of July and at the same time use helicopters from the national defence and private actors to limit the fires (MSB, 2018b, p. 15) (Björklund, 2019, p. 151).

During the 14th and 15th of July, several large fires broke out, some of them should later be consider as some of the most extensive fires in the modern history of Sweden. Together the fires covered an area of approximately 18 000 hectares (MSB, 2018b, p. 16) (Björklund, 2019, p. 151). The worst fire-affected areas were located in the county of Gävleborg, the county of Jämtland and the county of Dalarna (Björklund, 2019, p. 110). The prognosis showed that the fire risk should have reached extremely high levels in the south and middle parts of Sweden by the end of July (Björklund, 2019, p. 111). Due to these fires, many of the rescue services was under extreme pressure and could not handle the fire situation just with their own resources (Björklund, 2019, p. 252). The situation required external help and MSB took a national leading role to coordinate and align the multiple international resources and some of the national resources (Björklund, 2019, p. 153). MSB also contacted Norway and asked if they could assist with more helicopters and asked ERCC for more fire defence resources (e.g. fire fighters, water bombing planes) (MSB, 2018b, p. 18). ERCC sent their help to Sweden that arrived between 16-22th July from Italy, France, Germany, Lithuania, Poland, Portugal and Denmark, mostly in form of water bombing plans, helicopters, fire trucks and firefighters (Björklund, 2019, p. 234) (MSB, 2018b, p. 19). Later in July, help was also offered from Finland and Partnership for Peace (PfP) from NATO (MSB, 2018b, p. 20). Despite all international resources that came to assist, it was necessary to strengthen the efforts with volunteers, e.g. from voluntary defence organizations (Björklund, 2019, p. 56). At that time, it was also required to have a basecamp for evacuess in critical areas. In the county of Gävleborg a basecamp for 200 people was set up (MSB, 2018b, p. 20).

In the end of July, MSB held press conferences daily due to the huge interest from the public and media about the fires (MSB, 2018b, p. 21). These press conferences helped the information spread about the current fire situation. The need of information could also be seen on the increasing visitors at the website krisinformation.se (MSB, 2018b, p. 21). During this time, MSB urged municipalities and county administrative boards to impose fire bans in their districts to avoid the appearance of large fires and not burden the emergency service more than necessary since they already was under a lot of pressure (Björklund, 2019, p. 112). During the late of July, the rescue services in Gävleborg, Dalarna and Jämtland reported a more stable fire situation, which made the focus slightly swift to restore material and let the personnel get some rest (Björklund, 2019, p. 112).

### 4.2.5 The situation in August

In the beginning of August, the situation was still stable and the international ground troops and water bombing plans stopped their efforts in Sweden to be able to contribute in other parts of Europe that suffered from large fires (MSB, 2018b, p. 28). New fires still occurred in different places in Sweden, but no extensive fires started and the situation was under control (Björklund, 2019, p. 112) (MSB, 2018b, p. 29). The fire risk was still very high and to be able to handle a new large fire outbreak Sweden still had support from helicopter resources and a continuous dialog with ERCC (MSB, 2018b, p. 28). In the middle of August, the weather changed to less dry and more rainy, therefore the fire risk level could be seen as normal for that time of year (MSB, 2018b, p. 29).

### 4.2.6 Aftermath

As a result of the fires, the environment was affected and the risk for insect attacks highly increased (Eriksson, Frisk, Hansson, & Nilsson, 2018, pp. 17, 51). The large amount of burned wood also becomes a cost issue and therefore it was necessary to cut down the coarsest burned wood as soon as possible (Eriksson, Frisk, Hansson, & Nilsson, 2018, p. 51). The goal was to have performed this before the summer 2019. To achieve this goal it was necessary to give contribution to the affected landowners since some of them was hit very hard by the fires which led to large financial losses (Eriksson, Frisk, Hansson, & Nilsson, 2018, pp. 15, 51) (Björklund, 2019, p. 247).

However, it was not just landowners who got affected by the fires, also residents were highly affected by the situation. For those who were evacuated, many had a need of processing their experiences (Krisinfomration, 2019a). Residents in the affected areas were sent a lot of information during the fires, what the current fire situation looked like, when to prepare for an evacuation, when to evacuate etcetera (Björklund, 2019, pp. 277-278). Generally, residents experienced anxiety and great uncertainty about the situation, as a consequence of slow action by the actors involved in the rescue and information spreading work (Björklund, 2019, p. 247). The investigation from the government commission showed that this was a consequence of the low amount of information from the rescue leaders subordinates and the public (Björklund, 2019, p. 278).

Of the three most affected areas, the county of Jämtland, Gävleborg and Dalarna, were the county of Gävleborg the one that showed the greatest shortcomings in the initial phase, as a consequence of the large fires (Björklund, 2019, p. 247). After all, it was a lack of staff and the working shifts was too long during the fire fighting (Björklund, 2019, p. 144). To avoid these shortcomings in the future, the investigation from the government commission suggest more financial resources should be sent to municipalities (Björklund, 2019, p. 251). Many rescue services think the help from the armed forces, international efforts and volunteers was the reason the fire situation did not became worse than it did (Björklund, 2019, p. 248).

The Swedish Transport Administration (Trafikverket) has evaluated the damage on the infrastructure due to the fires. The evaluation showed just smaller damages, such as gravel roads that had been affected by the vehicle used in the rescue work (Eriksson, et al., 2018, p. 15). The total road length for public and private roads that needs to be restored after the fire season 2018 is 420 km and the total cost of restoring the infrastructure is estimated to 6 million Swedish crowns (Eriksson, et al., 2018, p. 17).

The investigation of the government commission has given a suggestion to do some changes in §LSO, which will enter into force on 1st of January 2020 (Björklund, 2019, p. 300). The changes are quite many, but some examples of them is that the deductible should be reduced for municipalities (Björklund, 2019, p. 299) and that the state should take over the command of the rescue work from the municipalities when the rescue work is particularly extensive as it was the summer of 2018 (Björklund, 2019, pp. 291-292).

# 5 Results of questionnaires

During year of 2019, two questionnaires were sent out by the author of this report. One for those who lived in the fire affected areas of Sweden 2018 and one for those who worked with the crisis and help the residents. A total of 116 filled questionnaires were collected, namely 48 from residents and 66 from personnel. The questionnaires were sent out to Swedish residents and personnel and therefore the questionnaires were in Swedish. This chapter presents a summary of the answers from the questionnaires. The whole questionnaires for residents can be find in Appendix B and the whole questionnaire for personnel Appendix C, both translated to English. The result of the questionnaires can be seen in Appendix D for residents and Appendix E for personnel, but these results are not translated to English.

## 5.1 Comparison between residents and personnel

The first two sections in the questionnaires, “About you” and “Information about the fire risk” are similar for both response groups, with just some smaller differences to fit the target group, so they would be easier to compare to each other. This chapter sums up the questions both residents and personnel answered.

Considering the residential respondents, 58 % (28 of 48 respondents) were women and considering personnel respondents 41 % (27 of 66 respondents) were women, see Figure 4a and Figure 4b. The average age was 53 years for residents and 47 years for personnel. Almost all residents lived in the counties of Jämtland and Gävleborg during 2018, where about the same number lived in both counties. The respondents to the personnel questionnaire, about 80 % (47 of 60 respondents, some answers did not specify the location of the respondent) declared they were located in the county of Gävleborg.

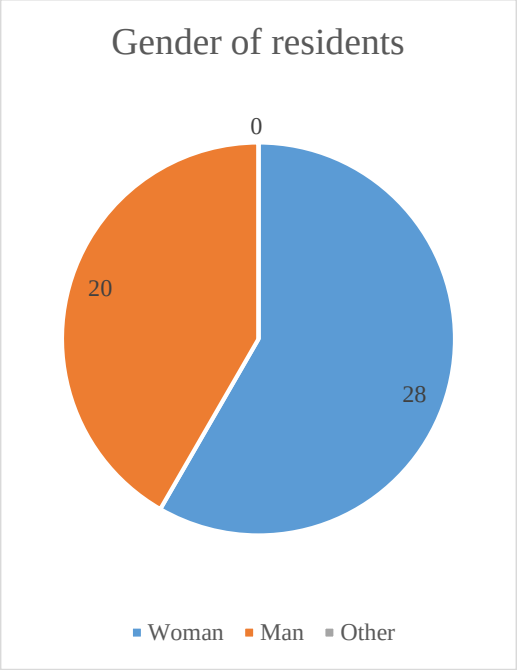


*Figure 4a – A chart over the residential respondents' sex. 58 % (28 of 48 respondents) of the respondents were women and 42 % (20 of 48 respondents) were men.*

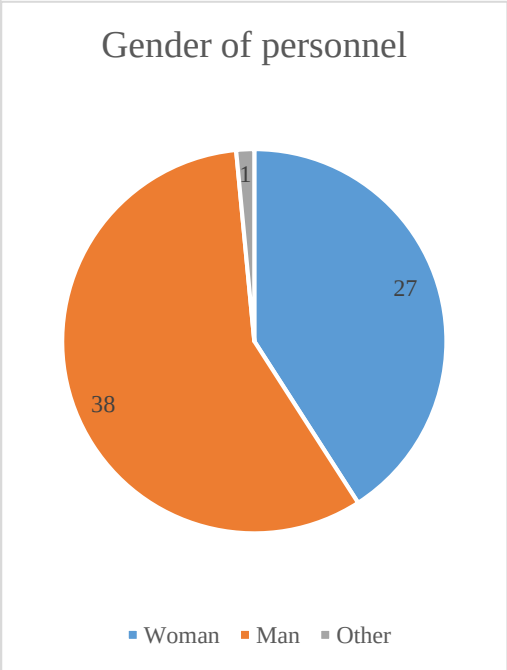


*Figure 4b – A chart over the personnel respondents' sex. 41 % (27 of 66 respondents) were women, 58 % (38 of 66 respondents) were men and 1 % (1 of 66 respondents) identified themselves as other.*

A total of 27 % (13 of 48 respondents) of the residents and 41 % (27 of 66 respondents) of the personnel had previous experiences from forest fires. Most residents had earned their experiences from conservation burning, while most personnel had earned their experiences from working in the rescue service or from working with conservation burning. 44 % (21 of 48 respondents) of the residents got an evacuation order compared to none of the personnel. Of those who did not receive an evacuation order, 14 % (4 of 28 respondents) of the residents were recommended to evacuate and none of the personnel. This is illustrated in Figure 5a for residents and in Figure 5b for personnel.

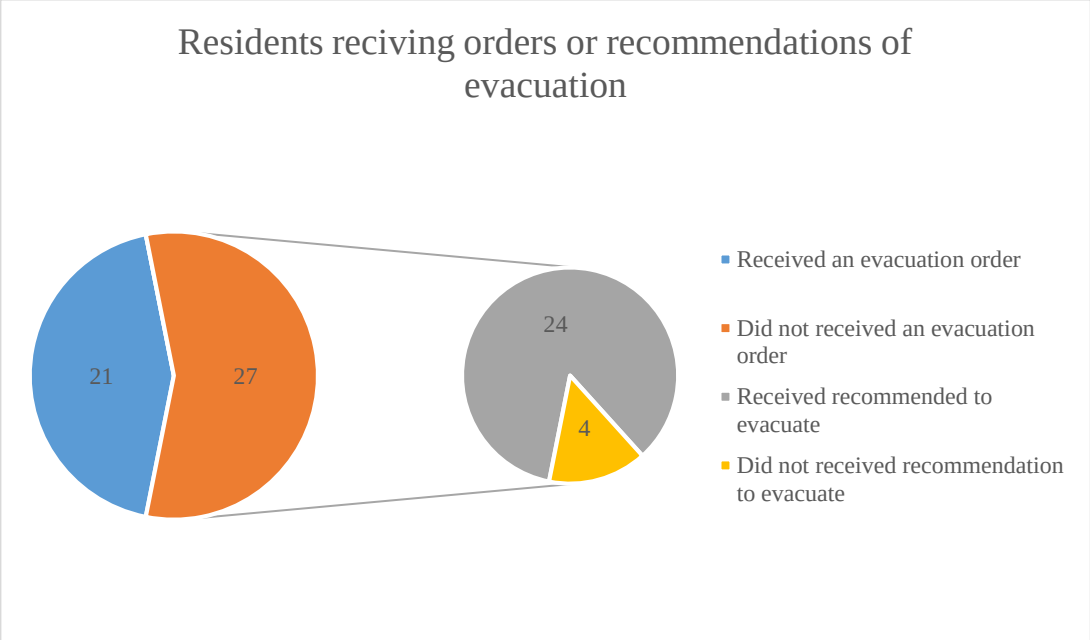


*Figure 5a – The left chart is the answers to the question if the respondents received an evacuation order for residents. 44 % (21 of 48 respondents) of the residential respondents received an evacuation order and 56 % (27 of 48 respondents) did not. Of those who did not received an evacuation order, 14 % (4 of 28 respondents) were recommended to evacuation, which can be seen in the right chart.*

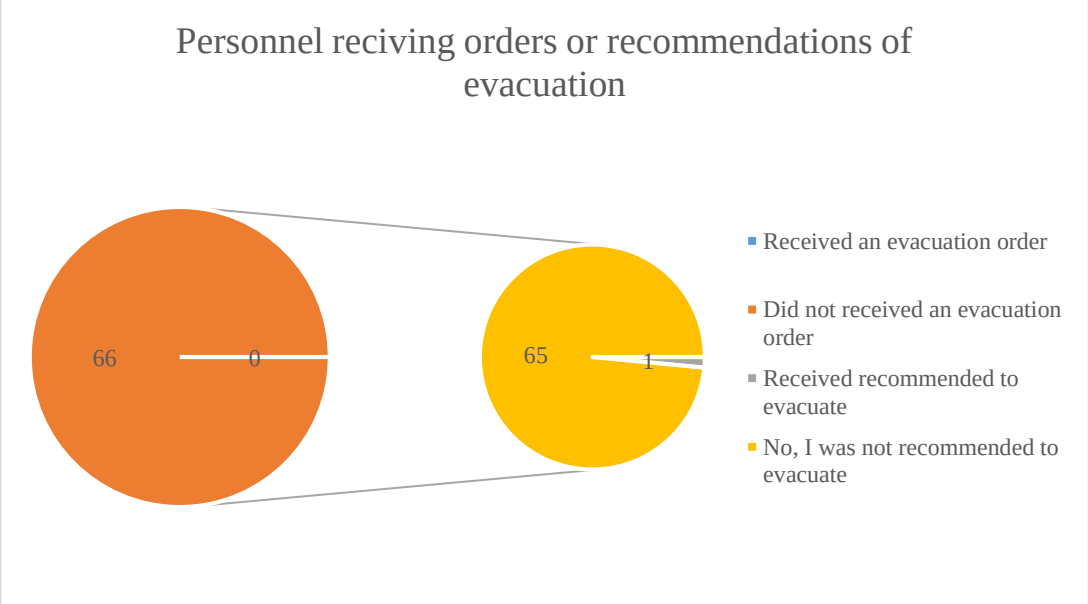


*Figure 5b – The left chart is the answers to the question if the respondents received an evacuation order for personnel. None of the respondents who were personnel received an evacuation order. The right chart shows that 1 % (1 of 66 respondents) were recommended to evacuate.*

Both respondent groups claimed that they were aware of the unusually high fire risk. 92 % (44 of 48 respondents) of the residents and 97 % (64 of 66 respondents) of the personnel did know about the increased fire risk. When the respondents find out that the risk were well correlated between the two groups, almost everyone learned about it in the beginning of the summer. All the personnel and 98 % (47 of 48 respondents) of the residents knew about the prevailing fire ban in Sweden.

Both groups were unsure how to prepare themselves for an evacuation. 81 % (39 of 48 respondents) of the residents and 64 % (42 of 66 respondents) did not knew how to prepare. None of the residents declared that they got information about how to firesafe their property, and 12 % (8 of 66 respondents) of the personnel said they received information about how to firesafe their property.

Of the residents, 69 % (33 of 48 respondents) declared a change in risk perception. Of the personnel, 59 % (39 of 66 respondents) answered that the fire incidents have changed their risk perception. For those who have changed their risk perception, respondents from both groups say that the change mainly is about that they have a better understanding of what a forest fire can look like and therefore will pay more attention to warnings for forest fires in the future.

## 5.2 Results from residents

The total number of responses were 48 from residents, 20 were men and 28 were women. The age range of the respondents was wide, between 20 and 76 years old, with an average age of 53 years and standard deviation of 16 years. The place of residence was equally divided between the county of Gävleborg and the county of Jämtland, which covered almost all who answered the questionnaire. About one quarter (13 of 48 respondents) had previous experience of forest fires, mostly from conservation burning.

During the summer of 2018, most (44 of 48 respondents) residents in the fire affected areas became aware of the risk for fires was higher than normal. Just 8 % (4 of 48 respondents) did not know that the risk for a fire was increased, but only one of the respondents had not heard about the fire ban that was set up in Sweden during this time.

Before the summer, 81 % (39 of 48 respondents) of the residents declared that they did not know how to prepare themselves for an eventual evacuation and 88 % (42 of 48 respondents) claimed that they did not get information from any governmental organisations on how to prepare. None of those who answered the questionnaire claimed that they had got information about how to prepare their property for the fires. 29 % (14 of 48 respondents) considered staying and defending their property as an alternative to evacuation.

After all, 69 % (33 of 48 respondents) declared a change in risk perspective for forest fires. In the text answers people describe their risk perspective change as they nowadays pay more attention to climate that can cause fires, e.g. dry weather and thunderstorms. Many residents claimed that the fires have made them realized how fast a fire can grow and spread. As a consequence they claimed that they will listen more carefully to the media coverage of forest fires as well as they will listen more thoroughly to information from the authorities. An overall carefulness and caution have been settled in their minds.

A mandatory evacuation order was sent out to 44 % (21 of 48 respondents) of those who answered the questionnaire, and of those who did not receive a mandatory evacuation

order, 14 % (4 of 28 respondents) got recommended to leave their homes. The most common way to hear that an evacuation order was announced was from authorities, mostly from sms, radio or TV. About a third of the respondents searched among other sources to confirm the evacuation order. All respondents declared turning to TV, radio, websites of authorities or family and friends to get more information.

Of those who got an evacuation order, all evacuated their homes. The evacuation order reached the residents in the middle of July. Half (10 of 20 respondents) of the respondents evacuated with one more person, 15 % (3 of 20 respondents) evacuated alone and 35 % (7 of 20 respondents) evacuated with two or more other residents. Figure 6 shows the distribution between the number of individuals. Of those who evacuated their home, everyone (18 of 18 respondents) left within 12 hours after receiving the evacuation order and over two thirds (13 of 18 respondents) of the evacuees left within 6 hours.

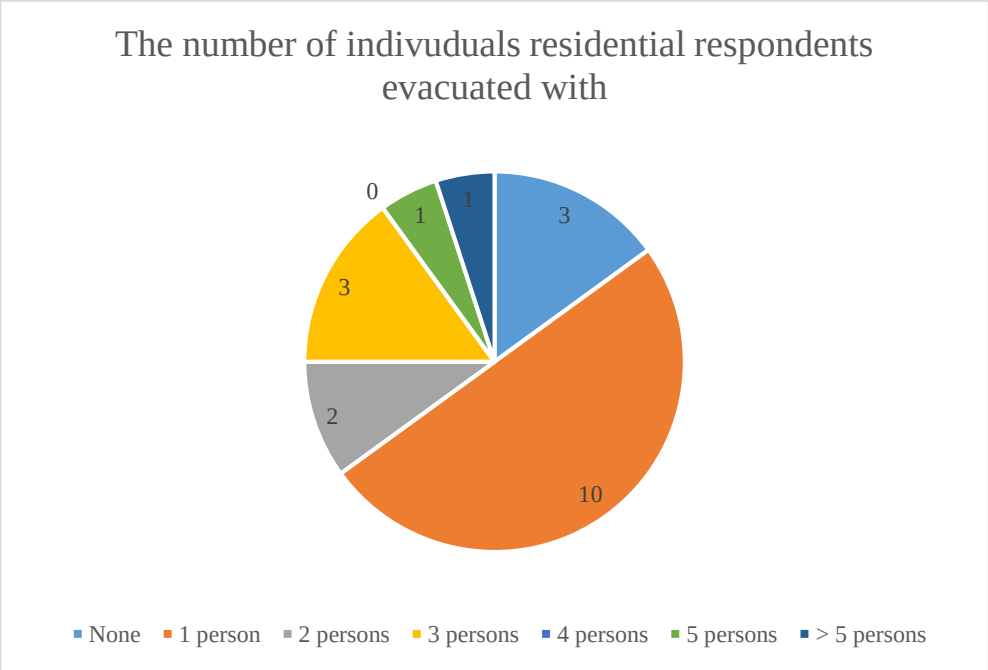


*Figure 6 – An overview of the number of individuals the respondents to this questionnaire evacuated with. Of the 20 respondents, 15 % did evacuate alone, 50 % evacuated with one other person, 10 % evacuated with two other persons, 15 % evacuated with three other persons, 5 % evacuated with four other persons, 5 % evacuated with five other persons and 10 % evacuated with more than five other persons. The exact numbers can be seen in the chart.*

Most (25 of 34 respondents) did not prepare their property for a fire, but of those who evacuated, almost half (9 of 20 respondents) tried to limit the potential damage on their property by watering and remove objects that could cause an explosion, e.g. gasoline containers. When asking residents how they felt when they received an evacuation order, most declared that they felt very threatened, which can be seen in Figure 7.

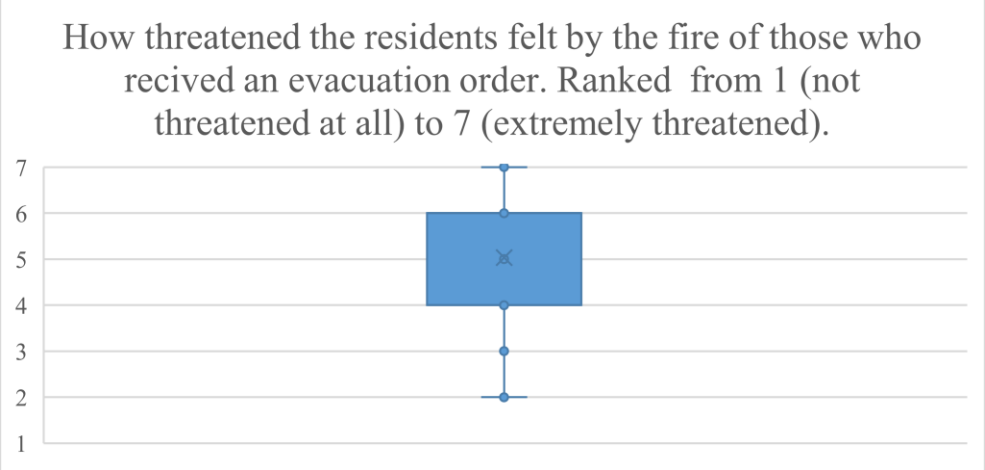


*Figure 7 – Many residents felt threatened by the fires after getting an evacuation order.*

Half of the evacuees (9 of 20 respondents) claimed that they did not get information on where to gather from their original source. Some locations did not have any place to gather or the respondents did not find out any information if there was any. Other residents found out on their own by calling the municipality. Most resident felt that they did not get as much information as they needed of how to perform an evacuation, see Figure 8.

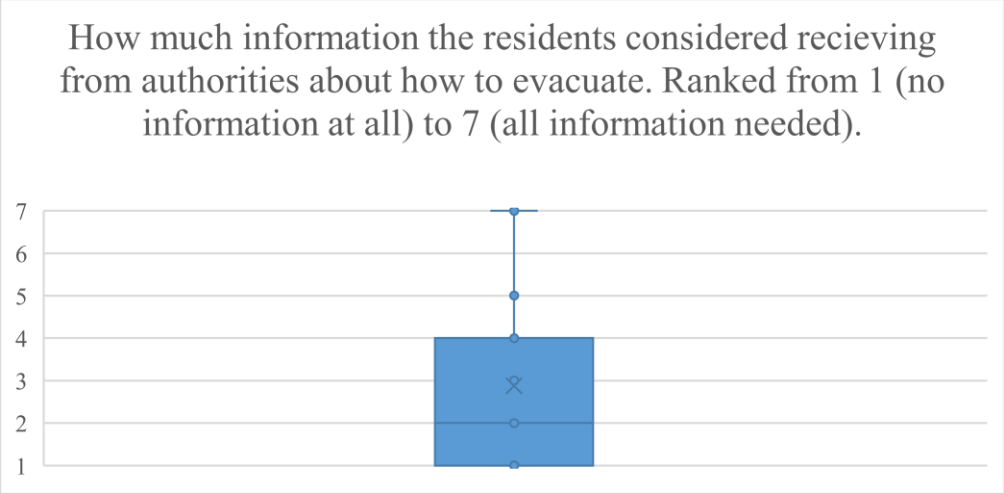


*Figure 8 – Most residents felt that there was a lack of information about how to perform an evacuation.*

How long the residents were evacuated differed among the respondent group, but with a slight preference to "wait 7-14 days" before coming back home, see Figure 9. The by far most common source of information that explained it was safe to return home was by radio or a call from the municipality. Two thirds of the respondents (16 of 24 residents) did not search for more information to confirm the original source that it was safe to return. Those who searched for more information did so using TV, radio, internet, social

media or talking in person with other people. Since the sample of data is small, this result should be read carefully.

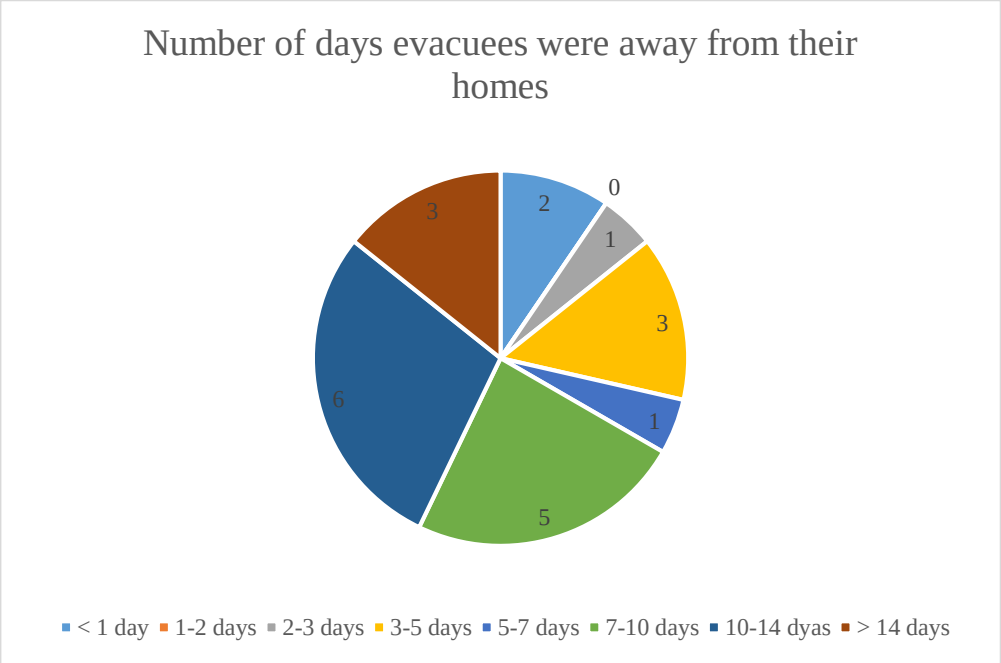


*Figure 9 – It varied greatly how long people were evacuated from their homes. Of the 21 respondents, 10 % returned home within 1 day, none retuned after 1-2 days, 5 % returned after 2-3 days, 14 % returned after 3-5 days, 5 % returned after 5-7 days, 24 % returned after 7-10 days, 29 % returned after 10-14 days and 14 % returned after more than 14 days. The exact numbers can be seen in the chart.*

The questionnaire ended with a text answer to give the respondents a chance to add more information by their experience that was not covered by the other questions. Overall, the residents seemed to be disappointed on how the whole situation was handled and felt run over by authorities. Respondent number 43 claimed: "The authorities must become better at clarifying the sequence of events during a forest fire. Where is it burning? Where does the fire spread? How fast is the fire spread?" and respondent number 20 claimed: "The authorities, e.g. MSB, should realize that there are places without any mobile coverage." Other examples of where the information was incomplete were at the website of the municipalities of Härjedalen and from the local radio, according to respondent number 9 and respondent number 14. Several residents describe that they searched for information on Facebook and on other municipalities' websites.

A recurring point in the free text answers is the feeling that the resources were too few and not used effectively. From the residents' point of view, the coordination and collaboration between and within municipalities, county boards, rescues services etc. were insufficient. Respondent number 3 from Sveg in the county of Jämtland, claimed that the fire in Skalet was prioritized, which probably caused that the fires in Kårböle and Fågelsjö grew more than necessary. All three fires occurred within a radius of 7 km.

Residents also describe that the situation had a large impact on the mental well-being, which the lack of information contributed to. Some suggestions on how to improve the mental health of those who were affected came along in the free text answers.

Respondent number 7 claimed: “It is necessary to get more information handed out after the fires for those who live nearby. What happened, what were the consequences, and what have been learned from the fires 2018? In Fågelsjö we did not got any information meeting.”.

## 5.3 Results from personnel

The total number of responses were 66 from personnel, 38 were men, 27 were women and 1 from other/do not want to declare. The age range of the respondents varied between 26 and 67 years old, with an average age of 47 years and standard deviation of 10 years. Of the respondents, about 80 % (47 of 60 respondents, some answers did not specify the location of the respondent) worked in the county of Gävleborg, the remaining answers came from people located in the counties of Jämtland and Dalarna. A few answered that they were active in more than one county. The most common roles were non-professional volunteer, fire fighter and being a part of the crisis management department at the county administrative board of Gävleborg. Before the summer 2018, 41 % (27 of 66 respondents) had earlier experiences from forest fires, the experience came from working in the rescue service or from working with conservation burning.

All of the personnel did know about the fire ban that was announced in Sweden during the summer of 2018. Just one of those who answered the questionnaire received a mandatory evacuation order, and none got recommended to evacuate their home, but 36 % (24 of 66 respondents) did know how to prepare themselves for an eventual evacuation and 12 % (8 of 66 respondents) got information about how to defend their property by e.g. build a firesafe space. 15 % (10 of 66 respondents) delegated other to evacuate or told other to prepare themselves for an evacuation.

Almost everyone who answered to the questionnaire were aware of the fire risk beeing higher than usual, i.e., only 3 % (2 of 66 respondents) had not heard about it. The respondents knew about the increased risk in the beginning or in the middle of the summer, for a more detailed view of when they got the knowledge, see Figure 10. The most common way to receive information about the current fire situation was from authorities, their TV and internet was the most used source. To hear about it from a relative was also common. Other common sources of information were the application BRANDRISK UTE and SMHI.

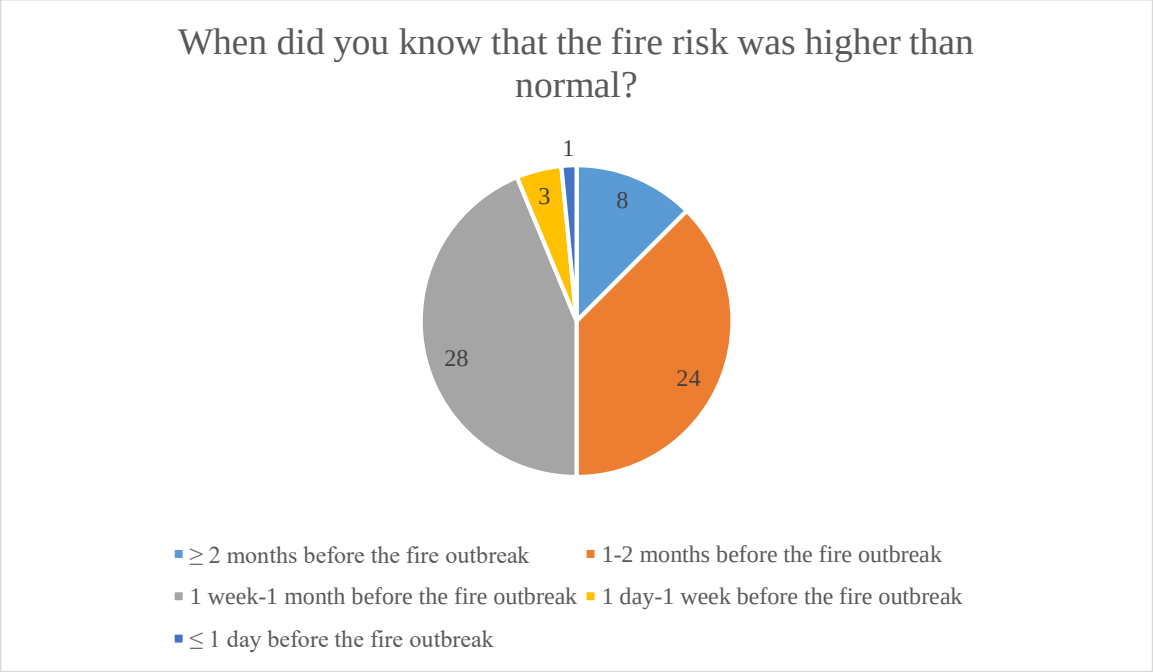


*Figure 10 – A chart of when the personnel who knew the risk for fires was increased compare to normal get to know about the risk. The chart is based on 97 % (64 of 66 respondents) of the responders, the other 3 % (2 of 66 respondents) did not realize the risk before the fire broke out. Of the 64 respondents, 2 % did know about increased fire risk less than 1 day before the fire/fires broke out, 5 % knew it 1 day - 1 week before, 44 % knew it 1 week – 1 month before, 38 % knew about it 1-2 months before and 13 % knew about it more than 2 month before. The exact numbers can be seen in the chart.*

Overall, 59 % (39 of 66 respondents) answered that their perspective regarding the risk of forest fire had changed after their experiences in 2018. Several respondents claimed that they nowadays have a better understanding for how fast and intense a forest fire can be and how hard it can be to extinguish these fires. Therefore, most claimed that they will listen more carefully to warnings and information about forest fires. Others describe how they after the fires are more observant to dry weather and lightnings.

By analysing the free text answers, the overall feeling after the summer 2018 was not uniform from the personnel. The answers give both a positive and negative picture of the crisis management. One criticism came from respondent number 40: "It became frighteningly clear that MSB did not earn experiences from the Västmanland fire, regarding equipment, connections and staffing.". The lack of routines for the large amount of fires at the same time slowed down the fire fighting and information flow. The respondents declared that the forest fire season 2018 made an impression of how climate change affects humans. Several of the respondents are worried about how fires will increase in the future, and therefore many respondents see a need of routines for large forest fires need to be improve.

Another mentioned shortcoming was the outdated resources, e.g. there was not enough hoses according to respondent number 15. When a forest fire occurs, there is often a lot of local resources available, but cannot always be used due to regulations. Such local resources are forest machineries and farmers. Nevertheless, several respondents think the

collaboration between civils and personnel worked well. Several answers are also about how impressive the emergency management organization handle the situation despite the lack of resources, e.g. respondent number 43 claimed: “I think that the rescue/crisis management organization worked in an impressive way despite the lack of materials, personnel, fire aviation, etc. However, we need to be even better prepared for various types of crisis in society. We need to build up our readiness.”.

As feedback on the questionnaire, several felt that the questions about evacuation were irrelevant for them, since they worked as administrative personnel and did not have contact with the evacuees. Another feedback was that it had been relevant to bring up the food issue in the questions.

# 6 Discussion

The survey shows that almost all residents and non-residents who participated in the questionnaires knew that the risk for fires was higher than normal in the summer of 2018 before the fires broke out. It seems like the respondents got the information from several different sources, but TV and radio were the most common for both groups. Notable is that several respondents answer that they got information about the fire risk from SMHI and the application BRANDRISK UTE. TV and radio are more passive sources than SMHI and BRANDRISK UTE, but this can be an indicator of that the affected people was not satisfied with the media coverage that was sent out on the more traditional sources.

After the summer 2018, 69 % (33 of 48 respondents) of the resident respondents and 59 % (39 of 66 respondents) of the non-resident respondents declared a change in their risk perspective. This means that 63 % of the total 114 respondents declare that their perspective of forest fire risk has changed. It is clear that the fires affected the perception of many of those who were involved. By studying the free text answers, it is notable that almost everyone who not had previous experiences of forest fires considered a change in their risk perception, but they who had previous experiences did in general not. Since the risk perception has changed for several people, the behaviour of those people would likely be affected if they would be involved in a similar crisis in the future. Perhaps they will prepare more, pay more attention to warnings and take a similar situation more seriously.

Although almost everyone seemed to know about the fire risk status, most did not know how to prepare for an eventual evacuation. For residents, 81 % (39 of 48 respondents) did not know how to prepare, and 88 % (42 of 48 respondents) declared that they did not get any information regarding preparation. None of the respondents got information about how to fire safe their property. The lack of information to residents before the fire outbreaks could be a contribute factor of why so many felt extremely threatened by the fires when they received an evacuation order. In general, the survey result indicates that personnel were overall more well-informed about the fire situation, what to do if a fire occurs close to them and how to protect themselves from the eventual fire. This can be a consequence of several reasons, e.g. the personnel had previous experiences of similar crisis, the residents had a higher average age and some lived in areas without mobile coverage, which can impact the use of media. Since not every respondent from the non-resident's questionnaire lived in one of the fire affected areas, it is difficult to conclude how many of those who should have received the information of preparation actually got it.

According to the questionnaire answers, not everyone receiving an evacuation order had a place to gather, or did not get information about its existence. For many of the evacuees, there was also a lack of information about 1) which roads were safe, 2) when they should evacuate and 3) when they could return home. Overall, most respondents were not satisfied with the information they received from authorities about how to evacuate. Even so, a majority did not seek additional information to confirm the evacuation order, neither to confirm that it was safe to return home. The questionnaire results showed that no one waited more than 12 hours to leave their home after receiving an evacuation order. This can be an explanation of why people did not seek additional information, because they felt very threatened by the fires, and did not think they had time to consider and evaluate the situation before handling.

An overall problem appears to be that it does not seem to have been any clear structure of what information should reach the residents and how the information should be handed out. This can be exemplified by the quotes from residential respondents number 32 who declared "Informers are generally most interested in providing sweeping information to the general public" and residential respondents number 19 who wrote "That texts did not reach us in Olingdal, everyone does not have mobile coverage". Some of those who got evacuation orders heard it from the news, others got texts and others had the police knocking on their door. According to the answers it does not seem to be any unified guidelines about how to contact the general public in such a crisis. The feedback from evacuees on the communication between residents and authorities are in general not positive. The view of how the communication worked is however split within the non-residential group, there several individuals in this group who think the communication was satisfying. Here it is desirable to evaluate the evacuation process and assess how information reach out to the general public.

The amount, condition and use of resources is also an issue that should be further evaluated. Resources such as fire hose were sometimes old and local resources were not used effectively. According to the free text answers from both respondent groups, 17 respondents to the questionnaires declared about a non-optimal use of resources, e.g. by having old and not well-functioning equipment. The resources were also not focused to the most emergent fires. Local resources, such as forest machineries and farmers, could have also been more involved in an earlier stage. Another issue mentioned by 8 respondents in the free text answers was the lack of collaboration and coordination across municipalities and county borders. It seems to be necessary to develop guidelines in Sweden on how to prevent and mitigate the consequences as far as possible for forest fires, since the changing environment indicates they will be more occurring. The fires of 2018 should be seen as a good way to earn experience to be a part of the base for these guidelines. One suggestion is to introduce a Firewise program in Sweden to make the emergency response more effective, to implement more fire safety in land use planning and to motivating the general public to prepare their community to be more resident against forest fires (Björklund, 2019, pp. 285-289).

Almost everyone who answered the residential questionnaire lived in the county of Jämtland or in the county of Gävleborg the summer 2018, but divided between several different locations within the counties. Since the main evacuation occurred in these counties, it indicates that the variation among the participators was wide and likely to reflect upon the reality of opinions among the ones living in the fire affected areas. For the non-residential group, there was a clear prominence of people located in the county of Gävleborg. The reason of the overrepresentation was connected to the greater amount of answers received from the crisis management department at the county administrative board of Gävleborg. This can contribute to a misrepresented picture of the global group's experiences. Desirability bias can also be a contributing factor of results not reflecting the reality. Examples of desirability biases could be that people do not want to say they did a bad job evacuating residents or that the respondent did not see the information even if there was much information available.

Some personnel respondents left a notice about not feeling that their experiences from the fires 2018 were relevant for the questionnaire. The main reason was that they were not in direct contact with evacuated people or fires since they worked as administrative tasks. Afterwards, it could have been an idea to only send out the personnel questionnaire

to those who worked operative during the fires. Another suggestion on improvement could have been to design three questionnaires instead of two; one for residents, one for operative personnel and one for administrative personnel.

## 6.1 Future studies

Since dissatisfaction was shown in the free text answers by 37 of 114 people in some aspects concerning how the situation was handle, more studies should be done on how lessons learnt from these fires can enhance evacuation preparedness and communication. On the prevention measures, there is a need to ensure that the general public have more knowledge about what to do in a forest fire situation that can eventually reach their property. There is also a need for communities to prepare for and enhance resistance against forest fires. It also seems that the authorities in Sweden need to implement a better structure of actions during forest fires, e.g. when it is necessary to ask for help from local or international resources. A suggestion is to investigate if Sweden should implement similar programmes such as the Firewise program launched in the U.S.

It seems to be important to investigate why the general public felt dissatisfied with the communication and information flow, while many of the personnel thought these components worked well. Further studies should evaluate these point of views more deeply, as it is recommended to listen to both sides.

It would be a good idea to examine the general public reaction after they have returned home after an evacuation since the free text answers in the questionnaire for residents showed that people felt that they had wanted to have more clarity about what happened and what consequences the fires brought. A further study could investigate if the general public would feel better if they could get more feedback after such event, e.g. by being offered therapy or by getting flyers and/or post disaster workshops with information.

Finally, it is crucial for this type of surveys to carefully design questions that respondents will understand. E.g. people who do not have much knowledge or earlier experiences in fire evacuation, may not be familiar with terms that seem obvious to someone studying the subject. For this reason, future research efforts should focus on developing a standardized template for performing such type of post-disaster questionnaire studies.

# 7 Conclusion

The survey results show that the information residents in the fire affected areas received regarding what they should do and the status of the currents situation seems to differ. According to the answers from residents, there was little information before the fire outbreaks from authorities about how to prepare for an eventual evacuation and how to firesafe properties. A minority, 12 % (6 of 48 respondents), of the residential respondents think they got all information they needed to conduct an evacuation. Most residential respondents state that they more or less did not get the amount of information they wanted about the situation and what to do. Those who received evacuation orders seem to have been more informed about what to do, e.g. where to gather, then they have been about how they should have prepare for an eventual evacuation. In total 28 % (9 of 32 respondents) declared that they received information regarding where to gather. It is not sure that the result from the survey corresponds to the reality since it seems like the questions about it have been misunderstood, and therefore it is not possible to say with certainty where the information came from.

Analysing the answers to the questionnaires, shortcomings in the communication were highlighted by 8 respondents in the free text answers. The residents were overall unsatisfied with the communication, both from authorities to residents, but also the communication and collaboration between and within authorities. The personnel respondents had a more divided view on how the communication worked, where some respondents thought it worked well while others think there is room for improvements on the communication in such crisis situations.

Considering the ones who evacuated their homes, all stated that they left within 12 hours after receiving the evacuation order, with a significant majority leaving within 6 hours. Since almost everyone of those who received a mandatory evacuation order did evacuate, it indicated on a fast decision-making process and that evacuees did not take much time in considering the decision about evacuation or not.

The general public who lived in the fire affected areas stated that they felt threatened by the fires after receiving an evacuation order. Overall there was a feeling of uncertainty among the public. This is based on that they in general did not think they had a good view of the situation, e.g. what was going on, what was likely to happened and what to do if the situation would worsened. The risk perception has in general changed among the public due to the fire experiences. Those, from both in the residential and personnel groups, who had previous experiences from did not declare that their risk perception has change, but respondents with none previous experience from forest fire have a new understanding for fire risks. Respondents to the questionnaires say their risk perception of forest fires has changed in the way that the nowadays know how fast a forest fire can spread and what consequences it can bring.

The overall conclusion of this thesis is that it seems that respondents were dissatisfied with the current strategies and guidelines of how to handle large and complex forest fire in Sweden. To improve the situation, a wildfire safety programme (such as the Firewise programme adopted in the U.S.), or similar, could be implemented in Sweden.

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# Appendix A: Case Study Description – Sweden 2018

During the summer of 2018, there was a large number of forest fires occurring in Sweden. The fire spread peaked in July. 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 counites 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 | Why? | *Prolonged heat and drought* |
| 4 | Initial fire size | *Many fire break outs at the same time with a fast fire spread speed due to the weather conditions.* |
| 5 | Area affected | *A burned area of 180 $km^2$ as a consequence of the fires which stared at the 14th and 15th of July.* |
| 6 | Type/s of forest involved in wildfire | *The ground was very dry as a consequence of the long-lasting drought. Most of the burned forest consist of pine and spruce.* |
| 7 | Did the fire spread inside the WUI | *Yes* |
| 8 | Average weather conditions | *During the beginning of the summer 2018, a long-lasting heat wave pulled in over Sweden. In combination with less rainfall than usual, it made the ground very drought. The summer was windier than normal, which probably contributed to the fire spread.* |
| 9 | Geographical highlights | *The worst affected areas are located approximately 400-500 meters above sea level.* |
| 10 | Was there any natural fire break? | *Roads, rivers, lakes and others were present as natural fire breaks.* |
| 11 | Did the Fire Service report extreme fire behaviour | *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 started.* |

| | | |
|---|---|---|
| 12 | Number of structures and infrastructures affected | *Just a couple of houses and vehicle was destroyed as a result of the fires.*<br>*Roads of a total length of 420 km needed to be reconstructed after the fires.* |
| 13 | Estimated direct and indirect economic damage | *Approximately forest area of a total worth of 900 000 000 Swedish crowns was burned down due to the fires.*<br>*300 000-400 000 Swedish crowns for volunteer work.*<br>*The cost of reconstruct damage roads due to the fires was estimated to 6 000 000 Swedish crowns excluding VAT.*<br>*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 | *National and EU Civil Protection mechanism.* |
| 16 | Brief timeline of the events | *The risk for fire events in Sweden was set very high during the summer of 2018 due to the unfamiliar, dry weather conditions. At the 14th and 15th of July many large, uncontrollable fires broke out in the middle of Sweden. These fires cause a burned area of 180 $km^2$ (total burned area due to the fire season was 210 $km^2$). These fires required a lot of resource 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 accomplished in parts of the counties of Jämtland and Gävleborg. In the late July, the fire risk was still extremely high, but the fire situation was stable, and the evacuated residents could retun home.* |
| 17 | Time of initial order to evacuate | *During week 29 (16th-22th of July), hundreds of people was given evacuation orders due to the large fires that started the 14th and 15th of July.* |
| 18 | Time when evacuation was | *When it was safe for evacuated to return home varied between the 22th and 30th of July depending on where they had evacuated from.* |

| | | |
|---|---|---|
| | considered completed | |
| 19 | Deaths/Injuries | *No one was seriously injured due to the fires.* |
| 20 | People Evacuated | *Between 300 and 500 people was evacuated.* |
| 21 | People threatened to be evacuated | *Have not found this information.* |
| 22 | Evacuation type | *Mostly by cars on roads.* |
| 23 | Personnel involved in rescue operations | *The Swedish Civil Contingencies Agency (MSB) was the organisation that had the overall responsibility for the rescue work.*<br>*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.*<br>*The municipalities had the responsibility of their own fire fighters.*<br>*Volunteers, mostly coordinated by the Swedish Red Cross, helped where there was a lack of resources.*<br>*The county administration boards were reasonable for the cooperation between fighter fighters from different districts, volunteers and so on.*<br>*The Emergency Response Coordination Centre (ERCC), provide a lot of resources from other countries.* |
| 24 | Did the smoke hindered significantly the evacuation because of low visibility or health problems | *Some roads were blocked* |
| 25 | Possible causes of issues in management operations | *The county of Gävleborg encountered difficulties in the initial phase, caused by the fire situation was too extreme to handle with their own resources.*<br>*The municipalities did not have enough knowledge about the systems that provide information of ongoing crisis.*<br>*On a local level, there was a lack of structure, because of the leader capacity was too low.* |

| | | |
|---|---|---|
| | | *Several recuse services had difficulties to get in touch with MSB in the initial phase.* |
| 26 | References | Björklund, J.-Å. (2019). *Skogsbränderna sommaren 2018 (SOU 2019:7)*. Stockholm, Sweden: Justiedepartementet.<br>MSB. (2018). *MSB:s arbete med skogsbränderna 2018 - Tillsammans kunde vi hantera en extrem skogsbrandssäsong*. Karlstad: MSB. |
| 27 | Name/Surname /Email/Date of who filled in this template | *Hahlin / Johanna / bra14jfr@student.lu.se /2019-05-31* |

# Appendix B: Questionnaire for residents

This survey is part of a thesis work done at Lund University. The purpose of this questionnaire is to investigate the information obtained by the general public and emergency respondents during the evacuations and evacuation threats due to the fire season 2018 in Sweden.

The survey will take approximately 10 minutes. It includes questions about yourself and then continues with how you experienced the information during fire season 2018. To take part in this survey you need to be at least 18 years old and you have been in Sweden during the fires in summer the 2018. Your response will be treated anonymously according to Dataskyddsförordningen EU (2016/679).

The result of this survey will be used in a master thesis in Risk Management and Safety Engineering that will be published on https://lup.lub.lu.se/student-papers/search/publication?sort=publicationstatus.desc&sort=year.desc

If you have any questions about the survey, please contact Johanna Hahlin by sending an email to bra14jfr@student.lu.se.

Thank you for your participation!

* means mandatory question

Part 1/4: About you

1.1 Your sex? *

- Female
- Male
- Other

1.2 Your age? Type a number from 18 to 99 *

_____ (18-99)

1.3 Did you have any previous experience with forest fire accidents? *

- Yes
- No

1.4 If you answered yes to question 1.3: Briefly describe the experience, e.g. where the experience took place, if you evacuated and if so where you went, how long were you affected of the fires, etc.

_____
_____
_____
_____
_____
_____

1.5 In what area were you living in during the summer of 2018? *

_____

1.6 Did you get an order to evacuate due to the fires? *

- Yes
- No

1.7 If you answered no to question 1.6: Were you recommended to evacuate?

- Yes

- o No

1.8 Do you think there has been a change in your risk perception for forest fires from last summer? I.e. if you nowadays pay more attention to fire evacuation information during the summer? *

- o Yes
- o No

1.9 If you answered yes to question 1.8: Why do you think this change in risk perception occurred?

_____
_____
_____
_____
_____
_____

Part 2/4: Information about the fire risk

2.1 Did you know there was a higher risk for fires in your area than normal at that time of the year before the fires broke out in the summer 2018? *

- o Yes
- o No

2.2 If you answered yes to question 2.1: When did you know about it?

- o ≥ 2 months before the fire outbreak
- o 1 – 2 months before the fire outbreak
- o 1 week – 1 month before the fire outbreak
- o 1 day – 1 week before the fire outbreak
- o ≤ 1 day before the fire outbreak

2.3 If you answered yes to question 2.1: Who sent you the information? And how did you receive the information? You can choose more than one option.

| | TV | Radio | Newspaper | Internet | Social media | In person | Other |
|---|---|---|---|---|---|---|---|
| Friends/ family | o | o | o | o | o | o | o |
| Authority | o | o | o | o | o | o | o |
| Other | o | o | o | o | o | o | o |

2.4 If you answered other to question 2.3: Please specify who sent you the information.

2.5 Did you get information about the fire ban that was declared in Sweden during the summer of 2018? E.g. it was not allowed to grill. *

- o Yes
- o No

2.6 Did you know, before the fire season started (approximately in May 2018), how to prepare for an eventual evacuation and/or how to get information for an eventual evacuation due to fires? *

- o Yes
- o No

2.7 Did you get information from any authority on how to prepare yourself for an evacuation, before you got an evacuation order? *

- o Yes
- o No

2.8 Did you get information about how to firesafe your property? E.g. how to build defensible space. *

- o Yes
- o No

2.9 Did you consider staying and defend your property as an alternative to evacuation if the fires should reach you? *

- o Yes
- o No

Part 3/4: Evacuation

If you did not evacuate your home, please skip this part.

3.1 Who sent you the first information about the evacuation order and how did you receive it?

| | TV | Radio | Newspaper | Internet | Social media | In person | Other |
|---|---|---|---|---|---|---|---|
| Friends/ family | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| Authority | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| Other | ○ | ○ | ○ | ○ | ○ | ○ | ○ |

3.2 If you answered other to question 3.1: Please specify who sent you the information.

_____
_____
_____

3.3 Did you seek additional source(s) to confirm the evacuation order?

- ○ Yes
- ○ No

3.4 If you answered yes to question 3.3: From what platform(s)? You can choose more than one option.

| | TV | Radio | Newspaper | Internet | Social media | In person | Other |
|---|---|---|---|---|---|---|---|
| Friends/ family | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| Authority | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| Other | ○ | ○ | ○ | ○ | ○ | ○ | ○ |

3.5 If you answered other to question 3.4: Please specify who sent you the information.

_____
_____
_____

3.6 Did you evacuate your home?

- Yes
- No

3.7 If you answered yes to question 3.6: What number of individuals did you evacuate with?

- Alone
- 1 person
- 2 persons
- 3 persons
- 4 persons
- 5 persons
- > 5 persons

3.8 When did you received an evacuation order? Be as specific of date and time as you can.

_____
_____
_____

3.9 Did you do anything to defend your home to minimize the damage from the fire?

- Yes
- No

3.10 If you answered yes to question 3.9: What did you do to get your home more resistible?

_____
_____
_____
_____
_____
_____

3.11 Please rank from 1 (not threatened at all) to 7 (extremely threatened) how threatened you felt by the fire when you got the evacuation order.

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | |
|---|---|---|---|---|---|---|---|---|
| Not threatened at all | O | O | O | O | O | O | O | Extremely threatened |

3.12 Did your original information source about the evacuation tell you where to gather?

- Yes
- No

3.13 If you answered no to question 3.13: How did you find out?

_____
_____
_____
_____
_____
_____

3.14 Did your original source tell you how to get to the safe zone/shelter? (e.g. in case of roads blocked by the fires)

- Yes
- No

3.15 If you answered no to question 3.14: Was any routing unsafe? How did you in that case find out?

_____
_____
_____
_____
_____
_____

3.16 How long did it take from when you received the evacuation order to when you leaved your home?

- ≤ 6 hours
- 6-12 hours
- 12-24 hours
- 24-48 hours
- 48-72 hours
- ≥ 72 hours
- Evacuated without being home and did not return before I evacuated
- I did not evacuate

3.17 Looking back, did you get enough information from authorities about how to perform an evacuation? Please rank you answer from 1 (did not get any information at all from authorities about how to evacuate) to 7 (got all information I needed from authorities).

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | |
|---|---|---|---|---|---|---|---|---|
| Did not get any information at all from authorities about how to evacuate | O | O | O | O | O | O | O | Got all information needed from authorities |

Part 4/4: Returning

If you did not evacuate your home, please skip this part.

4.1 How long were you away before you could return home?

- o < 1 day
- o 1-2 days
- o 2-3 days
- o 3-5 days
- o 5-7 days
- o 7-10 days
- o 10-14 days
- o > 14 days

4.2 How did you receive the information about if it was safe to return home? Who sent you the information? You can choose more than one option.

| | TV | Radio | Newspaper | Internet | Social media | In person | Other |
|---|---|---|---|---|---|---|---|
| Friends/ family | o | o | o | o | o | o | o |
| Authority | o | o | o | o | o | o | o |
| Other | o | o | o | o | o | o | o |

4.3 If you answered other to question 4.2: Please specify who sent you the information.

_____

_____

_____

4.4 Did you seek additional information to confirm that it was safe to return home?

- o Yes
- o No

4.5 If you answered yes to question 4.4: From what platform(s)? You can choose more than one option.

- o TV
- o Radio
- o Newspaper
- o Internet
- o Social media
- o In person

- Other

4.6 Did your source of information tell you how to get home? E.g. if some roads were still threatened by fires?

- Yes
- No

4.7 If you answered no to question 4.6: How did you find out?

_____
_____
_____
_____
_____
_____

Other comments

If you want to add something that was not covered by the questions, please write it here. *

Thank you for your participation!

# Appendix C: Questionnaire for personnel

Survey about the fires 2018 – for non-residents

This survey is part of a thesis work done at Lund University. The purpose of this questionnaire is to investigate the information obtained by the general public and emergency respondents during the evacuations and evacuation threats due to the fire season 2018 in Sweden.

The survey will take approximately 5 minutes. It includes questions about yourself and then continues with how you experienced the information during fire season 2018. To take part in this survey you need to be at least 18 years old and you have been in Sweden during the fires in summer of 2018. Your response will be treated anonymously according to Dataskyddsförordningen EU (2016/679).

The result of this survey will be used in a master thesis in Risk Management and Safety Engineering that will be published on https://lup.lub.lu.se/student-papers/search/publication?sort=publicationstatus.desc&sort=year.desc

If you have any questions about the survey, please contact Johanna Hahlin by sending an email to bra14jfr@student.lu.se.

Thank you for your participation!

* means mandatory question

Part 1/2: About you

1.1 Your sex? *

- Female
- Male
- Other

1.2 Your age? Type a number from 18 to 99 *

_____ (18-90)

1.3 Did you have any previous experience with forest fire accidents? *

- Yes
- No

1.4 If you answered yes to question 1.3: Briefly describe the experience, e.g. where the experience took place, if you evacuated and if so where you went, how long were you affected of the fires, etc.

_____
_____
_____
_____
_____
_____

1.5 What was your role during the evacuations or the evacuation threats the fire season 2018? If you had more than one (1) role, please fill in several alternatives. *

- Rescues service/Firefighter
- Military
- Police
- Professional volunteer
- Non-professional volunteer
- Other

1.6 In what area were you working during the summer of 2018? If you were located in more than one (1) area, e.g. working in several districts, please fill in all the areas you were connected to. *

_____
_____
_____

1.7 Did you get an order to evacuate due to the fires? *

- Yes
- No

1.8 If you answered no to question 1.7: Were you recommended to evacuate?

- Yes
- No

1.9 Did you give orders to others to evacuate due to the fires? *

- Yes
- No, but I told residents to prepare themselves for an eventual evacuation
- No

1.10 Do you think there has been a change in your risk perception from last summer? I.e. if you nowadays pay more attention to fire evacuation information during the summer. *

- Yes
- No

1.11 If you answered yes to question 1.10: Why do you think this change in risk perception occurred?

_____
_____
_____
_____
_____
_____

Part 2/2: Information about the fire risk

2.1 Did you know there was a higher risk for fires in your area than normal at that time of the year before the fires broke out in the summer 2018? *

- o Yes
- o No

2.2 If you answered yes to question 2.1: When did you know about it?

- o ≥ 2 months before the fire outbreak
- o 1-2 months before the fire outbreak
- o 1 week-1 month before the fire outbreak
- o 1 day- 1 week before the fire outbreak
- o ≤ 1 day before the fire outbreak

2.3 If you answered yes to question 2.1: Who sent you the information? And how did you receive the information? You can choose more than one option.

| | TV | Radio | Newspaper | Internet | Social media | In person | Other |
|---|---|---|---|---|---|---|---|
| Friends/ family | o | o | o | o | o | o | o |
| Authority | o | o | o | o | o | o | o |
| Other | o | o | o | o | o | o | o |

2.4 If you answered other to question 2.3: Please specify who sent you the information.

_____

_____

_____

2.5 Did you get information about the fire ban that was declared in Sweden the summer 2018? E.g. it was not allowed to grill. *

- o Yes
- o No

2.6 Did you know, before the fire season started (approximately in May 2018), how to prepare for an eventual evacuation and/or how to get information for an eventual evacuation due to fires? *

- o Yes
- o No

2.7 Did you get information about how to firesafe your property? E.g. how to build defensible space. *

- Yes
- No

Other comments

If you want to add something that not was covered by the questions, please write it here. *

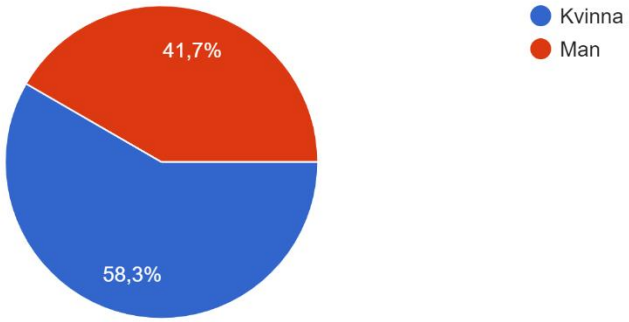
Thank you for your participation!

# Appendix D: Whole result from questionnaire for residents (in Swedish)

Part 1/4: About you

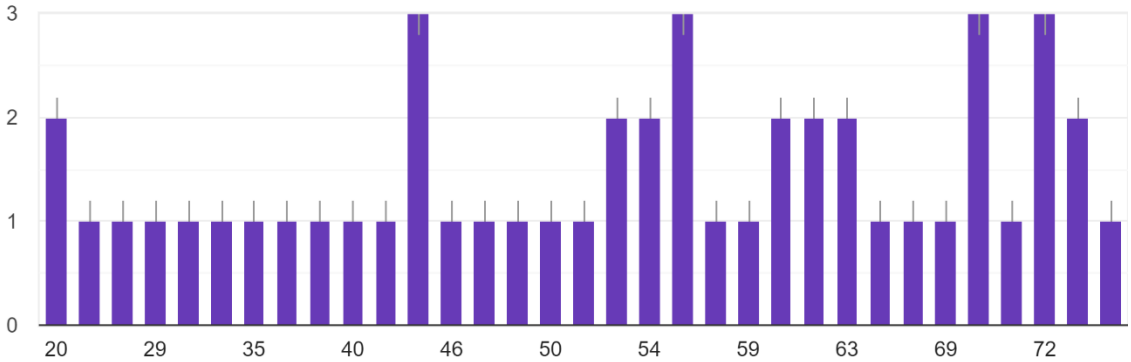
1.1 Vilket kön identifierar du dig med?

48 svar



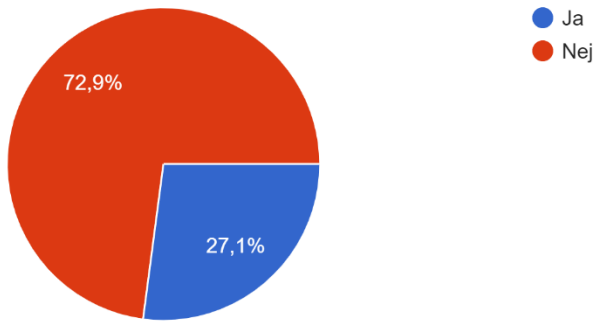

1.2 Din ålder? Skriv en siffra mellan 18 och 99.

48 svar



1.3 Hade du någon tidigare erfarenhet från skogsbränder innan sommaren 2018?

48 svar




1.4 Om du svarade ja på fråga 1.3: Beskriv kortfattat dina tidigare erfarenheter, t.ex. varifrån kommer din/dina erfarenheter. T.ex om du blev evakuerad och i så fall var du sökte skydd, hur länge varade branden, om du hade någon annan roll än evakuerad, etc.

12 svar

Removed for ensuring anonymity.

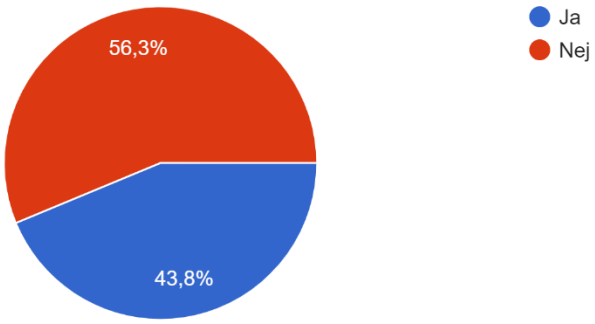
1.5 Var bodde du under sommaren 2018?

48 svar

Removed for ensuring anonymity.

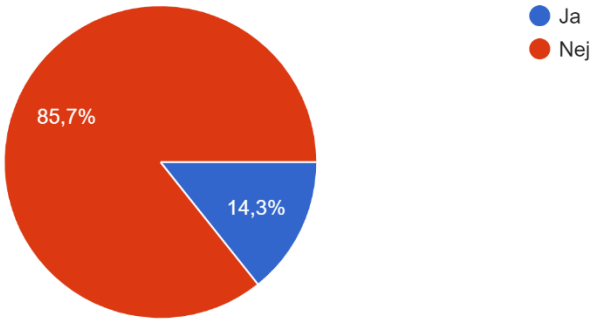
1.6 Mottog du en order om obligatorisk evakuering från ditt hem?

48 svar



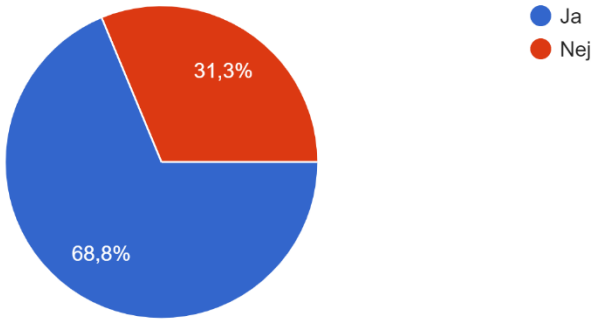

1.7 Om du svarade nej på fråga 1.6: Blev du rekommenderad att evakuera ditt hem?

28 svar



1.8 Har din riskuppfattning ändrats sedan förra sommaren? T.ex. om du lägger större vikt vid information om e... brandspridning jämfört med tidigare.

48 svar




1.9 Om du svarade ja på fråga 1.8: Varför tror du så och på vilket sätt har din riskuppfattning förändrats?

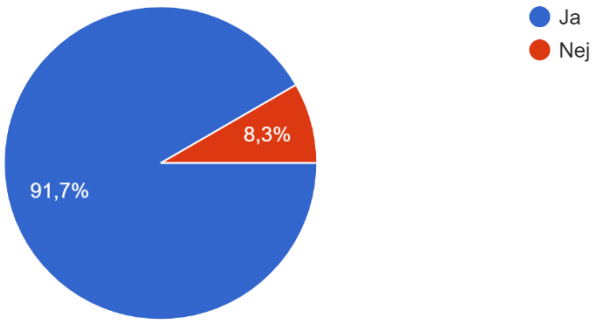
31 svar

Removed for ensuring anonymity.

Part 2/2: Information about the fire risk

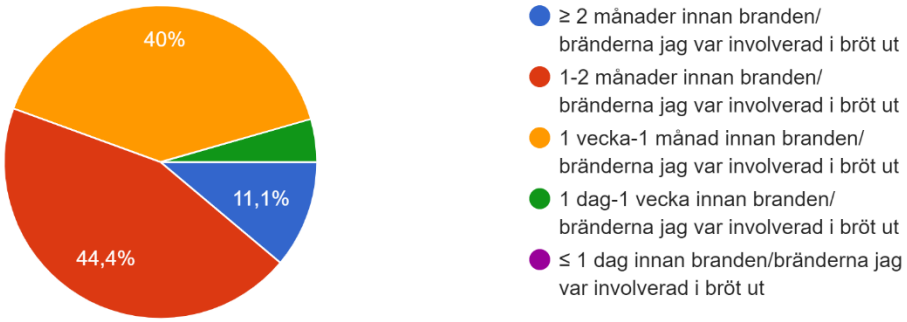
2.1 Visste du att risken för bränder var högre än normalt förra året innan bränderna bröt ut?

48 svar

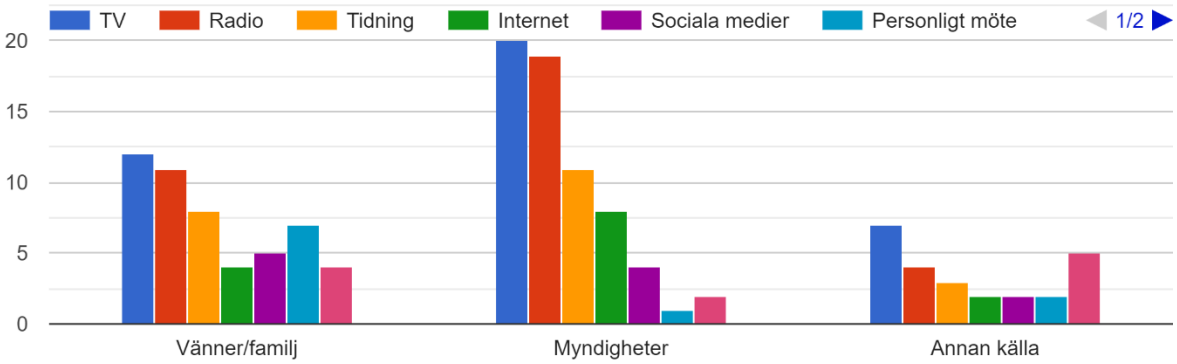



2.2 Om du svarade ja på fråga 2.1: När visste du att brandrisken var högre än normalt?

45 svar



2.3 Om du svarade ja på fråga 2.1: Från vem kom informationen ifrån? Hur mottog du informationen? Du kan välja flera alternativ.



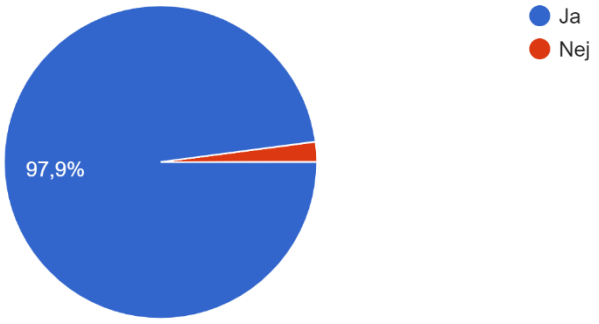

2.4 Om du svarade annan källa på fråga 2.3: Vänligen specificera var informationen kom ifrån.

23 svar

Removed for ensuring anonymity.

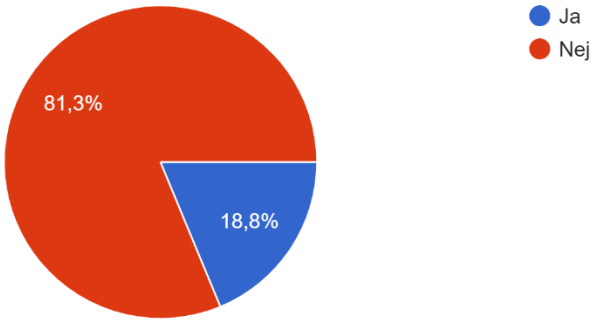
2.5 Fick du information om eldningsförbudet som rådde i Sverige sommaren 2018? T.ex. att det inte var tillåtet att grilla.

48 svar



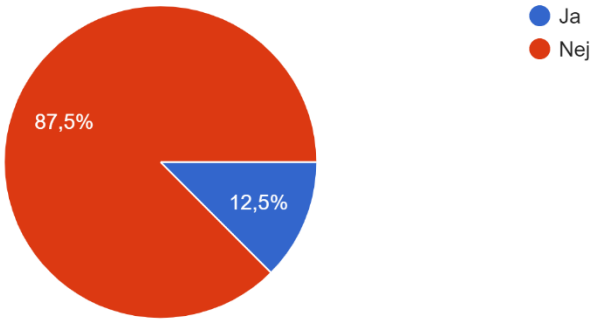
2.6 Visste du hur du skulle förbereda dig på en eventuell evakuering och/eller hur du hittar information om...äsongen startade (ungefär i maj 2018).

48 svar



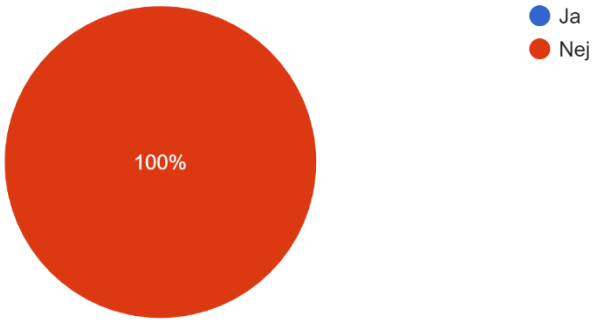

2.7 Fick du information från myndigheter hur du skulle förbereda dig inför en evakuering, innan eventuella order om evakuering delades ut?

48 svar



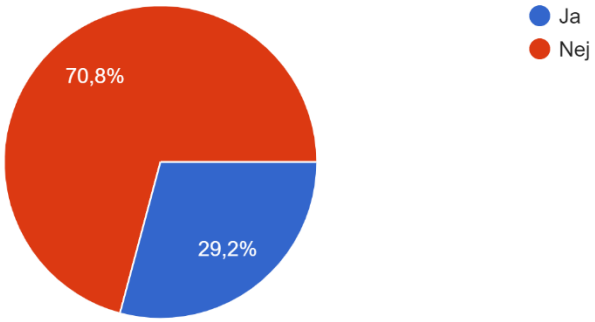
2.8 Fick du information hur du skulle säkra din egendom mot brand? T.ex. hur du ska göra för att bygga ett brandsäkert utrymme.

48 svar



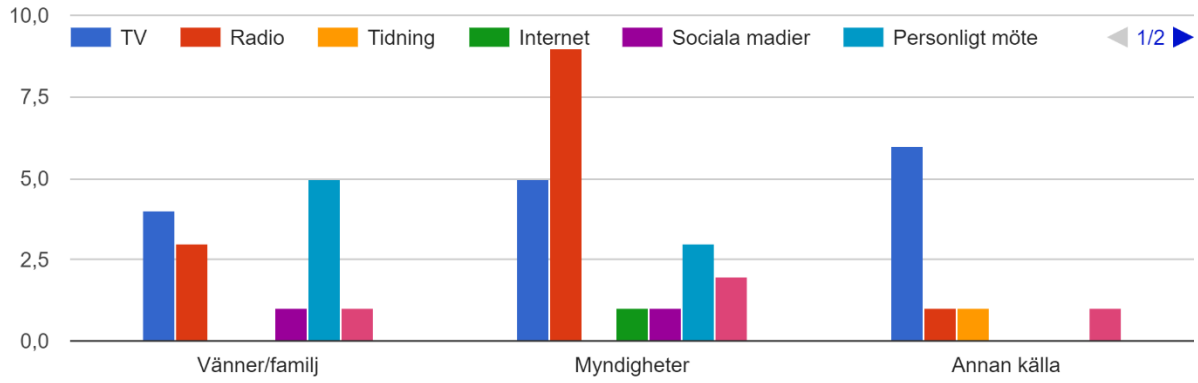

2.9 När du förstod att det fanns en risk att bränderna skulle närma sig ditt boendeområde, såg du det som ett alter...mot bränder istället för att evakuera?

48 svar



Part 3/4: Evacuation

3.1 Varifrån kom den första informationen du mottog att det hade utfärdas en order att evakuera?



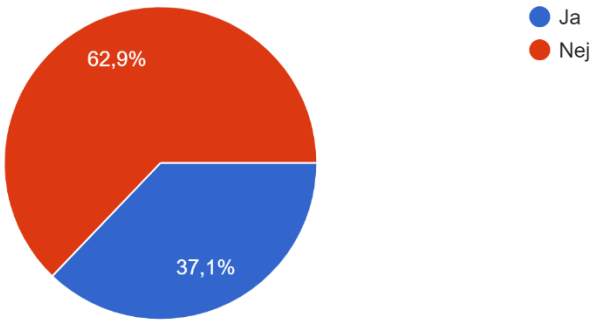

3.2 Om du svarade annan källa till fråga 3.1: Vänligen specificera var informationen kom ifrån.

14 svar

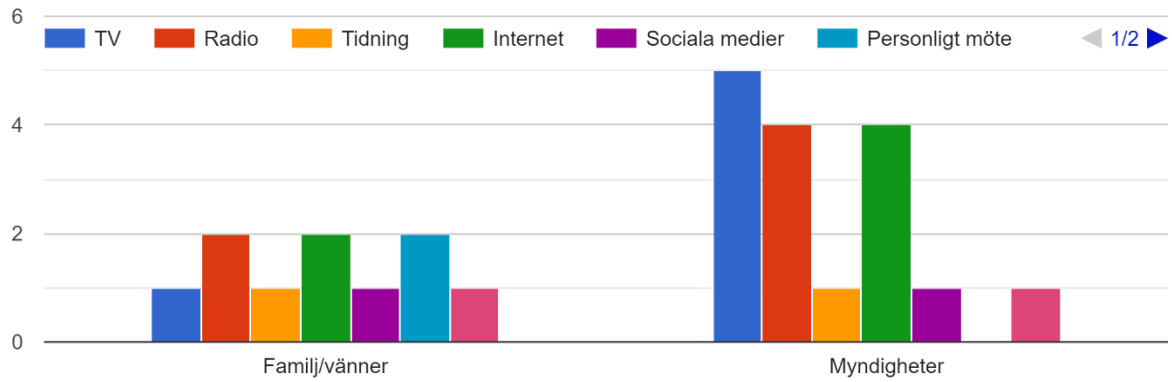
Removed for ensuring anonymity.

3.3 Sökte du bland andra källor för att bekräfta evakueringsordern?

35 svar



3.4 Om du svarade ja på fråga 3.3: Från var sökte du denna information? Du kan välja flera alternativ.



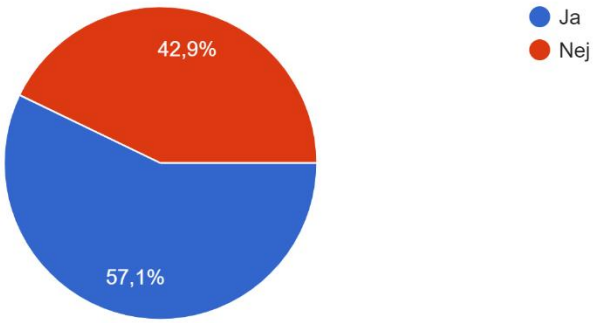

3.5 Om du svarade annan källa på fråga 3.4: Vänligen specificera var informationen kom ifrån.

2 svar

Removed for ensuring anonymity.

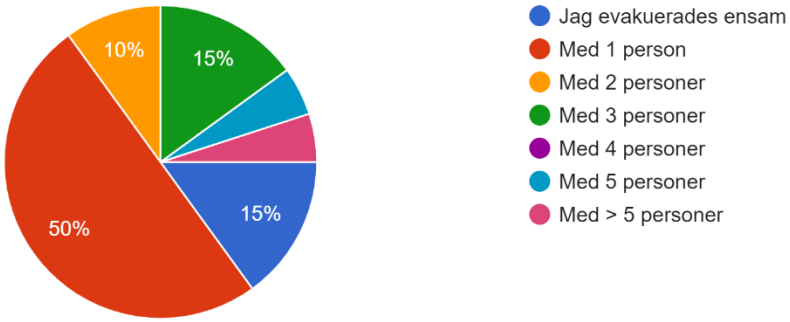
3.6 Evakuerade du ditt hem?

35 svar



3.7: Om du svarade ja på fråga 3.6: Hur många personer evakuerades du tillsammans med?

20 svar



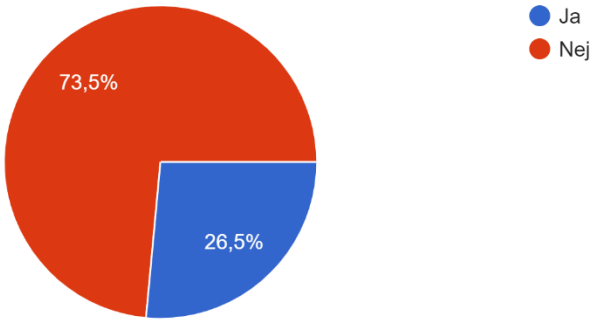

3.8 När mottog du en evakueringsorder? Vänligen var så precis du kan gällande datum och tid.

22 svar

Removed for ensuring anonymity.

3.9 Gjorde du något för att minska skadorna på din egendom om bränderna skulle nå dit?

34 svar



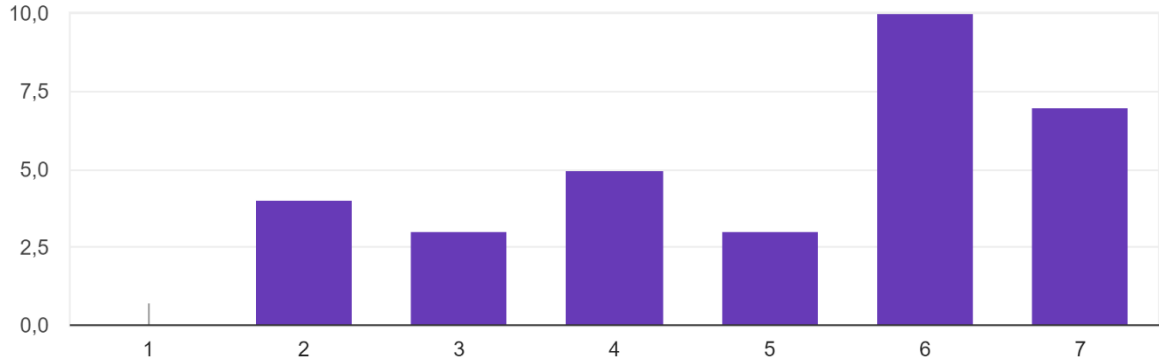

3.10 Om du svarade ja på fråga 3.9: Vad gjorde du för att din egendom skulle bli mer motståndskraftig?

9 svar

Removed for ensuring anonymity.

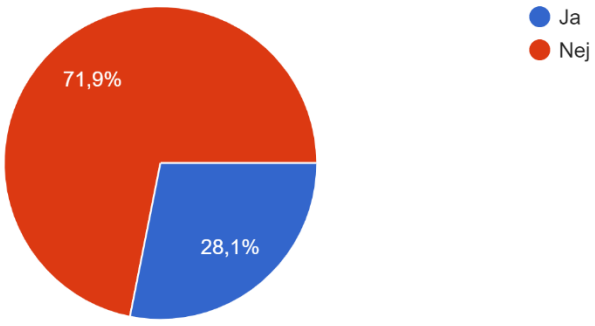
3.11 Vänligen rangordna från 1(inte alls hotad) till 7 (extremt hotad) hur hotad du kände dig av bränderna när du mottog evakueringsordern.

32 svar




3.12 Framkom det från din ursprungskälla angående evakueringsordern var samlingsplatsen fanns?

32 svar



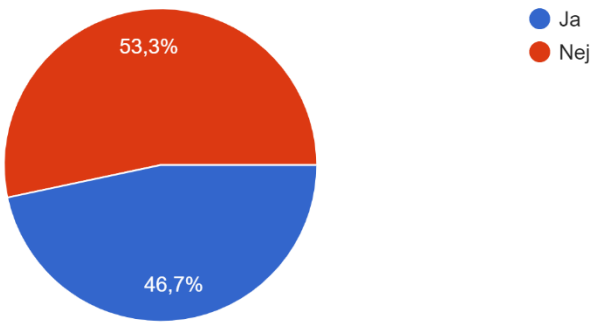
## 3.13 Om du svarade nej på fråga 3.12: Hur fick du reda på var samlingsplatsen var?

17 svar

Removed for ensuring anonymity.

## 3.14 Framkom det från din ursprungskälla angående evakueringsordern hur du skulle ta dig till samlingsplatsen? T.... var blockerade till följd av bränderna.

30 svar



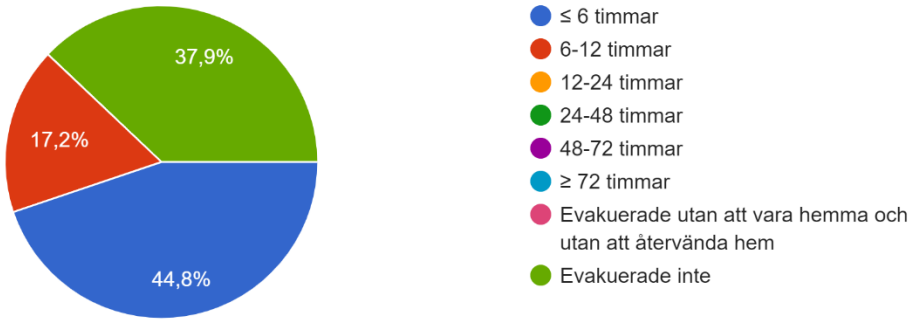

## 3.15 Om du svarade nej på fråga 3.14: Var något vägval olämpligt? Och hur fick du i så fall veta det?

10 svar

Removed for ensuring anonymity.

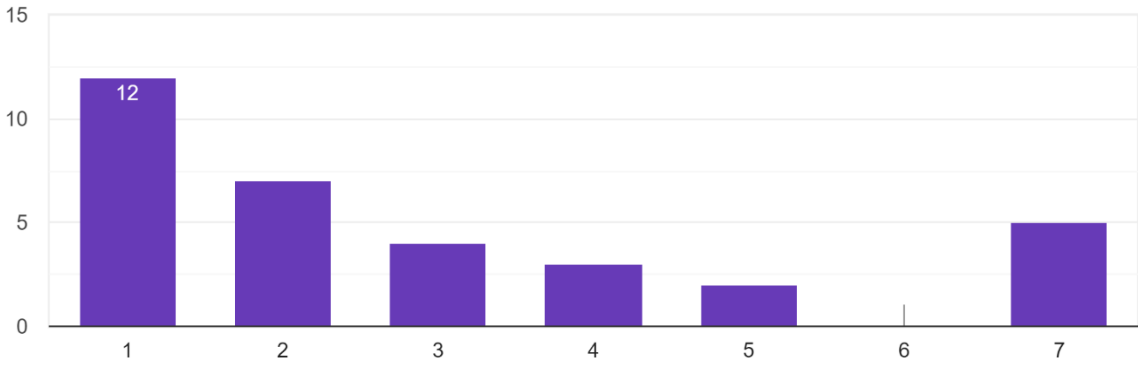
3.16 Hur lång tid tog det från att du mottog evakueringsordern till att du evakuerad ditt egendom?  Om du inte va...mnade ditt hem efter att ha återvänt.

29 svar




3.17 Tycker du att du fick tillräckligt med information från myndigheter om hur du skulle genomföra en evakuering...ation jag behövde från myndigheter).

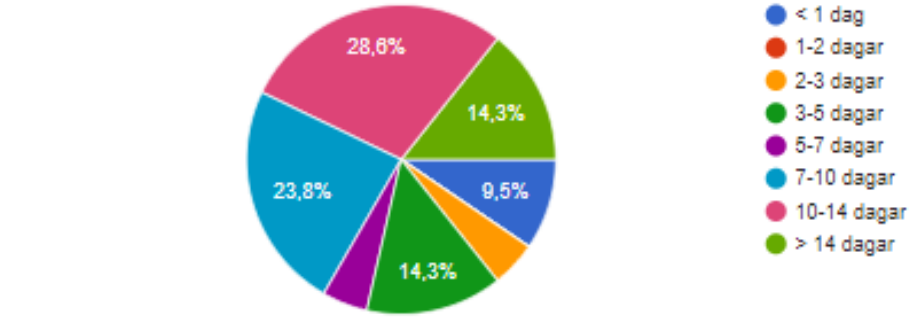
33 svar



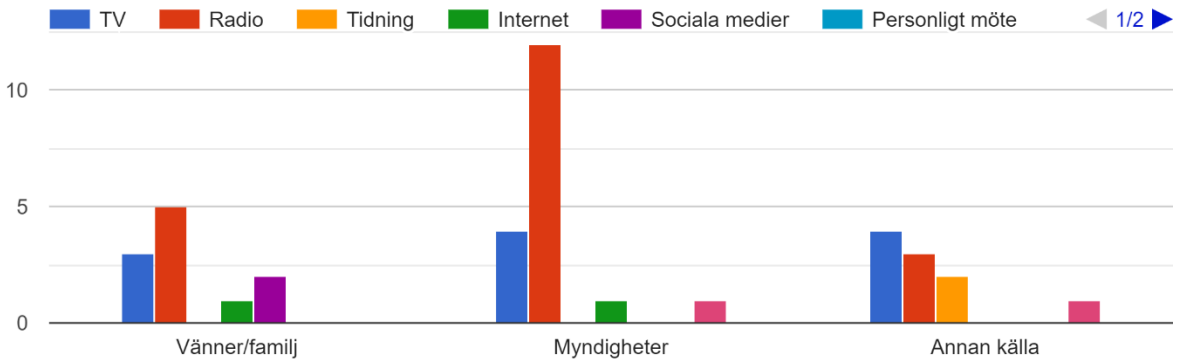
Part 4/4: Returning home

4.1 Hur länge var du evakuerad innan du återvände hem?

21 svar




4.2 Hur fick du reda på att det ar säkert att återvända hem? Varifrån kom informationen? Du kan välja flera alternativ.



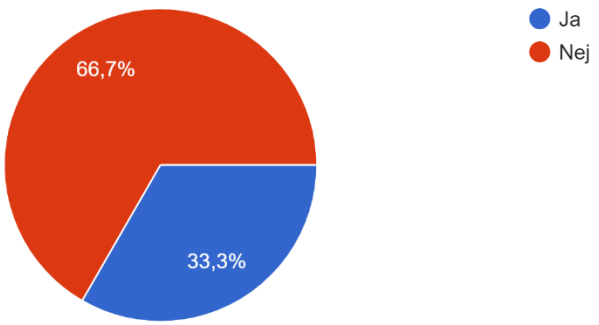
4.3 Om du svarade annan källa på fråga 4.2: Vänligen specificera varifrån informationen kom.

7 svar

Removed for ensuring anonymity.

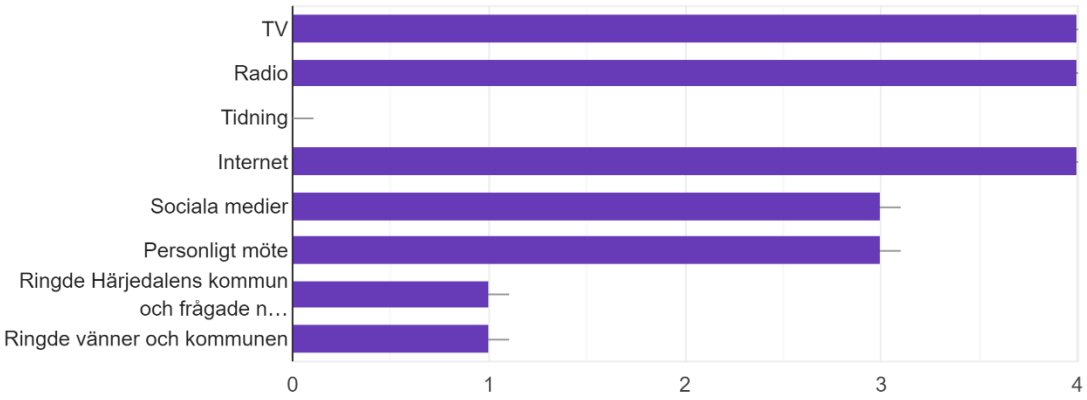
4.4 Sökte du ytterligare information för att bekräfta att det var säkert att återvända hem?

24 svar



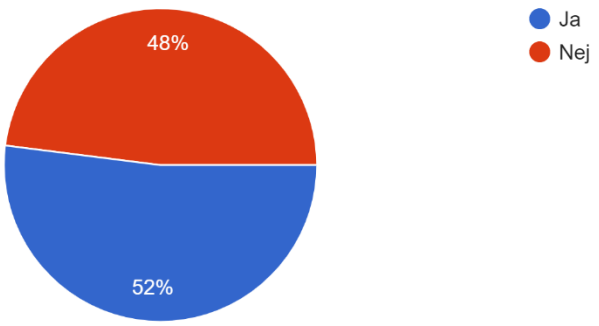
4.5 Om du svarade ja på fråga 4.4: På vilka plattformer sökte du efter mer information. Du kan välja flera alternativ.

8 svar




4.6 Framkom det från din ursprungskälla angående evakueringsordern hur du skulle ta dig hem? Ex. om någon färd...var blockerade till följd av bränderna.

25 svar



## 4.7 Om du svarade nej på fråga 4.6: Var något vägval olämpligt? Och hur fick du i så fall veta det?

8 svar

Removed for ensuring anonymity.

Other comments:

## Har du har något att tillägga angående skogsbränderna sommaren 2018 som tidigare frågor inte berört?

48 svar

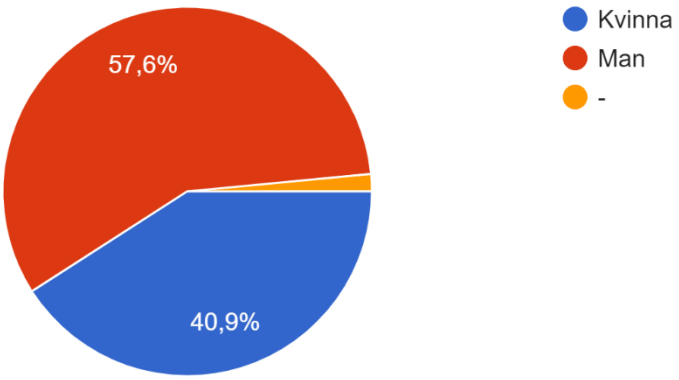
Removed for ensuring anonymity.

# Appendix E: Whole result from questionnaire for personnel (in Swedish)

Part 1/2: About you

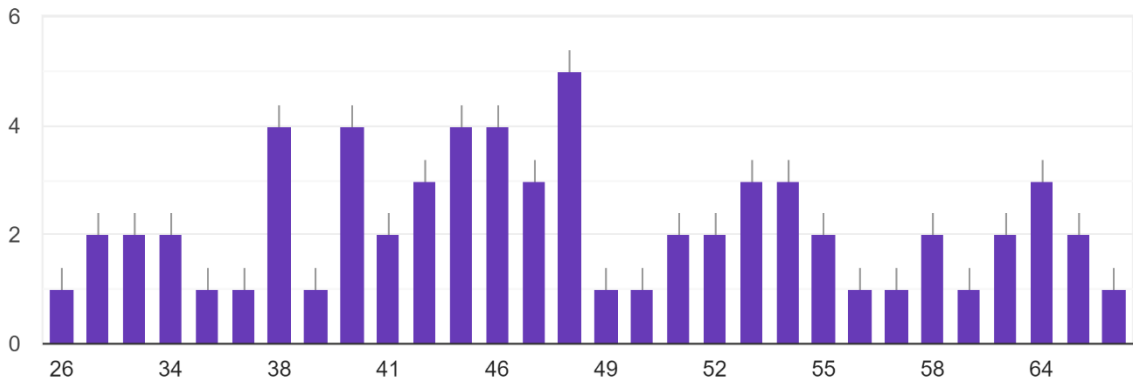
1.1 Vilket kön identifierar du dig med?

66 svar



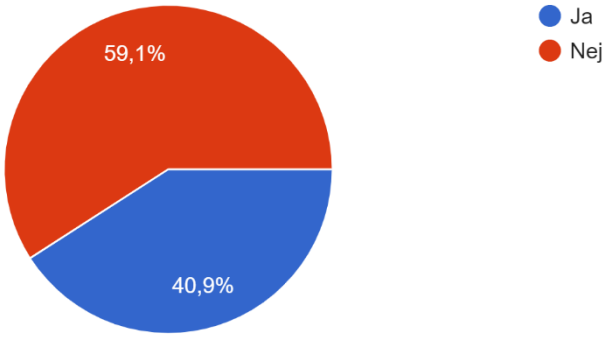
## 1.2 Din ålder? Skriv en siffra mellan 18 och 99.

66 svar




## 1.3 Hade du någon tidigare erfarenhet från skogsbränder innan sommaren 2018?

66 svar



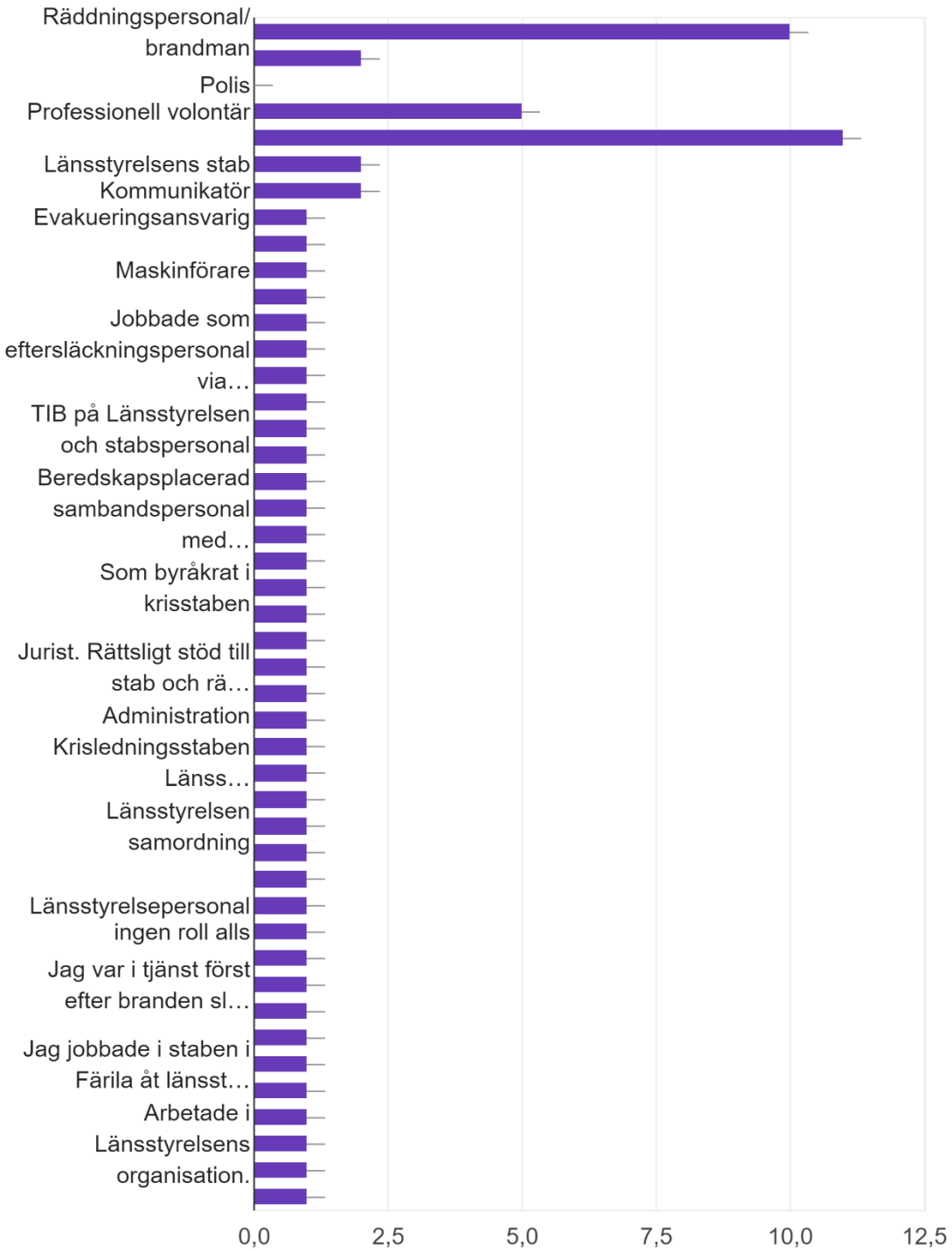
## 1.4 Om du svarade ja på fråga 1.3: Beskriv kortfattat dina tidigare erfarenheter, t.ex. varifrån kommer dina erfarenheter, vad har du haft för roll.

27 svar

Removed for ensuring anonymity.

## 1.5 Vad var din roll under evakueringarna/evakueringshoten till följd av skogsbränderna 2018? Om du hade me...mtliga alternativ som stämmer in.

66 svar



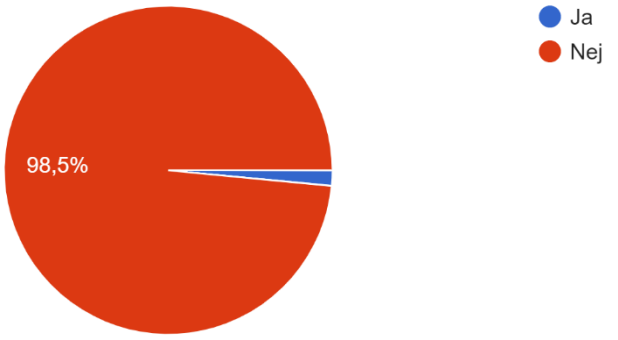
1.6 Var arbetade du under sommaren 2018? Om du verksam på flera platser i samband med skogsbränderna, vänligen skriv samtliga.

66 svar

Removed for ensuring anonymity.

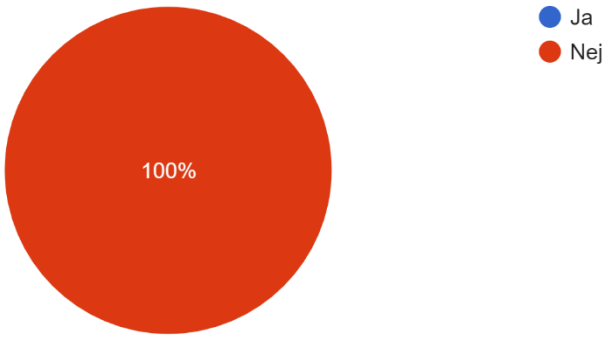
1.7 Mottog du en order om obligatorisk evakuering från ditt hem?

66 svar



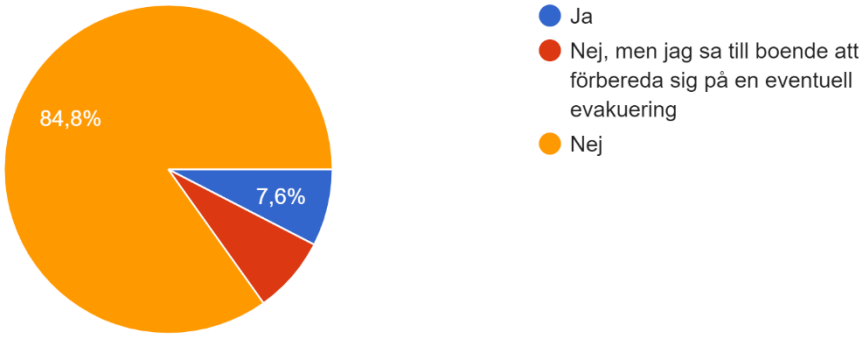
1.8 Om du svarade nej på fråga 1.7: Blev du rekommenderad att evakuera ditt hem?

58 svar



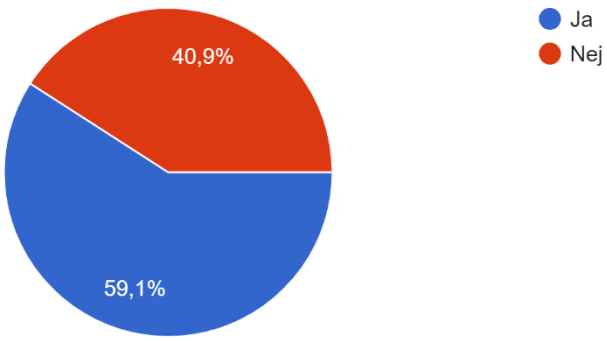

1.9 Gav du order om att andra skulle evakuera till följd av bränderna?

66 svar



1.10 Har din riskuppfattning ändrats sedan förra sommaren? T.ex. om du lägger större vikt vid information...brandspridning jämfört med tidigare.

66 svar




1.11 Om du svarade ja på fråga 1.10: Varför tror du så och på vilket sätt har din riskuppfattning förändrats?

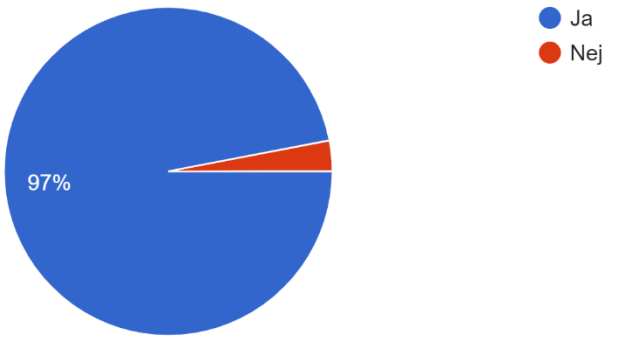
38 svar

Removed for ensuring anonymity.

Part 2/2: Information about the fire risk

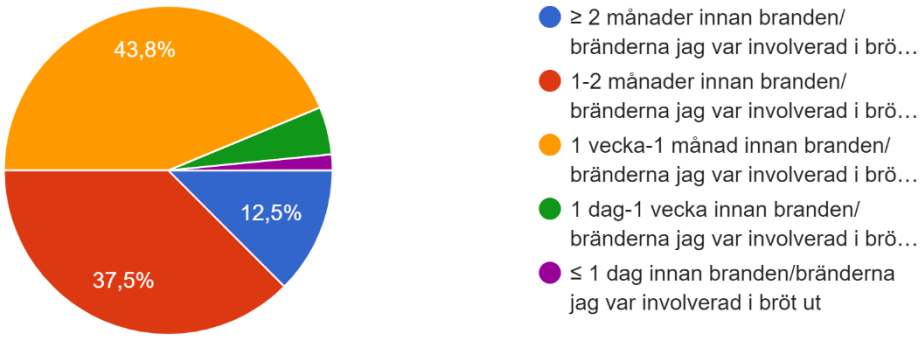
2.1 Visste du att risken för bränder var högre än normalt förra året innan bränderna bröt ut?

66 svar

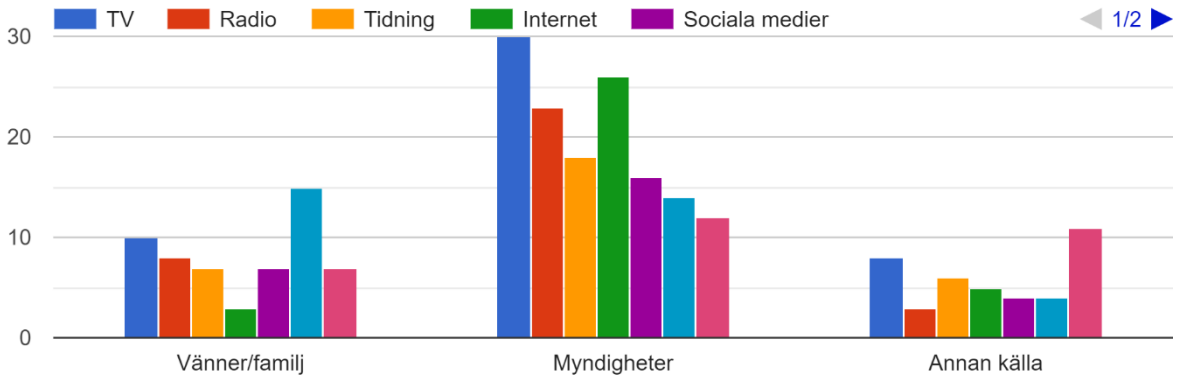



2.2 Om du svarade ja på fråga 2.1: När visste du att brandrisken var högre än normalt?

64 svar



2.3 Om du svarade ja på fråga 2.1: Från vem kom informationen ifrån? Hur mottog du informationen? Du kan välja flera alternativ.



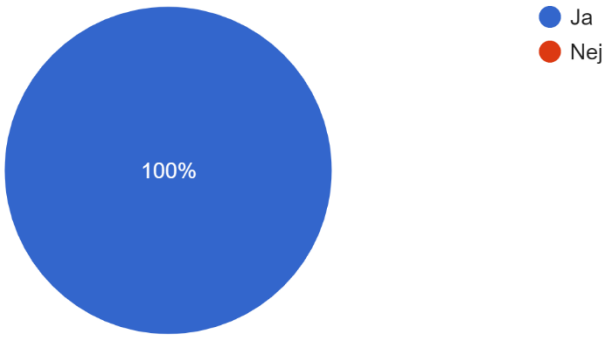

2.4 Om du svarade annan källa på fråga 2.3: Vänligen specificera var informationen kom ifrån.

31 svar

Removed for ensuring anonymity.

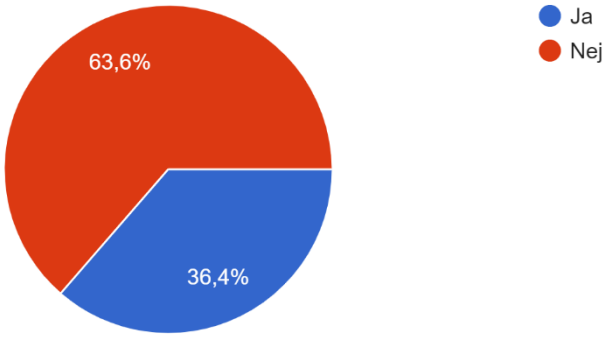
2.5 Fick du information om eldningsförbudet som rådde i Sverige sommaren 2018? T.ex. att det inte var tillåtet att grilla.

66 svar



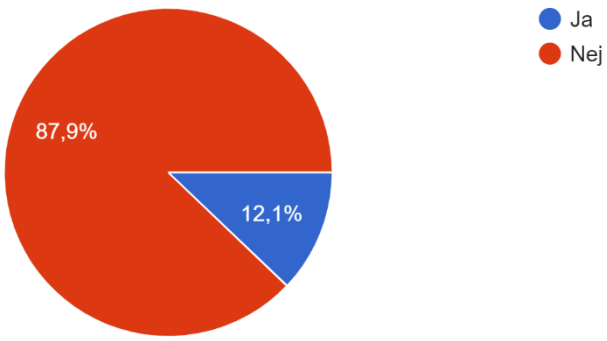

2.6 Visste du hur du skulle förbereda dig på en eventuell evakuering och/eller hur du hittar information o...ongen startade (ungefär i maj 2018).

66 svar



2.7 Fick du information hur du skulle säkra din egendom mot brand? T.ex. hur du ska göra för att bygga ett brandsäkert utrymme.

66 svar



Other comments

## Har du har något att tillägga angående skogsbränderna sommaren 2018 som tidigare frågor inte berört?

66 svar

Removed for ensuring anonymity.