

# Risk Communication in Veldfire Prevention and Preparedness – A Minor Field Study in the Vredefort Dome, South Africa

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- A Minor Field Study in the Vredefort Dome, South Africa**

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### **Abstract**

The World Heritage Site the Vredefort Dome in South Africa is an area that is continuously exposed to the dangers of veldfires. In this study it was investigated how risk communication is used to raise public awareness about safe fire use, fire hazards, and veldfires. To what extent the community is reached by the communication and their level of knowledge about fire hazards and risks was also studied. The goal was to identify possible improvements in the risk communication that could reduce the number of veldfires in the area and reduce the damages they cause.

Data was collected by a survey and semi-structured interviews that revealed that the knowledge base in the Vredefort Dome is generally good but that some groups are uninformed and would need more knowledge. The communicators primarily communicate using WhatsApp and the communication includes things like the daily FDI, weather forecasts, reminders about firebreaks, and warnings about when to be extra careful. Through community meetings, work is also being done to increase fire risk awareness. The communication is consistent with risk communication theory in general, however some communication gaps and exclusion of community members were identified. It was revealed that the communicators believed members were aware of some things that they were not. In terms of inclusion, it was disclosed that some groups are excluded and do not receive the information. Consequently, it would be valuable to evaluate measures to enhance the inclusion of all members of the community.

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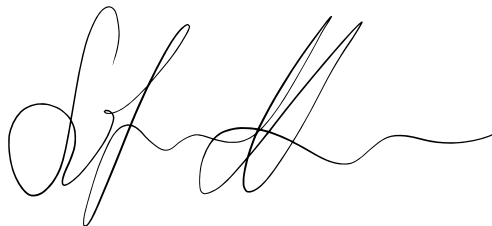
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## Summary

South Africa frequently struggles with raging veldfires that affect life, infrastructure, and the environment (Forsyth et al., 2010). The quantity and extent of fires in the country have increased due to human activity and small fires frequently escalate into uncontrolled veldfires (Working on Fire, 2022). Risk communication plays an important role in the prevention of these events by raising awareness about the steps that individuals and communities can take to reduce the likelihood of wildfires occurring. This information can also assist individuals in making informed decisions regarding how to protect themselves and their property from the dangers of veldfires (Lundgren & McMakin, 2013).

The Vredefort Dome is a listed UNESCO World Heritage site in South Africa and the area is yearly affected by veldfires. This study explores how risk communication in the Vredefort Dome is used in the prevention and preparedness of veldfires as well as investigates the level of knowledge about fire hazards and risks related to the use of fire in the Vredefort Dome community. The study also aims to determine if and how present risk communication strategies might be modified to better disseminate information about the dangers of veldfires to lessen their frequency and severity.

Data for the study was collected using semi-structured interviews and a survey. The study started with an initial literature study to gain basic knowledge about risk communication theory which was used in the creation of interview guides and the survey. The interviews were performed with different landowners in the Vredefort Dome, representatives from the two active Fire Protection Associations (FPAs), and representatives from Working on Fire (WoF). All interviews were recorded and transcribed, followed by coding and categorization in relation to the research questions. The survey was sent out to landowners through a community WhatsApp group.

The study found that the knowledge base about fire hazards and risks related to the use of fire in the Vredefort Dome is good overall but differs among the various social groups. Workers and non-permanent residents were identified as the main groups that require more knowledge. The most common purposes for fire use were found to include cooking, firebreaks, heating, and garbage disposal.

Regarding risk communication, it was disclosed that the performed risk communication in the Vredefort Dome is generally in line with risk communication practice. The communications are clear and customized with the recipient in mind, and a variety of channels are employed. The communicators are also trusted, and two-way communication is encouraged. The main risk communicators are Potchefstroom FPA, Vaal Eden FPA, and WoF. Various channels are used, such as WhatsApp, two-way radio, email, FM radio, and FPA websites, with WhatsApp being the main communication channel for prevention. WoF raise awareness through community awareness meetings, workshops, and school education. The FPAs primarily communicate the daily Fire Danger Index, weather forecasts, warnings, and reminders on when to put preparedness measures in place.

Exclusion is the primary issue highlighted with the risk communication. There are groups that are not engaged or reached by the FPAs' communication, which is a significant problem. Non-FPA-members are not included at all, while other groups, such as workers and tourists, rely

on landowners for communication. The Vredefort Dome community would benefit from everyone being included in the risk communication, therefore analyzing ways to enhance inclusion would be valuable. In addition to this, the study also identified some communication gaps between the communicators and the recipients as well as that more focus on prevention would be beneficial.

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# 1 Introduction

*In the introduction the background to the study, the research problem, and the research questions are presented as well as the study's inherent limitations.*

## 1.1 Background

The African continent has a long history of fires and is therefore sometimes called the 'fire continent' (Strydom & Savage, 2016). In 2021, more than 5 million hectares of land burned in South Africa alone (Global Forest Watch, 2022). The distribution of fire incidents over a year differs in different parts of South Africa however, in most of the country the fire season is during the dry winter months (Burnshield, 2022). Fires are a necessary phenomenon in the environment, in fact, the majority of the ecosystems covering South Africa must burn to maintain their ecological integrity (Lovei, n.d; Working on Fire, 2022). Fire is also used as a tool to manage the environment and prevent uncontrolled fires (Working on Fire, 2022). However, anthropogenic activities have increased the number and extent of fires in South Africa and small fires frequently escalate into uncontrolled wildfires (Strydom & Savage, 2016; Working on Fire, 2022). The quantity of these rampant wildfires can be expected to grow as climate change worsens and bring warmer weather and aggravated droughts (Xu et al., 2020).

Wildfires compose numerous negative effects and among other things they have a significant negative impact on human health, society, the environment, and the economy (Strydom & Savage, 2016). They pose a hazard to human health since the massive formation of smoke can be harmful if people are exposed. Smoke inhalation has been associated with several respiratory diseases, and extensive exposure can have a fatal outcome (Strydom & Savage, 2016). Another hazard that comes from wildfires is the impact on agricultural opportunities. The fires compose a threat to crop productivity and are hence a menace to food availability for society (Strydom & Savage, 2016). This is especially worrying for groups that rely on self-sufficiency regarding food resources. The adverse effects on the environment come mainly from the emission of greenhouse gases when biomasses are combusted. Greenhouse gases alter surface radiation balances by absorbing and reemitting radiation, thus warming the planet further (Eneh & Oluigbo, 2012). Another negative environmental effect that comes from wildfires is the impact on biodiversity (Centre for Environmental Management & North-West University, 2013). The economic effects of wildfires, from damaged infrastructure and loss of livelihood, are devastating and the cost of fires to the South African economy is immense. In 2016 the total financial losses incurred from fires were over US\$160 millions (Dlamini Zuma, 2020). The direct economic loss from disasters in South Africa was recorded as US\$530 millions in 2015 and 2016. This number increased significantly to US\$2,2 billions in 2017 and 2018, primarily due to wildfires (Southern African Development Community, 2019).

One way to handle risks with wildfires is to spread information and knowledge through risk communication. This is when experts and the general public exchange information prior to, during, and after a fire event (Nyame-Asiamah et al., 2022). Risk communication encompasses the dissemination of fire safety information that instructs individuals and

communities on how to prevent and prepare for wildfires, intending to reduce the number of incidents and mitigate the effects of those that do occur.

An area in South Africa where fires constitute one of the main threats is the Vredefort Dome World Heritage Site (G. Engelbrecht, personal communication, 12 September 2022). The area is mainly touched by veldfires, a type of wildfire that entails fires of grassland or fields. Because the site is listed as a World Heritage site, preserving and protecting its cultural and natural condition is essential (UNESCO, 2022b). The site belongs to two different provinces and is thereby managed by separate authorities (Fleminger, 2022). Management of the site must also consider that most of the area's land is privately owned (Fleminger, 2022). These factors allow for possible difficulties when it comes to risk communication regarding the prevention of disasters such as veldfires.

With negligence being the perceived leading cause of veldfires in the Vredefort Dome (G. Engelbrecht, personal communication, 12 September 2022), the people in the area must be well informed about dangers that can come from fire use as well as other fire hazards. Within this context, this project investigates how risk communication is used to spread knowledge and awareness about responsible fire use, fire hazards, and veldfires. The project attempts to display to what extent inhabitants and workers in the Vredefort Dome are reached through communication and investigates the level of knowledge about fire hazards and risks related to the use of fire in the area. The goal of the study is to ascertain to what extent current risk communication practices can be improved to enhance risk communication and help reduce the number of veldfires and the damage they induce.

## **1.2 Research Questions**

The following questions are issued in the project:

- *How is fire used and how can the level of knowledge about risks and precautions related to the use of fire and fire hazards in the Vredefort Dome be characterized?*
- *How is knowledge and information about veldfires and fire safety communicated to the Vredefort Dome community?*
- *How can communication regarding veldfires and fire safety in the Vredefort Dome be improved to reduce the number of veldfires and reduce the damage they impose?*

## **1.3 Limitations**

Several inherent limitations may impact the study's conduct and findings. As with all studies, time and resources are unavoidable limitations that affect the scope of the study. However, the perhaps most evident limitation of this study is that the researchers are not natives of the country under study. This means that the researchers are not entirely familiar with the history and cultures of the region. The limitation may be particularly significant in South Africa given its history with apartheid and the consequences that followed. As much as this can be a limitation it can also be a benefit to perform a study from an outside perspective. Another limitation that comes from the fact that the researchers are not native to the country is the language barrier. The fact that neither the researchers nor the interviewees speak English as their native tongue increases the likelihood of misunderstandings. To try to reduce the impact of this, the Swedish researchers always had a fluently Afrikaans-speaking researcher present

during the interviews to prevent misunderstandings. Another limitation connected to that the researchers are not from the country is that their network of contacts is restricted, which entails limitations in the study.

The research is limited to studying risk communication at the World Heritage Site the Vredefort Dome. Due to the unique conditions of that region, the result might not be directly applicable to other areas or countries.

## **2 Theoretical Clarifications**

*This chapter presents the study's theoretical foundation. Fundamental terms such as communication and risk communication are described. Further sections include the objectives of risk communication and theories on how they can be achieved.*

### **2.1 Communication**

Communication can be described as an act where information is transmitted between different parties with the purpose of generating a common understanding. The concept of communication is defined in several ways in the literature. The common denominator in the diverse definitions is that communication requires a sender, a message, as well as a receiver of the message (Velentzas & Broni, 2014). Some authors argue that feedback, meaning that the receiver originates an additional meaning-exchange circle to the sender, is required and is what completes the process of communication (Fatimayin, 2018). Other authors express that communication can be performed without the receiver being present at the time of the communication, indicating that communication can transpire through immeasurable distances in both time and space (Velentzas & Broni, 2014).

Communication can be performed in various forms including but not limited to: speaking, writing, hand gestures, body language, and eye contact (Fatimayin, 2018; Velentzas & Broni, 2014). A vital factor for good and successful communication is that the sender(s) and receiver(s) share a collective language or method of understanding (Velentzas & Broni, 2014).

### **2.2 Risk Communication**

Risk communication is communication that is utilized with the purpose of offering a general or specific audience the knowledge necessary to make informed, independent decisions regarding risks to their health, safety, and the environment (Lundgren & McMakin, 2013; United States Environmental Protection Agency, 2022). The ultimate purpose is that the communication reaches everybody at risk and that the information will enable all to make informed decisions about mitigating the effects of a hazard, such as a wildfire, and taking preventative action (WHO, 2020). Like any type of communication, risk communication requires a sender, a receiver, and some kind of message transmitted between them. However, risk communication can be seen as a more technical type of communication that is subject to its own typical principles (Lundgren & McMakin, 2013).

Literature provides many sets of objectives for risk communication, often based on a risk management agency as the communicator and segments of the general public as the intended audience (Renn & Levine, 1991). The extensive diversity of objectives that can be linked with risk communication can be summed up by the following items (Covello et al., 1986; Renn, 1988; Renn & Levine, 1991; Zimmerman, 1987):

- Function for enlightenment (to increase the target group's comprehension of risk).
- Convey hazard information to potential victims.
- Change attitudes to justify risk-related decisions.
- Function for legitimation (to increase confidence in the competence and fairness of the management process and to explain and defend risk management practices).

- Risk reduction function (to improve public safety by informing citizens about personal risk reduction measures).
- Function for behavioral change (to promote protective or cooperative behavior toward the communicating agency).
- To provide instructions for emergency situations or emergency conduct guidance.
- Function for public involvement (to inform decision-makers about the concerns and perceptions of the public).
- Function for participation (to assist in settling disputes over controversies relating to risk).

All these different goals and objectives require that the risk communication's purpose and objectives must be determined beforehand. Lundgren and McMakin (2013) emphasize that the objective and purpose should be formalized by writing it down and getting input from the group involved so that all have a common ground and understanding of why the risk is communicated and what the preferred outcome from it is.

How risks are conveyed has an impact on public opinion and the actions taken to address the problem (Ruiu et al., 2021). Risk communication, when used properly, can enable people with different viewpoints and degrees of experience to share a common understanding of the level of risk associated with a particular activity (Beecher et al., 2005). Therefore, well-adapted risk communication can play a significant role in the conveyance of information and how the risk is perceived. The theory on risk communication in wildfire prevention and preparedness is limited but highlights i) two-way communications between the communicator and the recipients of the message (Paveglio et al., 2009); (ii) stakeholder involvement (Zaksek & Arvai, 2004) (iii) the credibility of the information provider and the degree to which they exhibit trustworthiness, justice, and respect are of great importance (Steelman & McCaffrey, 2013); and (iiii) that framing and messages must be designed with the social context of where the risk is situated in mind (Steelman & McCaffrey, 2013). These factors can all be considered important in the context of this study and will be presented and elaborated on further in the following sections.

### **2.2.1 Two-way Communication and Feedback**

As with any type of communication, risk communication should be treated and viewed as a process (Cho et al., 2014). Contextual factors, sender and recipient characteristics, message characteristics, and "noise" or anything that might obstruct shared meaning all impact communication. Both the elements and how they interact with one another are constantly changing. That is why feedback is one of the most important elements in risk communication. Two-way communication is a prerequisite for feedback. Cho et al. (2014) continue that feedback enables risk communication to be adapted to the changing system and messages to be adjusted so that the chances of the message being understood and acted upon increase. If a risk communicator sends out a message explaining something about a risk and a receiver does not understand this message, the communicator must be able to get to know this. If the receiver can respond and say they do not understand, the sender can adjust the message and make it more understandable. Feedback informs participants about the communication

process and facilitates strategic adjustments to messages, channels, audiences, and situations, improving effectiveness (Cho et al., 2014).

### **2.2.2 Stakeholder Involvement**

The literature discusses whether stakeholders should be involved in the risk management of risks that affect them or whether the risks should be managed without their participation. Two distinct perspectives on the issue have emerged from the discussions: a technical perspective and a democratic perspective (Gurabardhi et al., 2005). The technical stance deems that decisions regarding technical issues should be handled by knowledgeable experts and scientists. Their main concern with involving stakeholders is that it would result in decisions that are not technically competent as well as the economic downside it entails (Gurabardhi et al., 2005). Contradictory, the democratic stance believes that people should have a say in decisions that have an impact on their way of life and is therefore emphasizing issues of justice and fairness. They view risk communication as a productive dialogue between all stakeholders involved or affected by the risk and emphasize the subjective, experiential, social, and cultural values that stakeholders bring into risk management and decision-making (Gurabardhi et al., 2005). In line with the democratic stance, Lundgren and McMakin (2013) discuss the benefits of stakeholder involvement and declare that it is advantageous for the audience to see for themselves precisely what is known about the risk, how the risk will be handled, and how decisions are made. The main argument is that when people are allowed to contribute to the risk decision, it is more likely to be accepted and durable.

### **2.2.3 Trust and Credibility**

Trust and credibility are two components that have a significant position in the literature on risk communication and are considered crucial for its effectiveness (Covello et al., 1986; Renn & Levine, 1989; Steelman & McCaffrey, 2013; Zimmerman, 1987). Whether or not a source is regarded as credible will affect how a risk is perceived and, thus, how an individual responds after receiving a risk communication (Wachinger et al., 2013). If the communicator is perceived to have a compromised mandate or a lack of competence, the credibility of the information supplied tends to suffer. Or, if a particular risk has been mismanaged or overlooked in the past, attempts to communicate risks may be met with suspicion and mistrust (Kasperson, 1986). Credibility and trust cannot be established rapidly but are instead the outcome of continuing actions, performance, and communication expertise (Covello, 1993).

Most definitions of trust strongly emphasize the reliability of information and the receiver's conviction that the message's source provided accurate and comprehensive information (Renn & Levine, 1989). According to the same authors, trust and confidence in a source might be distinguished by the latter's longer-lasting experience of trustworthiness over a long period of time. In other words, people have faith in a source if their prior trust in that source has not been betrayed over an extended period of time. Consequently, credibility is the result of many persons sharing confidence in a communication source.

Peters et al. (1997) found that factors that determine the perception of trust and credibility include knowledge and expertise, openness and honesty, and concern and care. In line with this, Kasperson et al. (1992) identified four key dimensions of trust: commitment, competence, care, and predictability. First, the perception of constant dedication to a mission or objective, as well as the performance of obligations or other social norms, is essential to trust. Perceptions of commitment are, in turn, contingent upon perceptions of objectivity and fairness in decision-making processes and the supply of accurate information. Peters et al. (1997) formulate that these factors are indicators of openness and honesty, making them crucial to the perception of commitment and consequently also trust and credibility. Second, risk managers must demonstrate competence in their area of expertise (Kasperson et al., 1992). Constant misjudgments can very well result in a lower level of trust. Third, when it comes to risks, individuals are often dependent on others with greater control and knowledge of the situation making the caring element crucial (Kasperson et al., 1992). Last, the fulfillment of expectations and faith is the foundation of trust which is why predictability is so important.

#### **2.2.4 Framing and Messages**

Risk communication can be performed both orally and/or visually. Ng and Hamby (1997) present important considerations regarding both types. Oral messages have the benefit of receiving quick audience input, yet they are prone to misunderstanding. Providing the audience with reference materials will strengthen the message. The person presenting the oral message must possess sufficient technical expertise to address the majority of inquiries, as well as exceptional presentation and listening skills. Visual messages are those that employ graphics and relatively few words, and they are good for bringing awareness to a certain issue. Written messages are another common way of communicating risk. However, to be effective, written messages must be brief, employ straightforward language, not play on the anxieties of the audience, explain how the risk was evaluated, and provide risk comparisons (Ng & Hamby, 1997). In addition, they should include recommendations on risk reduction and give the public some control over the risk and how it can be handled. It is also important to remember that written messages are sensitive to language nuances.

Risk communicators can distribute information through various media, including public meetings, newspapers, radio, television, the internet, and social media. It is best to employ numerous media sources while keeping in mind that each risk message must contain consistent basic information (Ng & Hamby, 1997). Santos (1990) emphasizes that different communication channels are suitable for different audiences and that finding an appropriate channel for a specific target can be a real challenge. She continues by adding that channels for communication should be chosen to maximize resource efficiency while maintaining overall goals. Brochures, information packets, newsletters, videotapes or slide shows, advertisements, data sheets, and press releases are a few examples of direct communication methods. Community gatherings, community advisory groups, service group presentations, instructional activities with schools, in-person meetings, and telephone interviews are examples of interactive means of communication.

When trying to communicate information regarding risk it is of vast value that the message is communicated in a language that the recipient comprehends for the communication to be effective (Lundgren & McMakin, 2013). Language barriers can pose substantial obstacles to accessibility and openness in the receiver (Sellnow et al., 2009). However, not only the language itself affects the comprehension of risk communication but also the manner in which it is employed (Lundgren & McMakin, 2013; Sellnow et al., 2009). Regardless of the communication channel, the risk communication message must be in the audience's language, both in terms of actual language and usage. This includes using words and phrases that the audience will understand as well as adapting the language in line with cultural influences of the recipient population (Lundgren & McMakin, 2013; Sellnow et al., 2009). Effective risk communication in terms of language is grounded on designing the message with the recipient in mind. Consequently, it can be advantageous for risk communication to incorporate various spokespeople from the impacted audiences or cultural groups (Sellnow et al., 2009).

How the message is framed or presented is also of great importance. Matlock et al. (2017) discuss how using metaphors in wildfire communication might encourage fire prevention practices. Using frightening metaphors might cause worry and fear, which affect how risk is perceived. This contradicts some previous theories in the risk field where fear appeals have been considered improper tactics for persuading people to follow risk communication guidelines (Witte, 1995). Witte (1995) uses the example of Covello et al. (1986, p. 175), who claims that:

*“people seldom respond appropriately to high-threat or fear communications, such as photographs or films graphically depicting the physical symptoms of disease or the results of a disfiguring or fatal accident. Such communications may induce excessive fear and anxiety, which, in turn, may reduce people's attention, induce defensive responses, and evoke hostility toward the source of the communication”.*

However, Witte (1995) argues that this is not always the case. If people believe they can perform measures to avoid harm, high-threat signals can effectively encourage self-protective measures.

### **2.3 Risk Perception**

The efficiency of risk communication is not only dependent on the risk communicators but also on the difference in risk perception of the receivers (Cho et al., 2014). Depending on the risk type, the context of the risk, the person's personality, and the social environment, perceptions may vary. Individuals' perceptions of the severity and acceptability of risks are influenced by a variety of factors, including knowledge, experience, values, attitudes, and emotions. People are often driven to behave in order to avoid, reduce, adapt to, or even ignore hazards based on their perception (Wachinger et al., 2013). What makes it even more challenging is that in a target population, background and perception will most likely vary significantly. In order to effectively communicate risks, recognizing the various influences on an individual's perception of risk is crucial (Brown, 2014).



### **2.3.1 Affecting Risk Perception Through Risk Communication**

Even though the effectiveness of risk communication depends on the risk perception of the receivers (Cho et al., 2014), communication is one of the ways to affect people's perception of a risk. Perception of a risk has two primary dimensions: the cognitive dimension which pertains to what people know and comprehend about a certain risk, and the emotional dimension relates to how the person feels about the risk (Paek & Hove, 2017). As previously mentioned, risk communication often aligns with spreading information and knowledge to enlighten and inform about a specific risk (Lundgren & McMakin, 2013; United States Environmental Protection Agency, 2022). By receiving information about a certain risk a person gains more knowledge about it which can in turn affect their perception of that risk. Gerrard et al. (1999) acknowledge several studies that examined the effect that risk communication had on people's risk perceptions. The results showed trends of increased risk perception from the information communicated. Literature also indicates that risk communication can have this influence on risk perception both by providing information about new dangers, but also by reminding individuals of risks they are already aware of (Gerrard et al., 1999).

### **2.3.2 Raising Awareness Through Children and Youth**

One way to raise awareness in communities that has increased in popularity is to target children as an audience for disaster education (Steelman & McCaffrey, 2013). The greater a child's awareness of hazards and realistic risks, the greater the possibility for adult education through the child's dissemination of this information at home (Ronan, 2001). Teaching children about risk is also a crucial step in activating the children's interest in knowing more about risk (Shaw et al., 2004). Children can influence their families to make adjustments for disaster preparedness, and they are generally extra motivated after learning about disasters in school (Kourofsky & Cole, 2010). When disaster education is done well, children actively learn how to manage disasters, disaster management becomes ingrained in the children's daily lives, and a culture of disaster preparedness emerges. All this aids adults in making wise decisions and taking appropriate actions in the face of disasters.

### **2.3.3 Experience**

The impact of risk communication on behavior depends on people's past experiences (Cho et al., 2014). Someone who has experienced many safe encounters before where nothing has happened will probably not perceive the risk as high as someone who just experienced the risk. In fact, it has been indicated that experience tends to outweigh description (Jessup et al., 2008; Lejarraga & Gonzalez, 2011). With this in mind, Cho et al. (2014) stress the importance of understanding the relationship between description and experience in effective risk communication.

Similarly, a literature review by Wachinger et al. (2013) on risk perception found that personal experience with a natural hazard together with faith, or lack thereof, in authorities and specialists have the greatest effect on risk perception. They found that direct experience in a natural hazard usually results in higher risk perception. However, this is not always the case.

The risk perception can decrease for people who experienced a natural hazard but did not experience personal damage, resulting in a belief that future events will not affect them either. Wachinger et al. (2013) conclude that it is the severity of the personal effects encountered in previous situations that impacts the respondents' perceptions rather than the experience "in itself". When in time the hazard was experienced is also an important factor. Felgentreff (2003) found that directly following a flood incident, risk perception and risk awareness reach high levels, but they quickly decline over time. This is where so-called indirect experience can play a role. Indirect experience is information from others about an event, for example watching the news about a wildfire on television or reading about a storm in the newspaper (Wachinger et al., 2013). Indirect experience can be used to recall previous personal experiences and increase risk perception and awareness again (Shaw et al., 2004), as well as motivate people to take preventative and preparedness measures (Wachinger et al., 2013). It allows risk communicators to take advantage of and expand the "window of opportunity".

#### **2.3.4 Optimism bias**

People have a tendency to believe that they are less likely than others to experience negative events and that their risk is less in comparison to the average risk (Cho et al., 2014). This "it won't happen to me"-phenomenon is known as the optimism bias, and it explains why people frequently merely downplay their personal risk.

### **3 The Study Context**

*This chapter covers the context in which the study was conducted, including the study region, the fire actors, and the local population.*

#### **3.1 The Vredefort Dome**

The Vredefort Dome, located south-west of Johannesburg in South Africa, is the remainder of the crater from the world's largest meteorite impact structure (UNESCO, 2022a). Its radius of 190 kilometers makes it the largest and most deeply eroded meteorite impact yet found on earth (UNESCO, 2022a). It is calculated that the meteorite event happened over 2000 million years ago, and the Vredefort Dome is the only example that offers a full geological profile of a meteorite impact (UNESCO, 2022a). In the report, the Vredefort Dome will frequently be referred to as "the Dome".

The Vredefort Dome was listed as a World Heritage Site by the United Nations Educational, Scientific and Cultural Organization (UNESCO) in 2005, however it has not yet been declared a World Heritage Site in national legislation (G. Engelbrecht, personal communication, 12 September 2022). This is a result of the complicated situation with the large number of stakeholders involved in the Heritage Site. Firstly, the Dome core area is located in two different provinces, the North West province and the Free State province as well as it straddles five different district municipalities (Fleminger, 2022). Secondly, the land in the Dome is owned by over 100 private landowners, with only one of them being the national government (Fleminger, 2022). The World Heritage Site the Vredefort Dome consists of a *core area* that measures just over 30,100 hectares, which contains all evidence that the meteorite impact happened, as well as a 5 km *buffer zone* around the core area (UNESCO, 2022a). When the Dome is declared a World Heritage Site it will be protected according to the World Heritage Convention Act of 1999 along with several other acts (UNESCO, 2022a). The protection implicates that all development in the Dome will be regulated and restricted in order to preserve and protect the evidence and remainders of the meteorite impact (UNESCO, 2022a).

##### **3.1.1 Residents of the Vredefort Dome**

The Vredefort Dome consists of 149 privately owned properties where 91 are in the Northwest Province and 58 are in the Free State Province (International Union for Conservation of Nature, 2005). Only 600 of the just above 30,100 hectares in the core area is state-owned land (International Union for Conservation of Nature, 2005). Many of the landowners in the Dome use their land for farming or tourism purposes (G. Engelbrecht, personal communication, 12 September 2022). There are also landowners who only use their land for private use. There are mainly three different languages used by the residents of the Dome: Afrikaans, Tswana and English. Afrikaans is the predominant language (G. Engelbrecht, personal communication, 12 September 2022).

## **3.2 Regulations**

This section summarizes relevant parts of the laws and regulations regarding veldfires in South Africa in order to get an understanding of how these fires are managed.

### **3.2.1 The National Veld and Forest Fire Act**

In South Africa, the management of veld and forest fires is regulated in the National Veld and Forest Fire Act (1998). The Act's goal is to prevent and battle veld, forest, and mountain fires throughout South Africa, and it provides for a variety of institutions, methods, and practices to do so. The Act places the responsibility of fire protection on the landowners in veldfire-prone areas. All owners of land where a veldfire may start or burn must for example have their own firefighting equipment and always have personnel available to fight a potential fire. They must also prepare and maintain firebreaks and always inform neighboring landowners when they plan to do so. If a landowner spots a fire on their or adjoining land it is their duty to notify the owners and the Fire Protection Association (FPA) as well as fight the fire.

The Act is administered by the Minister of Agriculture, Forestry and Fisheries (Salmon, 2020). The Minister should assist landowners and Fire Protection Associations (FPAs) in their work to prevent and fight wildfires. One important task in the prevention of wildfires assigned to the Minister as stated in the Act (1998) is to set up and maintain a fire danger rating system for the entire country. This has resulted in a fire rating system called the Fire Danger Index (FDI), which indicates the fire risk in a specific region for a specific day (Enviro Wildfire Services, 2013). The FDI is calculated using the following environmental factors: temperature, relative humidity, wind speed, and previous rain. The FDI is presented on a scale from 1 to 100 where 1 is a low fire risk and 100 is an extreme fire risk. It is the Minister's responsibility to regularly communicate the fire danger rating for each region to the FPAs. When the FDI is high no fires are allowed under any circumstances. Apart from mentioned regulations, the National Veld and Forest Fire Act (1998) also regulates the FPAs, administration of the Act, offenses and penalties, enforcement, as well as general and transitional provisions.

### **3.3 Fire Protection Associations (FPAs)**

Fire Protection Associations arose from the need for a single Integrated Wildfire Management framework (WoF, 2022a). Landowners in veldfire-prone areas are encouraged to come together and form a Fire Protection Association (FPA) to aid in the prediction, prevention, management, and extinguishment of veldfires in a specific area (Republic of South Africa, 1998). The establishment, registration, duties, and functioning of FPAs are regulated in the Act (1998), and an FPA must register its formation to qualify for assistance and receive its power and duties (Cape Peninsula FPA, 2022). When the veldfire hazard justifies the cost of forming and maintaining an FPA, an FPA should be established. An FPA deals with all aspects of veldfire prevention and firefighting and can make its own rules that the members are bound to follow. To ensure that the rules and the Act are complied with, the FPA can inspect members' properties (Cape Peninsula FPA, 2022). Every FPA should collaborate with a provincial umbrella FPA (UFPA) that is aligned with the Provincial Disaster Management Centre (WoF, 2022a).

With the exception of a few actors, it is not mandatory for landowners to join an FPA. However, being a member of an FPA have numerous advantages. A practical and economical advantage is that it enables landowners to coordinate their fire prevention and suppression efforts with others in their community. Joining an FPA also has legal advantages. Firewise (2017) lists a few. One is that the Presumption of Negligence will not apply to a member of an FPA, meaning that a person accused of negligence does not have to prove their innocence if member of an FPA. It is also more difficult for someone who wants to sue a person for fire-related losses to demonstrate that they did not take reasonable precautions to prevent the fire if the person is a member of an FPA. Another economic advantage is a possible decrease in insurance premiums; many insurance companies even oblige that their customers belong to an FPA (Potchefstroom FPA, 2022).

There are two active FPAs that manage the Dome. The area on the North West Province side mainly belongs to the Potchefstroom FPA. This Association is also a member of the North West Umbrella Association (Potchefstroom FPA, 2020). Vaal Eden FPA is the FPA that manages the Free State side of the Dome. They are members of the Free State Umbrella FPA. The Expanded Public Works Programme (EPWP) Working on Fire (WoF) assist both FPAs with firefighting, equipment, and fire awareness programs as well (Potchefstroom FPA, 2020).

### **3.4 Working on Fire (WoF)**

Working on Fire (WoF) is an Expanded Public Works Programme in South Africa created in 2003, aimed to provide young men and women with work possibilities as well as to reduce the frequency and impact of uncontrolled veldfires (WoF, 2022b). The Program is residing under and funded by the Department of Environmental Affairs. Participants from marginalized communities are recruited and educated in fire awareness and education, fire prevention, and fire control techniques.

WoF, in collaboration with authorities and FPAs, implements Integrated Fire Management Solutions (IFMS). This includes raising awareness, participating in suppression efforts, rehabilitating burned areas, and proactively implementing preventative measures such as prescribed burns and fuel load reduction. Currently more than 5000 people are employed by WoF and they are stationed around over 200 bases throughout the country (WoF, 2022b). The Potchefstroom FPA has access to two WoF-teams. During the fire season, employees stay in rural communities at farms in the Potchefstroom FPA area where they are on standby 24/7, ready to fight potential veldfires. In the off-season the teams will help with more preventative measures such as cutting down alien plants, making firebreaks, and running awareness programs. The Vaal Eden FPA have three WoF teams in their area.

## 4 Methodology and Methods

*This chapter provides a description of the study design and the methods used along with an explanation of their application.*

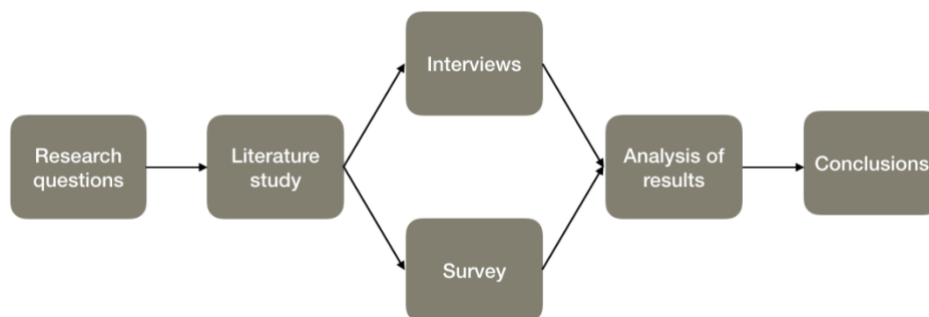
### 4.1 Study Design

The major methods for gathering and interpreting data in research are qualitative, quantitative, and mixed methods (Pathak et al., 2013), an explanation of the different methods can be found in appendix A. In this study a mixed-method research design has been used to broaden the scope of the study by employing different approaches for the various parts of the research. Quantitative and qualitative methods have been used to answer the first research question. This was found suitable since the goal was to in some way measure the knowledge base in the population, thus the quantitative research design. To characterize the fire habits and the knowledge of the respondents it was considered necessary to let the participants use their own words for some parts, hence the small qualitative features as well. This can be linked to the complementary purpose of mixed methods. To answer the second and third research questions, a qualitative research design was utilized because this is the approach that is considered to be the most suited when attempting to comprehend the significance of a phenomenon while providing a description of the participants' perspectives and experiences (Brinkmann & Kvale, 2015; McCusker & Gunaydin, 2015). The qualitative research design was found suitable because one of the aims of this study is to analyze communication and how it is viewed from the stakeholders' perspective.

Since the study took place in a setting that beforehand was unfamiliar to the researchers, considering a different country and culture, the researchers had to familiarize themselves with the context as well as understand how veldfires and emergencies are handled and organized in South Africa. The qualitative part of the study design was also found to help in this regard as participants frequently mentioned aspects that were unfamiliar to the researchers.

### 4.2 Method

After the research questions were formulated an initial literature study about risk communication was conducted. Data was then collected through semi-structured interviews and a survey. The data was coded and analyzed generating results that led to conclusions and a final report. An overview of the research process is visualized in Figure 1. Each step in the process will be presented in more detail in the following sections.



*Figure 1: The research process.*

### **4.2.1 Literature Study**

An initial literature study about risk communication was performed to gain basic knowledge about risk communication and what factors influence the success of risk communication in a wildfire context. This was mainly done to create the interview guide.

The literature used in the literature study was mainly retrieved from the research platforms Google Scholar and Lund University Libraries and to some extent the Google search engine. Initially, the literature was identified using key terms such as “Risk communication”, “Risk communication and wildfires”, “Risk communication theories”, “Risk communication channels” and “Risk perception”. As literature was read and interesting topics were found, additional key words were used such as “trust and credibility risk communication”, “participation risk communication” and “risk communication objectives”. The search results were refined based on the titles and abstracts. Citations in the papers found in the desk search were then used to identify additional sources.

### **4.2.2 Interviews**

Interviews are the most common type of data collection in qualitative research (Jamshed, 2014), the different kinds of interviews are explained in appendix A.

In this study, semi-structured interviews were performed. This interview type was chosen because it allows the interviewer to expand and follow up on interviewees’ responses which were necessary when interviewees mentioned new unknown information to the interviewers. The researchers still wanted answers to specific questions, making the semi-structured interview method the best choice.

Semi-structured interviews can reveal in-depth information since the interviewer can pick up on verbal as well as non-verbal responses. The researcher can typically draw nuanced findings by thoroughly examining the conversations and initially superficial responses (Kakilla, 2021). Additional strengths of semi-structured interviews include their flexibility, the large amount of detail that can be generated, it is comparable, and that it is fairly reliable (Alshenqeeti, 2014; Kakilla, 2021). Semi-structured interviews are sensitive to language barriers, are ideally performed face-to-face, and require a skilled interviewer for the best result. Apart from these considerations, some disadvantages of semi-structured interviews are that they can be time-consuming, both to perform and to analyze, and that it can be hard to analyze the data retrieved from the interviews (Adler & Clark, 2014).

All interviews in the study were recorded. The interviewees had the choice not to be recorded since there were always at least two researchers present during the interviews so one researcher could have written down the conversation. However, all participants gave their written consent to being recorded. Having interviews recorded is very useful when performing semi-structured interviews since the interviewer can focus solely on the interviewee and the conversation without the interruption of having to take notes.

### **Participant Selection**

A combination of the two sampling techniques snowball sampling and purposeful sampling was used to identify the interviewees. In snowball sampling the researchers use their participants' social networks by asking the interviewee if they know others that might be suitable to interview until the sample grows to the desired amount of participants (Robinson, 2014). This is a suitable technique when the researchers, as in this case, lack familiarity with the population. An issue with this sampling method is that it could lead to an unrepresentative sample by only talking to people from similar demographic backgrounds. The first landowners interviewed in this study were recommended by two professors from the North West University with connections in the Vredefort Dome. From there the snowball sampling began.

In purposeful sampling interview participants are picked for their specific knowledge or experience in the phenomena studied (Creswell & Plano Clark, 2017). This sampling technique allows researchers to hear from key personnel about their operation and perspective. In this study, the perspectives of both the primary risk communication senders and the receivers were of interest. With help from Prof. Dewald Van Niekerk from African Centre for Disaster Studies and Potchefstroom FPA, important persons from the organizations that are the main risk communication senders were identified and interviewed.

### **The Performed Interviews**

The interviews in this study were conducted in September and October 2022. 15 informants were interviewed during a total of 11 interviews, see Table 1 for a summary of the interviewees. There were never more than two participants interviewed together. The length of the interviews varied between 15 and 105 minutes due to the semi-structure of the interviews. The interviews tended to be longer in the beginning of the study since the researchers familiarized themselves with the context.



Table 1: List over the interviewees and in what role they were interviewed.

<b>Interview no.</b>	<b>Interviewee no.</b>	<b>Role</b>	<b>FPA Membership</b>
1	1	FPA representative	Potchefstroom
2	2	Landowner - Farmer	Potchefstroom
2	3	Landowner - Farmer	Potchefstroom
3	4	FPA representative	Potchefstroom
4	5	Tourism	Potchefstroom
5	6	WoF representative	North West
5	7	WoF representative	North West
6	8	FPA representative	Vaal Eden
7	9	Farm manager – Tourism	Vaal Eden
7	10	Farm manager- Tourism	Vaal Eden
8	11	Operations manager - Tourism	Vaal Eden
8	12	Landowner - Tourism	Vaal Eden
9	13	Landowner - private	Potchefstroom
10	14	Landowner - Farmer	Potchefstroom
11	15	FPA representative	Vaal Eden

The interviews were performed in English. All participants' first language was Afrikaans, therefore one additional researcher from South Africa with Afrikaans as their first language was present during most interviews to be able to translate occasional words in Afrikaans when the interviewee could not find the English word.

Almost all interviews with landowners were performed on the landowners' own properties in the Vredefort Dome which was good since it could help the interviewee to relax. The interviewee being relaxed can increase the likelihood of the interviewee speaking as truthfully and extensively as possible (Miles & Gilbert, 2005). Having the interviews on their properties was also good for the interviewers to grasp the context. One landowner was interviewed on the University campus. The FPA representatives and WoF were interviewed in coffee shops and in their offices.

Three different interview guides were created and used for the two different types of interviews that were performed, one for the interviews with the landowners, one for the interviews with the FPA representatives and one for the interview with WoF. The purpose of the interview guides was to direct the interviewers and ensure that all interesting aspects were covered. The full interview guides can be found in Appendix B.

### **4.2.3 Survey**

A survey is a means to gather information about a population from a sample of individuals (Pinsonneault & Kraemer, 1993), see appendix A.

In this study, a survey was made to characterize the fire use habits of the population of the Vredefort Dome as well as to study their knowledge about fire use and fire safety. A survey was used since the goal was to reach more people than in the interviews. The majority of the questions were close-ended, but there were also open-ended questions when the researchers wanted to test the respondent's knowledge and wanted them to answer in their own words since pre-defined responses could give the answers away.

A questionnaire created in QuestionPro with 29 questions was sent out in one of the Whatsapp groups that the Potchefstroom FPA uses to send out information in the Vredefort Dome. The group consists of landowners in the Dome and whomever they think needs to take part of the fire and safety information that is sent out on the group. This could be farm managers, family, or workers. This meant that the survey only reached out to people living on the northwest side of the Dome. The aim was to send it out to the Free State side as well, but this was not possible since the FPA on that side did not want to use their channels for that.

The questionnaire was translated into Afrikaans by an Afrikaans-speaking professor. The respondents could therefore choose themselves if they wanted the English or Afrikaans version. This resulted in some free-text responses in Afrikaans. These responses were translated using Google translate since they were short specific text phrases in the subject. Responses that got an unclear translation were sent for clarification to a native Afrikaner.

The questionnaire was sent out to a Whatsapp group with 160 members. The questionnaire was open for two weeks and multiple reminders were sent out during that time. However, the survey only got 13 responses resulting in a response rate of 8%. This is a considerable limitation of the study. Significantly more responses would have been desirable to get a representative result from the population. Instead, the survey had to be used as a complement to the interviews since the limited response rate on the survey was considered too low to draw any general conclusions. The sent-out questionnaire can be found in Appendix C.

### **4.2.4 Data Extraction and Analysis**

A thematic analysis was made of the interview data. All interviews were transcribed after they were performed. They were then all read through and manually coded. In the initial stage everything of interest was marked, then the marked extracts were divided into 48 codes. In this stage, some things not relevant to the particular study were sorted out. The two researchers marked and coded one transcript together to ensure they were doing it the same way, and then the interviews were split and coded separately to save time. This might have resulted in that their coding styles differed. The codes were compiled in an excel sheet and sorted into seven broader themes.

The data from the survey were compiled and close-ended questions were visualized through diagrams. Free text answers were shortly summarized since only short responses were generated. Anything of particular interest was brought out as well.

#### **4.2.5 Ethical Consideration**

Interviews can give rise to ethical issues and concerns depending on the studied area (Allmark et al., 2009). The nature of this particular study subject is not considered sensitive or private. However, there was a risk that people would feel judged or blamed for their fire habits or knowledge. To minimize these risks, an attempt was made to clearly communicate that they as individuals were not judged or blamed but that the investigation focused on the risk communication of the responsible agencies.

All interviewees were given an information sheet about the study and what participation implied before the interviews. Many of them got the sheet sent to them days before the interviews. The participants also had to sign a form of consent before the interviews, this can be found in appendix E. Participation was entirely voluntary and could be withdrawn at any time.

The survey was anonymous. Consent to participate in the study was given by submitting the form. This was written in the informational text that was shown before starting the questionnaire. This text also included information about the study and their participation. The respondents could stop the survey at any time before submitting it. Once submitting the form, participation could not be withdrawn because the responses were anonymous and could not be traced back to them except if the participants had voluntarily given out their contact details for potential interviews. This was also included in the information. As with the interviews, participation in the survey was completely voluntary.

## **5 Results**

*This section includes the empirical data collected during the study.*

### **5.1 Survey Results**

Due to the low response rate for the survey, the majority of the results from the questionnaire are not used in the study. Some results are however used as a compliment to the interviews and will be presented in this chapter.

The respondents use fire for various reasons and during all seasons of the year. Respondents answered that they use fire for cooking, making fire breaks, heating indoors and putting the ashes in an ash pit outside, garbage disposal, and agricultural purposes. The most common purposes are cooking and making firebreaks. The overall result from the survey indicates that most of the respondents have knowledge of fire safety and veldfires but that some respondents need more knowledge. Nine out of the 13 respondents even admitted that they could benefit from more knowledge.

The result of the survey can be found in Appendix D.

### **5.2 Interview Results**

Since a thematic analysis of the interview data was performed, the presentation of the interview results will not follow the same structure as the presentation of the theoretical foundation. During the thematic analysis of the interviews, seven key themes were found. These themes will be presented in the following section.

#### **5.2.1 The Perception of the Risk Management Structure**

As mentioned in Chapter 3, in South Africa the responsibility of veldfire management is put on each landowner. This has resulted in the creation of FPAs and communities coming together to manage veldfires. The organizations that help the communities manage the veldfires were frequently mentioned in the interviews. This theme therefore includes how the interviewees described how this management is structured and, in some ways, how they think it works.

First of all, several interviewees emphasized how all the people living in the Dome are entirely dependent upon each other when it comes to managing the fires. The area or ward managers in the FPA that were interviewed were clear that this was not their actual job but something they did voluntarily because somebody just had to. When one interviewee who helped the FPA distribute information in different Whatsapp groups was asked if that was some type of responsibility he had he answered “No,no,no, just my social responsibility”. The lack of help from the government was also mentioned.

The Potchefstroom FPA stated that about 60-70% of the properties in the Dome on the North West side are members of their FPA. Vaal Eden said that about 50% are members of the FPA on their side. Representatives from both FPAs said that most people that live permanently in the Dome are members. The problem is people that live in the cities and only have a property in the Dome that they visit occasionally. They were frequently referred to as “weekend-

farmers” in the interviews. The base membership fee for Potchefstroom is around 100 rand a month. One Potchefstroom FPA representative said it is so cheap that they do not think the fee is an obstacle for people to become members while another said that it is and that they knew permanent residents that are not members because they cannot afford it, see quote below. The membership fee in the Vaal Eden FPA is even higher, starting at 250 rands a month up to 250 hectares and then one rand per hectare.

*“I mean some of the people that we have are very poor so to pay that money every year I mean it is your bread or that money/.../” - Interviewee 4 (Potchefstroom FPA representative)*

The two FPAs are organized similarly and have the same authorities. They divide their whole geographical area into smaller areas with area managers. Potchefstroom FPA is divided into seven areas, where the Dome is one area with a separate area manager and five ward managers. To be a manager of any kind, one must live in the area. The Dome is also one of Vaal Eden’s areas.

During the fire season, the members must apply for burning permits from their FPA. The FPAs also make strategic fire breaks around cities and other important areas. The Vaal Eden FPA systematically determines where the strategic firebreaks should be using software and the history of fires. Both FPAs also state that they provide some equipment and training. If someone breaks the rules of the FPA or the Act, there is not much the FPA representatives have the authority to do. Two Potchefstroom FPA representatives expressed frustration about that.

Regarding the collaboration between the two different FPAs, the veldfire prevention is handled separately, but once a veldfire is close to the other side, they communicate and alert each other. If a fire from one side reaches the other, both FPAs fight the fire on both sides.

Most interviewees only had insight into their ‘own’ FPA, however the four interviewees that had experienced both Potchefstroom and Vaal Eden FPA expressed that Vaal Eden is much more organized. One interviewed property even switched from Potchefstroom to Vaal Eden, see the quote below.

*“We mainly moved away from Potch because they were if I can say, bluntly useless. We never got any service from them.” – Interviewee 11*

WoF help with managing veldfires. Landowners can get help with making firebreaks or grazing from the WoF-team through the FPA. However, the landowners must pay for it and are still responsible for the fire site. The WoF representatives thought that all members know that they provide this service.

### **5.2.2 Communication**

The risk communication in the Vredefort Dome involves several stakeholders, both on the sender and receiver sides of the communication. The theme of communication describes the

channels that are used for risk communication about veldfires and the information that is communicated on them.

### **Channels**

The two main communication channels in the Vredefort Dome are WhatsApp groups and a two-way radio system. There are also other channels for communication such as Facebook pages, websites, word of mouth, email, and FM radio. Other means of communication are trainings, workshops, awareness meetings, and meetings with the FPA members.

#### *WhatsApp*

WhatsApp is the main channel used, and the FPA communicate through this channel to all their members. All geographical areas in both FPAs have their own WhatsApp group with members located in that area. The WhatsApp groups are intended to serve as a communication channel for fire and fire safety but are also used for other safety issues. The area managers are responsible for the WhatsApp group in their area and are typically the ones who share the information from the FPA. The WhatsApp groups are open for two-way communication, so it is also the area managers' responsibility to ensure that the group chats are only used for their intended purpose.

Since it is the landowner of a property that becomes a member of the FPA, they are typically the ones who are members of the group chat. Both Potchefstroom FPA and Vaal Eden FPA allow several members in the group chats from each property. Therefore other people, such as farm managers or family members, can be in them as well. The majority of the interviewees said that their workers are not included in the WhatsApp group. According to a representative from WoF, they are also in the WhatsApp group so that they are informed of when they may need to send out a team but also to be able to share information about fire safety and fire hazards. Potchefstroom FPA allows non-members to be a part of their WhatsApp groups while Vaal Eden is very strict on only letting members be included. Some interviewees also mentioned that they are on other community WhatsApp groups where other incidents are handled.

The most significant issue with this communication channel is that the cell phone reception in the Dome leaves much to be desired. When asked, all interviewees stated that they have problems with cell phone reception in the area. Some of the interviewees explained that they do not experience this issue when they are close to their venue because they have wifi-connection there, however as soon as they are out on their farm or in the veld they have problems with messages not coming through.

*“././ we don't have great cell phone reception throughout the crater. So, it is a problem, and we've had fires that were so close to us that we only afterwards heard 'oh there was a fire, and it has been extinguished, and we only hear now'.” – Interviewee 5*

#### *Two-way Radio*

Another communication channel used in the Vredefort Dome is a two-way radio system. While WhatsApp is mainly used for communication concerning prevention, preparedness, and

to raise awareness of emergencies, the two-way radios are primarily used for organization purposes during firefighting and other safety aspects. The main problems with the radio system are that not all properties have a radio that is connected to the community network and that the Vredefort Dome is a mountainous area while the radio network is dependent on line of sight to function. A repeater has been installed on one of the mountains in an attempt to improve the radio system's signal. Out of the eight interviewed properties in the Dome, two of them did not have radios connected to the shared network.

### *Training*

The Potchefstroom FPA and WoF offer voluntary training focusing on how to extinguish a fire, fire behavior, and information on how to use fire safely. The training usually takes place in smaller groups where a number of neighbors gather to undergo training, but there are also occasions when larger groups undergo training. The Potchefstroom FPA and WoF representatives stated that training is offered to all members of the Fire Protection Association. Among their members, however, the perception of this is somewhat mixed. Some of the interviewees had never been offered any training from the FPA while others said they had been offered. Only one of the interviewees had received training from WoF and he found that it only covered "basic knowledge" he already possessed.

Vaal Eden FPA also offer training to their members, but instead of using the WoF teams, they have put together courses through the University of Free State. They offer two levels of training, one of which is designed for landowners and managers and focuses more on laws, while the other is designed for workers and targets things such as fire behavior and extinguishing techniques. On the Free State side, none of the interviewees said they had been offered any training, but one of them had heard that it existed.

### *FPA Meetings*

Potchefstroom FPA have held yearly meetings where they gather all community members on the North West side. However, it seems that the meetings have not been held in the last couple of years. According to a representative from Potchefstroom FPA they used to go through the do's and don'ts regarding fire during their meetings and inform about the various practical things the members should follow. Vaal Eden FPA holds meetings twice a year for their members. A representative from Vaal Eden FPA described that they usually prepare a PowerPoint for the meetings, inform the members about the firebreaks that have been done and discuss the fires that have originated in the area. Another interviewee explained that they are typically reminded to make firebreaks, keep their grass short, and other such things.

The majority of the interviewed FPA members admitted that they usually do not attend the meetings that are arranged by their FPA. Most with the justification that they do not have the time to go or that the same things get handled every meeting, and they believe that they already know the things that will be discussed. Interviewees that are members of Vaal Eden FPA also mentioned that the information that is discussed during the meetings is sent out to all members of the FPA through WhatsApp after the meeting, which an FPA representative also confirms.





### *Community Meetings*

In both provinces, the WoF teams conduct workshops in schools to raise awareness. The WoF teams are trained to educate children about fire safety and hazards. They hand out pamphlets with drawings and informational coloring books the children can play with, see appendix F for an example. Topics like personal safety, not playing with fire, and the dangers of fire are typically discussed. The teams attempt to tailor the information they provide to the grade level of the students they encounter. The hope is that the children will also bring the information home to their families to spread the knowledge even further into the communities.

*“/.../ the key focus is here that those children is going home tonight to their parents and say ‘the firefighters were at school today’ and then when mum wants to light a fire outside they are the ones that are going to say ‘no it doesn't work like that because the firefighter told me so and so’.” – Interviewee 1*

WoF also provides fire awareness every month for community members in their provinces. The fire awareness consists of community training on fire safety and takes place on different scales in the community to reach as many as possible. They do awareness partly by visiting healthcare facilities, older age homes, and similar locations. They choose these locations because they are frequented by a large number of people and they are confident that they reach community members they would not otherwise reach. They also do awareness door-to-door. Beyond that, WoF arrange community meetings where the whole or parts of the community are invited to participate.

### *Other channels*

Other communication channels that were only mentioned by some of the interviewees are Facebook pages, websites, email, FM radio, pamphlets, and word of mouth. Both the FPA and WoF have Facebook pages that are open to everyone. One of the interviewees believed that there are Facebook pages dedicated to the Vredefort Dome and thought that they would be an effective channel for reaching visitors, for instance. Potchefstroom FPA also has a website where they share information daily with the community. In addition to WhatsApp, Vaal Eden FPA uses email to communicate with its members. Both the Vaal Eden FPA and the Potchefstroom FPA communicate via FM radio which they use to inform the community of potential incidents in the region. Furthermore, a representative from Vaal Eden FPA has a weekly half-hour segment on the channel where he updates the community on what is happening in the province, what fires are burning, and what to expect in the coming week. Another important channel where knowledge is transmitted is the day-to-day communication between community members.

### **Communicated Information**

The FDI is one of the main communications shared in the Vredefort Dome. Both Potchefstroom and Vaal Eden FPA use their WhatsApp groups to send out the daily FDI during the fire season. In addition to the daily dispatch, they weekly send a weather forecast with the FDI for the coming week to prepare their members for the time ahead. Vaal Eden FPA also send out the weekly forecast to their members through email. Most interviewees were very positive regarding the FDI and that it is sent out daily. They consider it very

accurate and believe that it is effective in the community since it instructs members when it is acceptable to use fire and when to be extra cautious. A representative from Potchefstroom FPA stated that they send out a chart explaining the meaning of the FDI colors every week to ensure everyone understands the FDI but also as soon as a member indicates that they do not understand it. Some of the interviewees did however not agree with that and said that they rarely, or never, received explanations of what the FDI means.

Additionally, the FPAs communicate reminders to their members to construct firebreaks. All FPA representatives stated that they send out information well in advance of the fire season and continue to send reminders until the fire season begins. This information is primarily communicated through WhatsApp. Most interviewees confirmed that they receive numerous reminders to construct firebreaks before the start of the fire season.

*“././ or before the fire season start, there is constant reminder ‘remember you have to make firebreaks’.” – Interviewee 3*

A representative from Potchefstroom FPA stated that he occasionally sends videos of disastrous fires to members to remind them of the devastating effects of fire and increase their risk perception. Most interviewees agreed that experiencing a fire or hearing about others who have endured devastation from one, has the greatest impact on people’s awareness and perception. Despite this, there is no official feedback or summary of the recent fires in the region. Some of the interviewees felt that they often hear about events from other community members, but that an official, more credible summary would be advantageous. Since WoF are funded by the government, they must report all their actions. They must therefore make reports on all incidents they get dispatched to, about what caused it, how big the fire was, and the damages it caused. These reports are only used internally.

*“I think the part whereby the devastation has already happened or maybe the disaster has happened, then you come that, you bring that to light that this was caused because of certain thing, maybe it’s a cigarette or arson or whatever and how much damage it has done. Then, I think it brings light to other people. Because I think a lot learn from what has happened, but not from what has not happened” – Interviewee 6*

Nearly all interviewees concurred that there is a heavy emphasis on preparedness measures and response work, while there is little communication about pure preventative measures. Many of the interviewees thought there is a lack of information about how to use fire safely.

The majority of the communication is conducted in Afrikaans, with some English when it is needed. Both representatives from FPAs and landowners believed that everyone involved in the communication understood at least one of the two languages, with Afrikaans being spoken by the vast majority. The interviewees who are senders in the communication cycle have never been informed that there is someone who does not understand Afrikaans and believe they would be notified if this were the case. WoF do however have the ability to use the most prevalent languages in the regions where they conduct fire awareness, such as Tswana and Zulu. Therefore, training and awareness meetings in the North West Province are conducted

in the language spoken in the area where it takes place. One Potchefstroom FPA representative also explained that they try to keep the messages they send out as short and concise as possible to ensure that people understand them and read the whole message. When he was asked how he makes sure everyone understands what is communicated he answered the following:

*“Short messages and clear messages. Not, not any detail for if somebody wants to burn, um it would say on the message ‘not now, not allowed today’, that’s it. No, not any fussy messages. Basic English you know, basic yeah. Not a whole big SMS. What we also found what we all do we start opening a message and it’s a long message you just read the first three words and then skip, skip, skip, skip.” – Interviewee 4*

Some individuals are not directly included in the communication from the FPA or WoF, mainly tourists and workers. Some tourists will be informed at the venue they are visiting, others and also visitors who do not visit a venue are not informed in any way. Some of the interviewed landowners working in tourism have written rules and regulations that inform the guests, for example, that barbecuing is not allowed outside the designated areas. One also mentioned that they are very focused on doing briefings on how to set up their campsite and how to act on their land. Another interviewee said they do not bring it up with their guests unless they ask because they do not want their visitors to feel like they cannot do anything. Instead, they make sure always to keep an eye on their guests to prevent any accidents.

*“To the visitors we, you don’t connect too much with the visitors, with the fire and stuff. Cause you do not want them to think they can’t do anything” – Interviewee 9*

Workers rely primarily on their landowners to relay the information to them. However, not all landowners do it. Some landowners provide their workers with training to ensure they have sufficient knowledge to minimize risk. However, this training is more focused on the response to fires than preventive or preparedness measures. One landowner said they do not communicate any of the information to their workers. Instead, they have strict rules that the workers are never allowed to use fire on their farm as stated by one interviewee:

*“I don’t tell my farm workers anything/.../I just, within wintertime they think it is going to burn every day, that is how it works.” – Interviewee 15*

One interviewee was asked if he communicates the information he gets to his workers, and responded:

*“No, not necessarily. We don’t actually. That is a very good point actually. I don’t communicate to my workers.” – Interviewee 5*

### **5.2.3 Prevention and Preparedness Measures**

Since much of the communicated information includes that people must take measures for prevention and preparedness, what measures people actually take is an interesting aspect

when evaluating the risk communication. Therefore, these measures were discussed in all interviews which is what this theme will handle.

### *Firebreaks*

Firebreaks are a big part of the prevention and preparedness work when it comes to fire. It can both be used to stop a fire from spreading (prevention); however, most interviewees agree that it is most important to be prepared to fight a fire once it occurs.

The majority of the interviewed landowners stated that they do firebreaks every year. Some interviewees did say that they did not make firebreaks but that they kept their grass very short. However, two FPA representatives mentioned that there seems to be a misunderstanding of what a firebreak is and that some people think it must be burned. The quote below captures this aspect.

*“Take slashers, just slash it! I don't care, if the grass is this short we can spray it. We can start a back burn and we can drive there, that's it. And if we can start making that in their heads I think we have got a big win. Because I think people have a wrong idea of what a firebreak is.” – Interviewee 15 (FPA representative)*

Most of the interviewees mentioned that the Vredefort Dome is a mountainous area, making it hard to make firebreaks. Interviewees living on properties by the mountains all mentioned that this was a big obstacle for them to make firebreaks, some of them said that it was impossible. It would be too risky as can be seen in the quote below.

*“But ya for every property owner to go make a firebreak um it's impossible 'cause I can't make a firebreak, well my mountains are just here so and then going over that mountains there's no road so you have to go in by hand and that's, the risk is too high for that.” – Interviewee 4*

Besides it being too risky to make firebreaks, several interviewees mentioned that it is also an economic question. It can be expensive to make firebreaks; therefore, some might think it is not worth it. Some also thought it would be too risky to make it themselves but said they would do it if they could get help.

During the interviews it also came up that the different landowners had different interests depending on what their land was used for. Some landowners wanted to preserve their land with limited interference. Especially one interviewee was clear that he disagreed with what was expected from him with doing firebreaks and all the preparation. He meant that he would rather reserve his land and let it burn down if so may be. Other interviewees also discussed this and expressed frustration since landowners not doing their firebreaks put their neighbors at risk as well. However, this was something the interviewee was aware of as he said:

*“/.../it is problematic because some of our neighbors would see us as a dangerous section. Once the fire hits there it's gonna fly through the farm and it's because, yeah it's a problem.”. – Interviewee 5*

The frustration other interviewees felt over the neighbors not doing firebreaks is captured in the following quote:

*/'.../ Because sometimes like for instance when we need to do firebreaks and the old mate he do not want to do a firebreak, and then because he said no it actually burned his whole farm down. And I want to tell him 'listen you d\*\*khead, you should have done this this way because now your whole farm is burned down. You should have listened to us, why didn't you listen to us?'. – Interviewee 2*

Other ways that the fire risk is managed in a preventative way that was mentioned include being strict on open fires, working with electrical tools in the dry veld, keeping the ground clear, and having strict rules on smoking for workers and visitors.

#### *Preparedness*

A vast majority of the interviewees mentioned how they are always prepared for fire, especially during the winter. During the fire season, the firefighters are loaded onto the bakkies, people are on the lookout for smoke and ready to go as soon as something is up. If someone is burning something they are good at notifying their neighbors and ensuring they have enough water, firefighters, and workforce to handle it.

#### **5.2.4 Compliance**

Even though most interviewees stated that they do their prevention and preparedness such as firebreaks, most also mentioned that it is a problem that other people in the area do not do it and that they do not comply to the rules such as following the FDI. If this is due to a lack of knowledge or something else is an interesting aspect in regard to risk communication. The interviewees brought up their views and thoughts on compliance making it a relevant theme in the result.

All interviewees believed that negligence is one of the leading causes of fire in the area. Mainly they mentioned that this takes the form of people using tools such as grinders and welding machines when it is too dry even though they should not. The interviewees said that people underestimate the danger of using tools and think it will be fine, as portrayed in the quote below. Other fire causes mentioned were arson, workers cooking food and not disposing of the coals properly, cigarettes, and garbage disposal.

*“People just underestimate how dry the veld is, how dangerous it is and how strong the wind is blowing. Sometimes you're working in a kind of breeze and you think it is okay but you don't actually know how strong it is and you don't know when it will pick up, and once it started it is a mess.” – Interviewee 5*

One interviewee claimed that they know how dangerous it is but that they just do not think that it will happen to them:

*“They know how dangerous it could be but they leave it to number 99 to clear that veld” – Interviewee 4*

When asked why the interviewees thought people are negligent, most said that most people have knowledge but they just do not care. This and negligence are big problems. The interviewed FPA representatives said that they work on it but that it is hard. They said that some farmers believe that since it is their farm, they can do whatever they want and no one can tell them what to do. The representatives mention that they have gone out to them, nagged them, and tried threatening with fines, but nothing seems to help. Interviewee one expressed this as:

*“And you know just like you can bring a horse to water but you can't physically make it drink. So I can do whatever I want, speak to them, fight with them, pamphlets and videos, training, but if they don't want to do it is absolutely nothing I can do.” – Interviewee 1 (FPA representative)*

Despite the reminders to do firebreaks, there are still people that choose to do their burns or clearing during the fire months, see the quote below.

*“We, we know roundabout more or less middle August the burn season starts. So a month before I would say ‘listen, at the end of August the burn season starts so if you want to do bush clearing bloody, bloody, bloody, please do it now’. And then three weeks before, two weeks before and then a week before I send every day: ‘please do it now, please do it now, please do it now’, and then we had a last week a block burning.”- Interviewee 4 (FPA representative)*

One FPA representative wished for peace officers that could go out and give people that are not complying fines. Currently, the Potchefstroom FPA has no active ones in the area and the representatives themselves do not have the authority to hand out fines. The representative meant that when he goes out to people that are not complying to tell them that they are breaking the rules, they both know that there is simply nothing he can do to stop them. Another interviewee also agreed that there must be consequences or people will keep going as always. However, the three other FPA representatives were hesitant if fines would work since there have been people given fines in the past which did not help.

Even though some people do not listen, the vast majority of the interviewees still think that most of the people in the Dome comply. One part of the population that all interviewees see as a problem, though, is the so-called weekend-farmers. FPA representatives from both provinces said that they do not have a compliance problem with the members of the FPA but with the people that are not members. Most of those are weekend-farmers. Since they are not there very often, they do not have insight into the problems with fire and what buying property in a veldfire-prone area implies. These ‘farmers’ are uninformed and so are their possible workers, according to several interviewees. One FPA representative claimed that he had experienced that once a weekend-farmer has had their property for a few years, they start

to get what it is all about and get more involved but also that once they have experienced or seen a fire, they start to care. Some FPA representatives also mentioned that most fires start on the weekends.

### **Experience**

One thing all interviewees said was that they noticed that people are more cautious after a big fire event. After such a fire people do not make fires, they follow the FDI and make their firebreaks. The same applies to people that have ever experienced a big fire. One FPA representative said that all the big farmers that have been hurt by veldfires in the past have their firebreaks in place 110%. Some interviewees explicitly mentioned the devastation aspect, that people who have lost something in fires or even those who have just seen the devastation are much more careful. A few interviewees even believed one must have experienced a fire to learn and truly care. Two FPA representatives tried to use this in their communication by sending dramatic videos and that one of them said that he can see an improvement in that people are more careful a while after seeing those videos. However, most interviewees also said that people loosen up after some time after a big fire event and start to go back to normal, see quote.

*././ two years back we had lots of fires, everyone burned down, like this whole area burned down, me as well. And the year after that everyone makes their firebreaks, everyone has equipment ready. And this year no one had nothing again so next year we will burn again and the sequence go on like that.” – Interviewee 14*

### **5.2.5 Communication Evaluation**

This theme covers indications from the interviewees of how well the risk communication works. Sometimes interviewees mentioned aspects of it themselves during the interviews, but they were all asked to evaluate the risk communication at the end of each interview.

Overall, almost all interviewees thought the risk communication works very well. They think it is convenient to get the WhatsApps and that the information they get is helpful. It is appreciated that information about meetings and burnings is sent out well ahead of time and that the groups are open for feedback. One FPA representative thought the idea of the risk communication works well but that it is not as effective in practice since people do not listen. Representatives from Potchefstroom FPA and WoF both said that the number of veldfires has decreased significantly from last year’s even though they expected an increase. The representatives believed this was due to good preparedness and increased effort in raising awareness.

Two interviewees mentioned that they do not think that the meetings are the most effective mean of communication since many people think it is a struggle to get time off to attend them and that there is a possibility that people feel that information is just “shoved down their throats”. One interviewee expressed that he thought a problem with the fire communication is that “it is booklets of things you have to comply to” and that it is less about getting people to change their behavior and prevent the fire origin in the first place.

Regarding inclusion, a need for more communication with workers was expressed. The Potchefstroom FPA representatives also said that inclusion is a tricky part, mainly that it is hard to include people that do not want to be included.

All interviewed landowners were asked if they trusted FPA with their communication and they all responded that they do. As one interviewee said:

*“If we do not trust them, where do we start?” – Interviewee 9*

### **5.2.6 Improvements**

The interviewees were asked how they thought the risk communication could improve. The answers were mixed but are compiled in this theme.

During some interviews the role of the workers was discussed. Not all interviewees had workers but four interviewees that had workers expressed that they think improvements must be made in the area of communicating the fire information to their workers. Similar thoughts were shared regarding spreading information to tourists and visitors. One interviewee suggested making posters that the tourist sector could get and put up throughout their property. Another interviewee thought that more road signs are necessary to inform the visitors. Regarding the workers, some interviewees said they need to be more involved in the fires and see what it is all about to get more invested and care more about the issue. When knowing what it is all about and that they have to fight the fires, they will want to prevent them from starting.

One FPA representative and one WoF representative brought up thoughts on coming together more. The FPA representative talked about how he had started sending out educational videos on how firebreaks work and what can happen if you have them or do not have them hoping that people would understand how the community is all in this together. The WoF representative talked further about how different regions have to come together more and agree on the same things, like where and how to perform their awareness training.

WoF expressed hope to reach out more through social media and advertisement. They thought that by advertising on social media and traditional media like TV and billboards, they could arouse people’s interest and, in that way, educate people. They recognized that the digital world is the way to go and that they should follow that trend.

One interviewee has thoughts about behavioral change and stopping fires at their origin. For that he thought people’s habits have to change. As mentioned before, some interviewees also said they would really appreciate more formal feedback after a fire regarding what happened, why it started, the damages it caused, what was done, and improvements. Better opportunities to give people fines is also an area of improvement according to one FPA representative and one interviewee. Training is another aspect brought up by a few interviewees. They thought that more training is needed for the entire population in the Dome, not just the landowners but their families and workers as well.



### 5.2.7 Knowledge Base

The knowledge base in the population of the Vredefort Dome was investigated using both the interviews and the survey. In the interviews some interviewees talked about how they thought the knowledge base is. The information from the interviews will be compiled in this theme as well as other things the interviewees said that proved their knowledge.

Firstly, all interviewed landowners were aware of the veldfire risk and agreed that veldfires are one of the main risks in the area threatening their property. Regarding their perception of the general knowledge base of the population, not everyone mentioned this, but out of the seven that did, the majority said it is relatively good. Once again, an FPA representative said that it is good among the members but not among the rest. The weekend-farmers were called uninformed during a few interviews. Another FPA representative thought that people do not have an idea about the extent of the problem with fire and that people have more to learn. A few interviewees expressed that much of the knowledge about fires is just common sense and that it would be much less of a problem if people just used common sense.

Another group that about half of the interviewees identified as lacking knowledge was the workers. Several times the workers were pointed out as the irresponsible ones. Some mentioned that they use open fires and dispose of the coals after cooking unsafely but also that many workers smoke and do not think it starts fires. That the workers are seen as a problem is caught in the quote below.

*“ I don't think people do it purposely, I think they are very conscious of the rules. I think it is their laborers that are not so conscious of the rules.” – Interviewee 11*

Other interviewees on the other hand claimed that their workers are knowledgeable, that they have been trained, and that they are very strict on when and how to use fires.

Despite that the researchers tried to be clear that the focus of the research was preventative risk communication all interviewees except WoF tended to constantly want to talk about firefighting and the response phase of risk communication. The interviewees talked about how they communicate during the response, how they fight fires, their tactics, how it is coordinated, and their equipment. All interviewed landowners said they learned the firefighting skill through practical experience. Two of them said they have almost died in fires more than once. If the fire is too big for the landowners to handle, the WoF-teams and fire brigade get dispatched. Regarding the risk communication during firefighting, all interviewees mentioned several areas of improvement.

## **6 Discussion**

*In this chapter, the meaning and significance of the results will be discussed. A reflection of the study and sources of error will also be presented.*

### **6.1 Habits**

It can be concluded that fire is frequently used for various reasons in the Dome. Most informants who use fire seem to only utilize it weekly or monthly. However, the interviews indicate that machinery is used more often, which means there are frequent risks for veldfires. It is also noteworthy that fire use is distributed over all seasons, even during the fire season. Regarding purposes for fire use, the survey result complies with the result from the interviews in that the most common purposes include cooking, firebreaks, heating, and garbage disposal.

### **6.2 Knowledge**

The knowledge base of the interviewees can be considered good. All interviewed landowners had stayed on their property for a long time and had long experience managing veldfires. Especially the detailed way they described their firefighting indicated that they possess extensive knowledge of the subject. They had all seen fires and from that they knew how to fight them, what can cause them and how to prepare for and prevent them. If their knowledge comes from their experiences, good communication, or a combination of both is however not possible to determine from this study.

The answers from the respondents in the survey do not as clearly indicate a good knowledge base. An example of this is the two informants who responded that they do not think there are risks with using fires. Most respondents mentioned relevant weather conditions to contemplate before using fire but not even half included all relevant ones. This could be due to lack of knowledge but maybe also that the respondents did not take much time to respond and did not fully commit to analyzing their habits. This reasoning also applies to other questions in the survey, mainly the free text questions where the respondents had to thoroughly think for themselves.

The respondents provided good explanations of what the FDI is, however when asked about what an orange FDI meant, not many answered accurately regarding the level of risk. They answered that it was lower than it is, indicating that they downplay the risk. The FPA representatives stated that they frequently send out explanations of the meaning of the FDI, however there was one interviewee who said that they had never received such information. A simple explanation could be that the interviewee does not read WhatsApp. It could also be that the explanations are not sent out as frequently as claimed. Nonetheless, there seems to be a need for more or better explanations since not everybody fully understands what it means.

According to the interviewees the knowledge base in the Dome is generally good but varies, which is confirmed by the survey. The interviewees expressed that it is primarily workers and weekend-farmers that are uninformed, but several survey respondents also expressed that they would need more knowledge. Most respondents would like further information in the form of brochures, followed by courses and videos. The FPA already use all these formats, but they could possibly be distributed to a greater extent.

It is important to note how the interviewees frequently identified other people as “the problem”. For example, interviewees said workers and weekend-farmers are the ones lacking knowledge and being negligent. This is however only what the interviewees think and how they perceive it, and it does not have to equal the truth. It is not possible to determine from this study if their perception is “right” but would certainly require the perspectives of the designated groups. This tendency to point out other groups might have something to do with the optimism bias mentioned in the theoretical clarifications. According to the bias people tend to downplay their personal risk and they believe that they are less likely than others to experience negative events (Cho et al., 2014). Consequently, this affects an individual’s perception of other people’s risk as well, and that others are more likely to be hit by an unfortunate event than themselves. In this case, this could for example result in that a farmer does not think they have to take the same amount of preventative measures as others. If their neighbor, however, has taken the same measures but a fire starts on their property, the farmer might still think that their neighbor was being negligent while it in fact had another explanation. This does not only apply to what was said about knowledge but can be applied to the results in general.

### **6.3 Risk Communication**

In this section the risk communication in the Dome will be discussed.

#### **6.3.1 Two-way Communication and Feedback**

As Cho et al. (2014) discuss, two-way communication is one of the important elements to make sure that risk communication is treated as a process. The community in the Vredefort Dome has numerous feedback channels, which indicates that the opportunity to provide feedback is favorable. Since the WhatsApp groups are open for two-way communication the members always have the possibility to communicate back directly through the WhatsApp chat. In addition, members can also give feedback and communicate with the senders during the meetings that are arranged by the FPA. These channels enable the communicators to find out whether or not the communication is working and can make them aware if any changes are needed, as Cho et al. (2014) also mention. The important element of available two-way communication thereby seems to be fulfilled for the members of an FPA. One thing that was not disclosed during the interviews was to what degree the feedback channels actually are used by the members.

#### **6.3.2 Stakeholder Involvement**

Lundgren and McMakin (2013) discuss how it is advantageous for the audience to get involved in the risk management. The meetings held by the FPAs are a good way to involve the community. It is good that they get to discuss the success and setbacks of the year and strategies for what is to come. It is also a good educational opportunity. All this presupposes that the community attends the meetings, which is a problem in this case. Most interviewees did not attend the meetings with the explanation that they are usually too busy or that the same things get handled every year, things that they already know. They also mentioned that they get a summary of what was handled at the meeting on WhatsApp anyways. That this is sent out afterward is valuable and necessary to inform parts of the community that could not attend. Therefore, it is problematic that it is used as an excuse to skip meetings. If not

attending, people miss the opportunity to get involved and gain insight into the process. To get out all the benefits of having these meetings, ways to get more people to attend should be investigated.

The same authors emphasize the importance of all stakeholders having a common ground and understanding of why the risk is communicated and its preferred outcome. This is partly covered through the FPA meetings, but as one WoF representative expressed, there might be a need for the FPAs and WoF to come together more and create a common goal that could be discussed and elaborated further with the members on the meetings. One aspect that they could discuss is to focus more on prevention. Nearly all interviewees said communication focused almost exclusively on response and preparedness measures. This was also reflected in the interviews where everyone frequently wanted to talk about the response even though they were informed that it was not the scope of the study. This might reveal a need for improvement in that area as well and might be interesting for another study. The lack of communication about prevention could be explained by that the focus might be on fixing the response. However, better prevention would lead to less need for response.

### **6.3.3 Trust and Credibility**

The relationship between the communicators and recipients of the risk communication within the Dome appears positive. All interviewees expressed complete faith in the FPA and the information they disseminate, which can be due to many different factors. As Renn and Levine (1989) declare, accurate information is one aspect that can influence the trust with a receiver and several of the interviewees expressed that the FPA's communication is very accurate. Another factor that can be a basis for the good relationship is that some community members are involved in the communication process from the FPA. As Kaspersen et al. (1992) and Peters et al. (1997) identified, the perception of commitment, care, and concern significantly impacts the recipient's trust, which is likely best accomplished by a person who is personally also affected by the risk. A good relationship can also open up the recipients' willingness to communicate back and give feedback. This, coupled with the fact that the community has numerous feedback channels, indicates that the opportunity to provide feedback is favorable.

### **6.3.4 Framing and Messages**

Both FPAs and WoF use various channels to communicate information and raise awareness among the population. This is in line with Ng and Hamby (1997) who state that it is best to employ numerous media sources. They also state that it is important that each message is consistent with basic information and straightforward language which is also something the FPAs seem to be good at. Representatives say they try to keep the information short and concise, which is a good approach according to the same authors. Recommendations on risk reduction practices are also one of the main things communicated which Ng and Hamby (1997) also emphasize as necessary. As Santos (1990) presents, communication can be either interactive or direct. Both types are used in the Dome which once again is a good mixture.

Another thing that the FPAs do well, in line with the theory mentioned by Sellnow et al. (2009), is that they have spokespersons from the impacted audience. The area and ward managers that distribute information live in the Dome and know the type of language and culture and can therefore automatically design the messages with the recipient in mind. However, since these managers are experienced and proficient in fire management, they may presume that the audience is as knowledgeable as they are. Therefore, they should bear this in mind and regularly send out explanations of things such as the FDI.

WhatsApp is the main communication channel for regular prevention and preparedness communication, but it became apparent that the cell phone reception is bad. This is not considered a big problem for the risk communication studied in this research since it is not crucial that messages about prevention get delivered on time. However, this is surely a big issue during response.

The fact that the risk communication in the Dome is managed separately by the two provinces was one of the interesting aspects to investigate in the study. However, the interview result did not indicate that the risk communication is affected negatively by it. It did emerge that Vaal Eden FPA is more organized, so from that aspect it may be valuable if they cooperate and learn from each other.

### **6.3.5 Experience**

During the interviews it appeared that experience plays a vital role on people's perception and behavior in fire which is consistent with the literature (Jessup et al., 2008; Lejarraga & Gonzalez, 2011). Unfortunately, the risk perception and awareness levels decline over time following an incident (Felgentreff, 2003) which all interviewees agreed on is accurate for the people in the Dome. To prevent this decline in perception, the communicators can utilize indirect experience as mentioned by Wachinger et al. (2013), especially since such a big extent of the population in the Dome has experienced fires. The FPAs already take advantage of this when they send videos of devastating fires. One representative from Potchefstroom said that he could see an improvement after sending such videos but that he had to do it consistently so people do not forget. This supports Witte's (1995) theory that high-threat signals can encourage self-protective measures and raise risk perception levels. Covello's (1986) take on that such messages instead reduce people's attention does not seem to be the case in this context, possibly because the community feels that they can do measures to protect themselves and reduce the risk as Witte (1995) suggest. On another aspect of experience, the interviewees said they would appreciate formal reports following veldfires. This could also work as an indirect experience by reminding people about fires using examples from their home area. Since WoF already create formal reports, it would be interesting to investigate if these reports could get shared with the public in any way.

### **6.3.6 Communication Gaps**

There were a few communication gaps revealed during the interviews. First, a communication gap can be identified regarding the training offered by the FPA. The FPAs say that they offer training to everyone while a significant number of interviewees said they had never been offered any training. There were even interviewees who were unaware that there is training available. It was not revealed during the interviews how information about training is communicated. Regardless, no matter how it is communicated, it does not seem clear enough or reach out to all relevant persons. If training is offered, the FPAs should look into informing their members more clearly about this. Another communication gap was found in the dissemination of the descriptions of what daily FDI means. The FPAs meant that they frequently send out explanations of the FDI chart while several interviewees said that they did not receive such explanations.

Since firebreaks are one of the measures that both the FPA and many landowners value highly, it should be of great importance that all community members understand what it is. The findings revealed that some of the interviewed informants were unaware that firebreaks do not always involve burning the surface. One area manager was very aware of the problem with misunderstanding of firebreaks and proclaimed that he was working on it. It was also made clear that some interviewees were unaware that they could receive assistance from WoF when making firebreaks. The fact that some interviewees clearly stated that they would do firebreaks if they could get help indicates a communication gap. Contrary to that, both WoF representatives and FPA representatives believed that everyone was aware that the WoF teams can assist with creating firebreaks when the result says otherwise. This indicates that the problems need to be brought to a broader audience's attention, and it should be investigated how the information can be disseminated to inform the community members further. A suggestion that could increase awareness of WoF's assistance would be to include information about their availability in the messages that remind the community to construct firebreaks.

It is also evident that there seems to be a communication gap when it comes to the workers in the Dome and the tourists that visit the Dome. According to the interviewees, neither workers nor tourists are included in the official communication, and each landowner is responsible for educating and informing them. Several interviewed landowners admitted that they never communicate any fire safety information or the daily FDI to their workers or visitors. The group of visitors who visit the Dome on their own is even less included in the communication since there is no one who communicates with them. The exclusion of these groups is a concerning discovery, especially since many perceived it as the workers and tourists primarily are the ones who lack knowledge and are irresponsible. For preventive measures to be effective, it is essential that the entire community participate; for that to be possible, everyone must be included. Accordingly, it should be assessed how to ensure that these groups are also reached with the knowledge and information. As one interviewee mentioned, a possibility that could increase the number reached by the communication is to expand the number of informational road signs so that it is not possible to enter the Dome without passing one of the boards.

### **6.3.7 Awareness**

It is interesting that the number and extent of veldfires have decreased in the province despite an expected increase. Two representatives from WoF and Potchefstroom FPA thought this was due to good implementation of preparedness measures and an increased effort in raising awareness. If this is the case, it indicates that their communication is working since a better implementation of preparedness measures can result from good communication. The implementation of an increased effort in raising awareness can be very valuable because it increases the chances of people becoming aware and knowledgeable (Gerrard et al., 1999). It is especially a good tool for preventing people from accidentally starting fires in the first place. However, it could be that the decrease in veldfires is purely coincidental or due to something completely different.

Regarding awareness, one distinctive thing WoF seems to be doing right is targeting children, which is in line with the theory presented by Ronan (2001). WoF said that they hope they can reach the adults through the children, which is precisely what Ronan (2001) means is likely to happen. Both WoF and FPA truly believed that this is one of their most effective awareness-raising strategies and that they noticed how the children learned and brought it home to their parents. This approach also ensures that the Dome's future generation are educated in disaster risk.

### **6.3.8 Compliance**

It appears as the risk communication is good overall and in line with the literature on several points. Not all people complying with the rules seem to be mainly due to carelessness or non-members being uninformed and not due to bad communication. Especially since representatives expressed that they frequently send out reminders and nag them about it, but nothing seems to help. It is hard to say what is the cause of the potential negligence. It could be that the landowners seem to have different interests and that some do not agree with what is expected from them or that they should be able to do what they want on their land. Other interviewees had theories that people do not listen since there are no consequences if they do not comply. If consequences such as fines would help were not agreed on during the interviews, however it could be valuable to investigate further. It was not possible to establish the causes and potential solutions to the negligence within the scope of this study, but it is a single research topic by itself and could be an interesting subject for future research.

### **6.3.9 Inclusion**

When it comes to veldfires, it is important that all people are on board and do their part to manage the fires. It just takes one negligent person or one piece of unprotected land for fires to spread extensively. This means that everyone in the Dome must be informed and reached by the risk communication about fires to prevent them from starting and spreading. From the results it can be retrieved that inclusion is where the most significant problem lies in regard to the risk communication. As discussed, the actual communication in terms of channels and messages is good, however not everyone is included. This is probably not a problem for the Dome alone but for the whole country since the system is built with veldfire management put on each landowner alone. This has resulted in the formation of FPAs, however you must pay

to be a member, meaning that you have to pay to be included in the risk communication. Even though the membership fees are not that high for Potchefstroom and Vaal Eden FPA, interviewees still said they knew that they are too high for some people. This means that there are people who want to and need to participate in the communication but cannot, due to financial reasons. It also seems like there are community members that do not want to be members because it means obligations, and therefore they do not receive the information. The weekend-farmers are an example of that, and they are a group that was identified as a big problem by all interviewees. It becomes even more problematic in an area like the Dome where the landowners have different interests, making it hard to agree and work together while veldfires must be managed together. Considering that inclusion is identified as the main problem with risk communication in this study, it would be interesting to investigate if the current system is the best. It could include examining if there are alternative systems that are more including as well as if there should be an alternative authority responsible for the risk communication regarding veldfires.

#### **6.4 Sources of Error**

There are sources of error that may have impacted the result of the study to various degrees. Since the Vredefort Dome consists of parts from North West and Free State province, controlled by separate authorities, it was necessary to include members of both provinces in the study. However, since the researchers had more contacts in the North West province, more participants came from there. A solid attempt was made to reach people from the Free state, but it proved difficult as many declined to be interviewed. This uneven distribution primarily affected the survey since it could not be distributed in the Free State. Another factor that might impact the result is that not all groups of the community have been part of the study. The interviewees in the study are primarily community members who frequently take part of the risk communication. In order to accurately represent all Dome community members it would have been valuable to talk to all parts, such as weekend farmers and workers who were not incorporated in this study. It would also have been valuable to include tourists and get their perspectives on the topic.

The survey's low response rate is a significant limitation that makes it hard to draw general conclusions from it. The expectation was that sending it out using WhatsApp would generate many responses. The solution with the survey being used as a complement to the interviews is still considered to work since it means that less emphasis is on the surveys, however it still has its limitations. The number of interviews is also a limitation. In many topics consensus was reached in the interviews while it was not for other topics. Therefore, more interviews could have been beneficial. However, this would not have been possible with the time and resources available.



The study has some inherent uncertainty because it relies on the perceptions and evaluations of the informants. Information retrieved cannot be controlled or completely verified. There is a risk that interviewees answer what they think the researchers want to hear and want to elevate their knowledge or behavior. This can also be applied to the survey, especially the close-ended questions. Respondents might choose the answer that seems to be the 'right' or choose answers that sound good without reflecting on their own actual behavior or knowledge.

## 7 Conclusions

*This chapter presents the research findings in the order of the research questions.*

### **Fire Use and Knowledge**

When it comes to fire use in the Vredefort Dome, fire is frequently used for various reasons. Fire use is distributed over all seasons, even during the fire season. Regarding purposes for fire use, the most common purposes include cooking, firebreaks, heating, and garbage disposal. The knowledge base in the Dome is generally good but seems to vary between different groups in the community. According to the informants in this study it is primarily workers and weekend-farmers that are uninformed but there are also some landowners who need more knowledge. However, the results are based on the perceptions of the informants which means that they might not be completely accurate. Interviews with more informants and the designated groups are needed to verify these statements. From the study it can be established that several landowners and workers in manager positions are very experienced and possess valuable knowledge regarding veldfires.

### **Risk Communication**

The risk communication in the Vredefort Dome is mainly communicated from Potchefstroom and Vaal Eden FPA. They communicate things such as the daily FDI, weekly weather forecasts, reminders to construct firebreaks, and warnings about when to be extra cautious. The FPAs communicate mainly using WhatsApp but they also use other channels such as two-way radios, email, FM radio, website, Facebook, and pamphlets. WoF is involved in conducting training, fire awareness meetings, and school workshops. Additionally, they are present on social media. Many community members are good at transferring knowledge to other community members in the everyday by word of mouth. The communication in the Dome is primarily performed in Afrikaans with complementary English.

### **Evaluation and Improvements**

It is concluded that the way veldfire risk is communicated in the Dome is generally in line with risk communication theory. Various channels are used, the communicators are trusted, feedback is encouraged, and the messages are clear and adapted with the recipient in mind. However, some deficiencies were identified. It emerged that the communicators think the members are aware of certain services and things when this is not the case. This especially applies to training and firebreaks. There is also a need to identify how to get more members to attend the meetings. Another aspect that occurred is that the current communication is very focused on preparedness and response. It would be interesting to investigate if a greater emphasis on prevention would be preferable. To raise awareness and increase the risk perception in the area it could also be investigated if the fire incident reports from WoF can be shared with the community.

The main identified problem with the risk communication is exclusion. Some groups are not involved and reached by the communication from the FPAs, which is a significant issue. Workers and tourists, two of the excluded groups, only rely on communication from separate landowners, which was shown to be unreliable. Other non-members, such as the 'weekend-farmers', are not included in any communication at all. The problem lies in that you must be a

paying member to be included in the risk communication, which some do not want or cannot afford. This is an extensive problem on a system level; hence, it would be valuable to determine whether the existing system is optimal. It could involve assessing whether there are other, more inclusive systems, whether a different authority should be responsible for veldfire risk communication, or if the current system can be improved. Reasonably, less extensive measures could also improve the risk communication to these groups to a certain extent, such as putting up more road signs and information points.

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## 9 Appendices

*The appendix includes material that is informative but not essential to the reader's comprehension of the report.*

### Appendix A - Study Design

This appendix provides a general description of the different research methods that exist.

#### Study designs

Qualitative and quantitative research are the two major methods for gathering and interpreting data in research (Pathak et al., 2013). Quantitative research is a wide range of methods that use statistical or numerical data to study social phenomena in a systematic way. Quantitative research, then, is based on measurements and the idea that the phenomena being studied can be measured and quantified (Watson, 2015). It seeks to examine data for trends and links and to confirm the accuracy of measurements. Common quantitative research methods include surveys and experiments (Sukamolson, 2007). Qualitative research is distinguished by its goals, which are related to understanding some aspect of social life, and by its techniques, which (in general) yield words as data for analysis rather than numbers (McCusker & Gunaydin, 2015). Qualitative research can have the ability to add a new dimension to some studies that measuring variables alone cannot (Pathak et al., 2013). Examples of qualitative research methods are interviews, focus groups, field observations, and open-ended questionnaires (Böser, 2015).

One single research project can use both quantitative and qualitative research methods. This is referred to as mixed methods (Bryman, 2006). Mixed methods can be used for various reasons. Greene et al. (1989) sum up some of them. Researchers might want to measure something in more than one way to get more accurate results and can therefore for instance use interviews as one method and counting as one method and then compare the two. Mixed methods can also be used to catch the complexity of the social world by revealing the different dimensions of a phenomenon. Greene et al. (1989) refer to this as a complementary purpose for mixed methods. Gilbert and Stoneman (2008) used this themselves in a study on vulnerability where they used secondary analysis of quantitative data, interviews, and visual methods. The quantitative data provided them with an overview of the various aspects of vulnerability, the interview data allowed them to learn about people's individual experiences of vulnerability and the measures they take to protect themselves, and the visual data revealed how individuals perceived their communities. Greene et al. (1989) mention expansion as one of the purposes for a mixed method approach as well. The goal here is to broaden the scope of the study by employing different approaches for the various parts of the research. For instance, if one study contains multiple research questions, different research methods are used to answer the different research questions since a single approach is not suitable to answer every research question.

## **Interviews**

Research interviews are conversations between a researcher and a subject to discover how that subject articulates their experiences or reasons for their actions (Brinkmann & Kvale, 2015). There are three different kinds of interviews: structured, semi-structured, and unstructured (Roulston & Choi, 2018). Structured interviews remind of a standardized survey with specific set questions in a specific set order. In semi-structured interviews, questions on a certain topic are asked but the questions and the order of the questions are not set. This enables the interviewer to ask follow-up questions and ask them in an order that feels natural in the moment. Unstructured interviews are, as opposed to the other two interview types, participant-driven and very loose without a set topic, question, or guide (Roulston & Choi, 2018).

## **Surveys**

Standardized processes are used to gather data, ensuring that the same questions are asked of each respondent in the same way (Scheuren, 2004). A survey can be qualitative, quantitative, or mixed. In quantitative surveys close-ended questions are common which are question types that ask respondents to choose from a distinct set of pre-defined responses (Reja et al., 2003). In qualitative surveys the questions are open-ended, allowing the respondents to answer in their own words.

## **Appendix B – Interviews**

*This appendix includes the three different guides that were used during the semi-structured interviews. Different interview guides were used for FPA representatives, landowners as well as WoF representatives.*

### **Interview Guide for FPA Representatives**

- What does your role in the FPA entail?
- How long have you worked for the FPA?
- Can you please explain a bit to us about how the FPA system in South Africa works?
- How are the FPAs structured in the Vredefort Dome area?
- What is the FPAs connection with Working on Fire?
- How much do you know about the communication about disaster risks in the Vredefort Dome?
- Can you please explain how the communication about disaster risk in the Vredefort Dome works?
- Can you please explain how the communication about veldfires in the Vredefort Dome works?
- How do you make sure that everyone in the Vredefort Dome, (even the ones who are not in the WhatsApp group), is reached by your communication?
- What is your perception of the reception of the FPAs communication, (is it trusted by the receivers)?
- How do you know if the information you communicate is understood by the receivers?
- To what extent do you receive feedback on your communication?
- Is there any redundancy in the communication system(s) used?
- What does the preventative work with veldfires look like?
- Is there any communication or collaboration between the different FPAs in the two provinces in the Dome?
- Does the FPA communicate about the disaster risks in the Dome with any other authorities?
- Do you know the main causes of veldfires in the Dome?
- How do you think the knowledge base about fire risks and fire safety is in the population of the Vredefort Dome?
- To what extent does the population of the Dome take preventative measures when using fire?
- How well do you think that the risk communication in the Dome area works?
- According to you, how can it be improved?

### **Interview Guide for Landowners**

- Please introduce yourself and what you do in the Vredefort Dome.
  - Are you a member of the FPA?
- According to you, what are the major risks threatening life and property in the dome?
  - How do you handle these risks?

- How do you communicate with other members of the community about the risks in the dome?
- How is disaster risk/veldfire risk communicated to you?
  - What is communicated to you?
    - Information on safe fire use? Only FDI?
  - Do you understand what they communicate?
    - What language is it communicated in?
  - Who communicates this information to you?
  - Do you trust the FPA with their communication?
  - What does the FDI entail?
    - Do you follow what it says?
    - Do you think the FDI is helpful?
  - Do you have a two-way radio?
    - Where did you get it?
    - Did you have to pay it yourself?
  - Do you have cellphone reception on your land?
  - How do you prefer to receive the communication?
    - Two-way radio/WhatsApp/other
    - Pictures, text, spoken messages, video
- Do you experience that you are more cautious after you have heard about a big fire or seen pictures/videos of such an event?
- Is it communicated if there has been a fire in the Dome?
  - What are you told?
  - Who communicates it to you?
- Do you communicate the information you are given further to anyone else?
- Are there people who work/reside on your land who are not members of the WhatsApp groups?
  - Do you communicate the information you are given further to them?
- Is everyone that needs to be included in the communication included?
- How do you experience your opportunities to influence how veldfires are prevented?
  - Do you ever give feedback to the communicators?
  - Do you feel that your feedback is listened to?
- Do you take any precautions to prevent veldfires?
  - Which ones?
  - Where have you received the information to do it?
  - Fire breaks? Why/why not?
  - What would give you the incentive to prevent fires?
  - Do you understand why you should do it?
- Did you receive any training in how to use fire safely and how to fight a fire?
  - From who?
  - Was it valuable?
  - Has anyone else on your land received training?
- Do you feel that you have a sufficient amount of knowledge when it comes to fire safety and preventing veldfires?

- Negligence is the main cause of veldfires, why do you think that is?
- Have you ever experienced a veld fire?
  - Did you lose anything?
  - How do you think that has affected your perception of fire risk?
- How well do you think the people/visitors in the Dome, including yourself, follow the rules and the information communicated?
  - For example, everyone should establish fire breaks on their property, the FDI, and signs that say “no open flame”.
  - What do you think would make people follow the rules/regulations more?
  - Do you believe that peace officers could be an option?
- How well do you think the risk communication works?
- According to you, are there any improvements that can be made to the risk communication that takes place?
- What would be the ideal communications situation according to you?

### **Interview Guide for WoF Representatives**

- Please introduce yourself and what you do.
- How long have you worked with working on fire?
- Can you tell us a bit about working on fire?
- What is the role of working on fire?
- Is your work restricted to the province?
- How much is Working on Fire involved in risk communication?
  - How much are you involved in communication about veld fire prevention?
- We have heard that you hold training with community members, can you please tell us more about that?
  - What does it consist of?
  - Whom do you train?
  - Is it appreciated?
  - Do you think that it is effective?
- We have also heard that you work a lot with school children, can you please tell us more about that?
- What do you do to raise awareness about safe fire use and veldfires?
- What languages do you communicate and have training in?
- Is everyone included in the risk communication?
- In your experience, to what extent is the Tswana population in the area included in the risk communication?
  - Do you experience that they are less included than the Afrikaans people?
- How do you think the knowledge base about fire risks and fire safety is in the population of the Vredefort Dome?
- What is your perception about to what extent the population of the Dome takes preventative measures when using fire?
- How well do you think that the risk communication in the Dome area works?
- According to you, how can it be improved?
- According to you, what would the ideal communication situation be?

## **Appendix C – Questionnaire**

*In this appendix the questionnaire that was distributed is presented. The first page is the information the respondents could read before starting the questionnaire. They could also choose to get an Afrikaans version of the questionnaire.*

This questionnaire is part of a study with the purpose of investigating how communication is used to prevent veldfires in the Vredefort Dome. The project will also attempt to characterize the use of fire in the Vredefort Dome, display to what extent the inhabitants and visitors of the Vredefort Dome are reached through the communication, and investigate the level of knowledge about risks related to the use of fire in the Vredefort Dome. The goal of the study is to ascertain to what extent current risk communication practices can be improved and how improved risk communication can help reduce the number of wildfires and thus the damage they induce.

This questionnaire covers questions about your fire habits and knowledge about fire risk. The survey is intended to assess whether authorities' risk communication is successful and will not examine any person's individual knowledge or habits. It is therefore important that you answer the questions as truthfully as possible.

By submitting this form you consent to that your answers can be used in the study. Your answers will be anonymous.

The project will result in a thesis for a Master of Science in Engineering, Risk management and safety engineering at Lund University in Sweden. The study may also be used by the African Center for Disaster Studies at North West University in Potchefstroom as a part of the development of a disaster management plan for the Vredefort Dome.

### **NOTE!**

- **In the questionnaire the term "use of fire" refers to outside use of fire only, except for when indoor use is explicitly mentioned in the question/answer.**
- **If you are not a landowner the term "your property" in the questionnaire refers to the property you work/live on.**

**What is your connection to the Vredefort Dome?**

- I am a landowner and I live on my property
- I am a landowner but I do not live on my property
- I only work in the Dome
- I only live in the Dome
- Other: \_\_\_\_\_

**What province does your property belong to?**

- North West Province
- Free State Province

**What is your property in the Dome used for? (*Multiple answers available*)**

- Farming
- Hunting
- Tourism
- Private use
- Other: \_\_\_\_\_

**How often is someone available to respond to any potential emergencies (e.g. you, workers, family members, neighbor etc.)? (Mark the most applicable answer)**

- Always
- During the day (every day)
- Most days
- Weekly
- Monthly

**During what seasons is fire used on your property? (*Multiple answers available*)**

- Summer
- Spring
- Winter
- Fall
- Fire is never used

**During the seasons fire is used on your property, how often is it used? (Mark the most applicable answer)**

- Daily
- Weekly
- Monthly
- Never

**For what purposes are fire used? (*Multiple answers available*)**

- Garbage disposal
- Cooking
- Cooking indoors and the ashes are put in ash pit outside
- Heating indoor and the ashes are put in ash pit outside
- Fire breaks
- Agricultural purposes
- Other: \_\_\_\_\_

**What do you think are the risks with using fire? (*Free text*)**

**When do you consider it safe to use fire? (*Free text*)**

**When do you consider it not safe to use fire? (*Free text*)**

**How often do you consider the risk of fire spread before you use fire?**

- Every time
- Often
- Seldom
- Never
- I never use fire

**How often do you contemplate the weather condition before you use fire?**

- Every time
- Often
- Seldom
- Never
- I never use fire

**How often do you contemplate the weather condition before you use machinery?**

- Every time
- Often
- Seldom
- Never
- I never use machinery

**Which weather conditions do you contemplate? (*Free text*)**

**What time period's weather do you take into account? (*Multiple answers available*)**

- Today's
- Last weeks
- Last months
- I don't consider the weather

**What does Fire Danger Index (FDI) mean? (*Free text*)**

**Imagine that the daily FDI is 62 (orange) - What does that mean? (*Free text*)**



**How often are you aware of what the current FDI is?**

- Daily
- Weekly
- Monthly
- Never

**How often is the FDI communicated to you?**

- Daily
- Weekly
- Monthly
- Never
- When I want it I actively find it.

**How is it communicated to you? (*Multiple answers available*)**

- Whatsapp
- SMS
- Spoken (through neighbors, coworkers etc.)
- Newspaper
- TV
- Radio (FM)
- Two-way radio
- It is not communicated to me
- Other: \_\_\_\_\_

**Do you have a functioning two-way radio on your property?**

- Yes
- No

**Do you regularly forward the fire risk information you receive to someone else?  
(*Multiple answers available*)**

- Yes, to family members.
- Yes, to my workers/colleagues.
- Yes, to tourists visiting the property.
- No, I don't communicate it further.
- Other: \_\_\_\_\_

**If yes, how often do you forward the fire risk information you receive?**

- Every time I receive information.
- Most times I receive information.
- Only when someone asks for it.
- Other: \_\_\_\_\_

**What precautions do you take before you use fire? (*Multiple answers available*)**

- I have water easily accessible/nearby.
- I inform the neighbors beforehand.
- I inform the FPA.
- I never use fire when I am alone.
- I make sure I have support available.
- Fire breaks are in place on the property.
- Other: \_\_\_\_\_

**Have a fire on your property spread to the extent that you could not control it?**

- Yes
- No

**If yes, what happened? Why do you think it spread? (*Free text*)**

**Do you feel that you would like to have more knowledge and understanding about what you can do to use fire safely and prevent veldfires?**

- I am confident and don't need to learn more.
- I know a lot but it could be useful to learn more.
- I can manage as it is but would be greatly helped by learning more.
- I don't know enough and need to know more.

**How would you have liked to receive that information? (*Multiple answers available*)**

- Brochure
- Course
- Video
- From other community members
- Other: \_\_\_\_\_

**Is there anything else you would like to share with us regarding fire use and fire safety? (*Free text*)**

**If you would be willing to attend an interview to discuss this topic further, please write your contact details below.**

## Appendix D – Survey Results

In this section the results from the survey will be presented. When a question contains the phrase “multiple answers available” it indicates that the respondents could select multiple options, which is why the responses can be more than 13 or add up to more than 100%. See appendix C for all survey questions. Only questions considered relevant to the study will be presented.

The first questions (Q1-Q3) were asked to get to know what background the respondents had to see which persons the survey reached. Almost all respondents (11 out of 13) were landowners living in the Dome. One person was a landowner but did not live in the Dome and one person was not a landowner but residing in the Vredefort Dome. All respondents had land/lived on the North West Side of the Vredefort Dome.

### ***Q4: What is your property in the Dome used for? (Multiple answers available)***

The respondents’ main area of use of their property in the Dome is farming, see Figure 2. Some of the respondents also use their property for private use or tourism purposes.

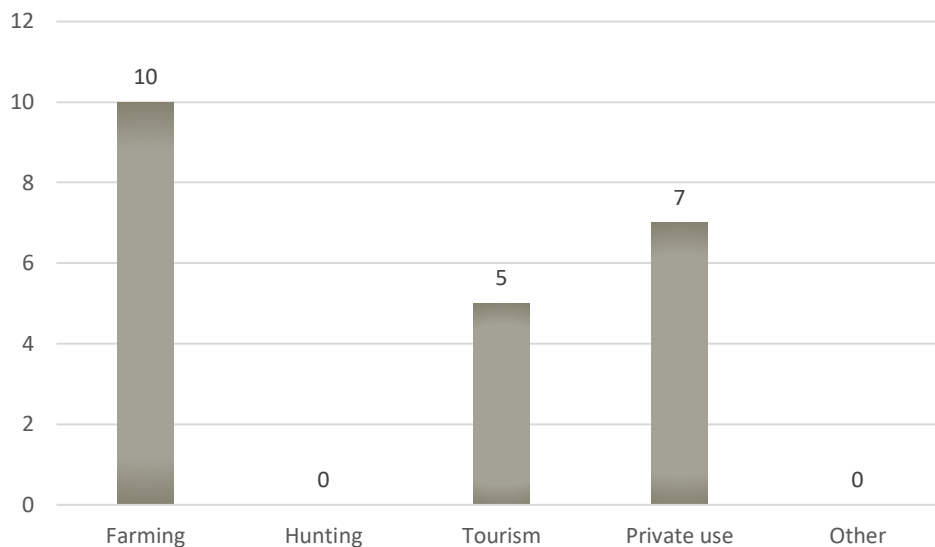


Figure 2: What the respondents use their property in the Dome for.

**Q6: During what seasons is fire used on your property? (Multiple answers available)**

The respondent's answers show that fire is used during all seasons in the Vredefort Dome. Some respondents stated that they never use fire on their property, see Figure 3.

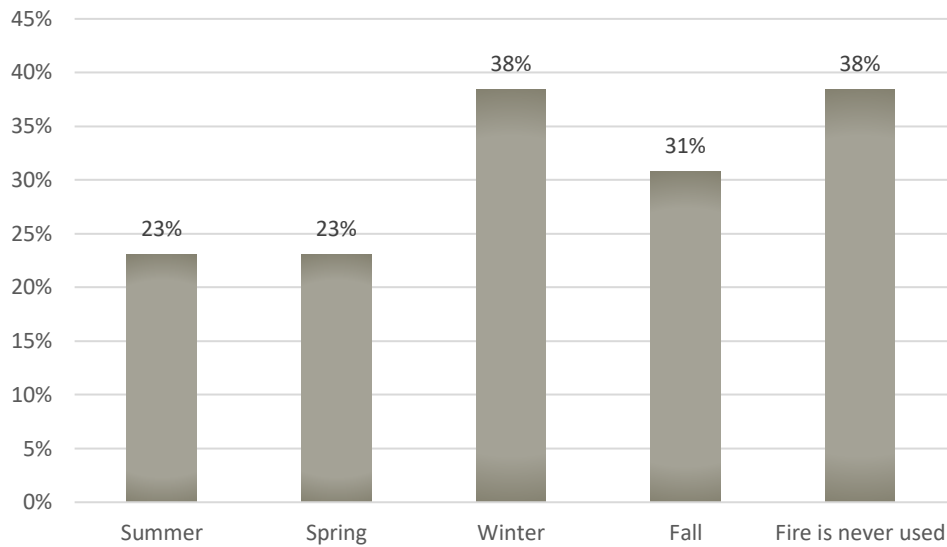


Figure 3: What seasons the respondents use fire on their property.

**Q7: During the seasons fire is used on your property, how often is it used? (Mark the most applicable answer)**

The majority of the respondents that use fire on their property declared that they use it monthly or weekly, see Figure 4. Only one respondent answered that they use fire daily.

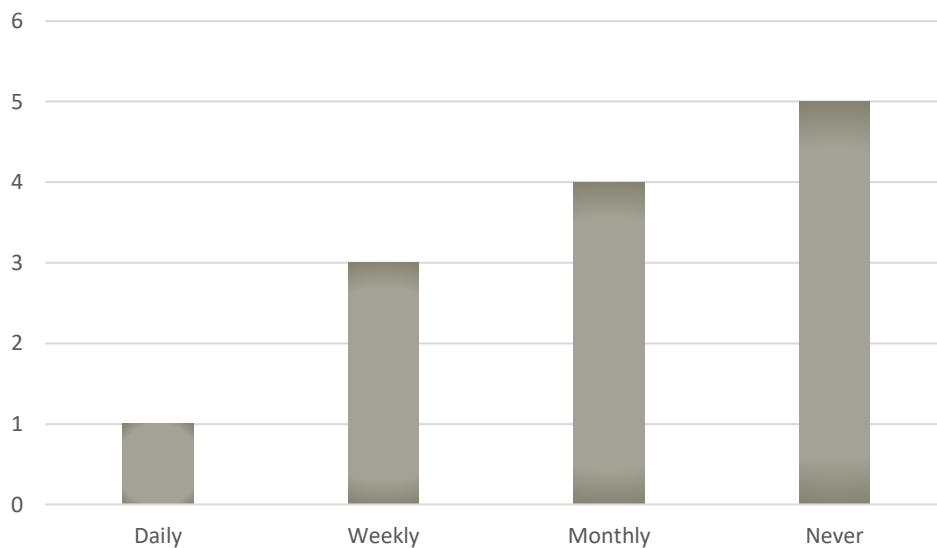


Figure 4: How often fire is used during the seasons the respondents use fire.

**Q8: For what purposes are fire used? (Multiple answers available)**

The survey results indicate that fire is used for various purposes in the Vredefort Dome, see Figure 5. Using fire for cooking is the most common purpose according to the respondents. Firebreaks are the second most common purpose for the use of fire. Other answers include agricultural purposes, garbage disposal, and heating indoors and the ashes are put in an ash pit outside.

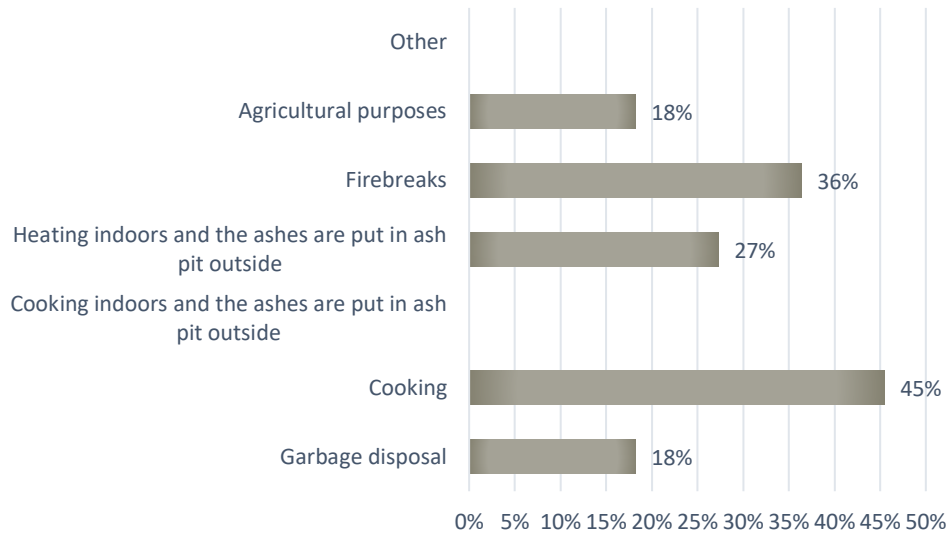


Figure 5: The purposes respondents use fire for.

**Q9: What do you think are the risks with using fire? (Free text)**

The majority of the respondents indicated that the risk of fire spread is the most significant risk associated with using fire. Several respondents mentioned consequences such as the loss of infrastructure, livestock, and grazing lands, as well as the possibility of putting people’s lives at risk or causing them to incur a loss of income.

Two of the respondents answered that they do not perceive any risk with using fire. Their motivations were that they are “responsible fire users” as well as the fire “is controlled when it is done”.

**Q10: When do you consider it safe to use fire? (Free text)**

The weather and the current season are two factors most respondents believe determine when it is safe to use fire. Eight of the respondents mention that the wind must be low. In concurrence, it is mentioned that it is safe when the daily FDI is green. Respondents also declared that use of fire can be considered safe only when it is under full supervision, necessary preparations have been made as well as assistance or appropriate means to extinguish the fire is present.

**Q11: When do you consider it not safe to use fire? (Free text)**

One respondent did not answer this question. All the other respondents included that they do not consider it safe to use fire when it is windy or tricky wind conditions. Six respondents answered that it is unsafe when it is dry or during the dry season and one included that August to October should be avoided entirely. Two respondents mentioned when the FDI is high. When preparation is lacking and another person is not available were stated by two other respondents.

**Q12: How often do you consider the risk of fire spread before you use fire? (Mark the most applicable answer)**

All respondents that ever use fire answered that they always consider the risk of fire spread.

**Q13: How often do you contemplate the weather condition before you use fire? (Mark the most applicable answer)**

All respondents who ever use fire said they always contemplate the weather conditions.

**Q14: How often do you contemplate the weather condition before you use machinery? (Multiple answers available)**

The majority of the respondents answered that they always contemplate the weather condition before they use machinery. Nearly a quarter of the respondents stated that they often consider the weather condition while 16% answered that they seldom or never contemplate it, see Figure 6.

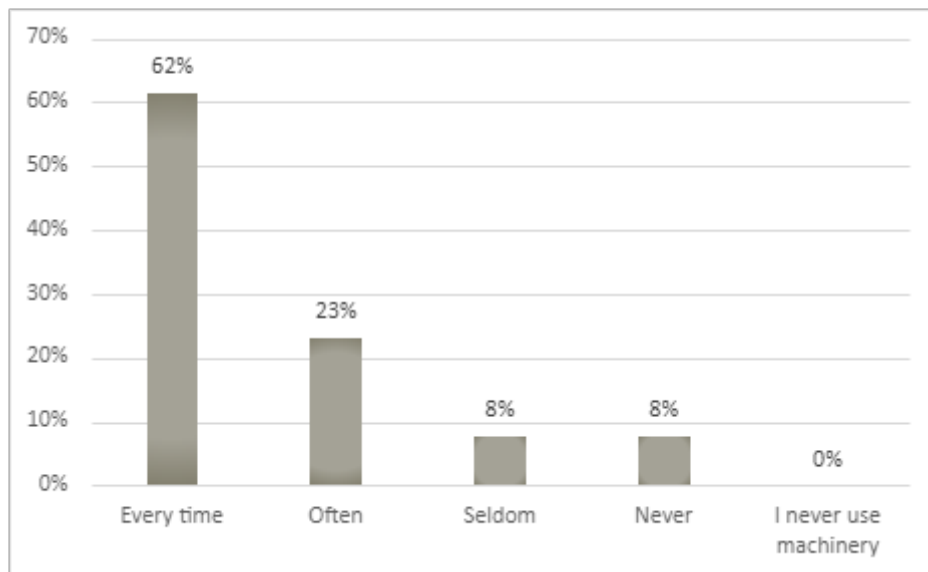


Figure 6: How often the respondents contemplate the weather condition before they use machinery.

**Q15: Which weather conditions do you contemplate? (Free text)**

All respondents mentioned that they consider the wind conditions. Most also consider the temperature/heat. Seven respondents mention rainfall and humidity. One respondent only answered wind and five answered all three factors (wind, temperature, and humidity).

**Q17: What does Fire Danger Index (FDI) mean? (Free text)**

Almost all respondents (10/13) included that it indicates the risk for fires to start or spread. One respondent even explicitly said that it was a model that use temperature, humidity, and wind to calculate the fire danger. Other respondents answered that it tells when you can use fire or machinery and indicates the danger when working with fire.

**Q18: Imagine that the daily FDI is 62 (orange) - What does that mean? (Free text)**

An FDI between 61 and 75 (or higher) indicates that fire danger is considered “very dangerous”. This means that no fires are allowed in the open air under any circumstances.

Regarding the respondents’ answers some of them wrote that no open fires can be made. However, one of them wrote “That it is not really suitable to do fires unless it is really necessary and there is enough manpower and equipment to prevent the fire from getting out of control.” and another one that it is best not to make fire. Some respondents included a rating of the fire danger and some of them wrote that the risk was medium or moderate, while some mentioned dangerous or fairly dangerous. It was also commonly mentioned that it meant that it was risk for fires to spread or get out of control.

**Q19: How often are you aware of what the current FDI is? (Mark the most applicable answer)**

A vast majority, 11 respondents, stated that they know what the daily FDI is every day. The remaining two responded that they are aware of the FDI weekly, see Figure 7.

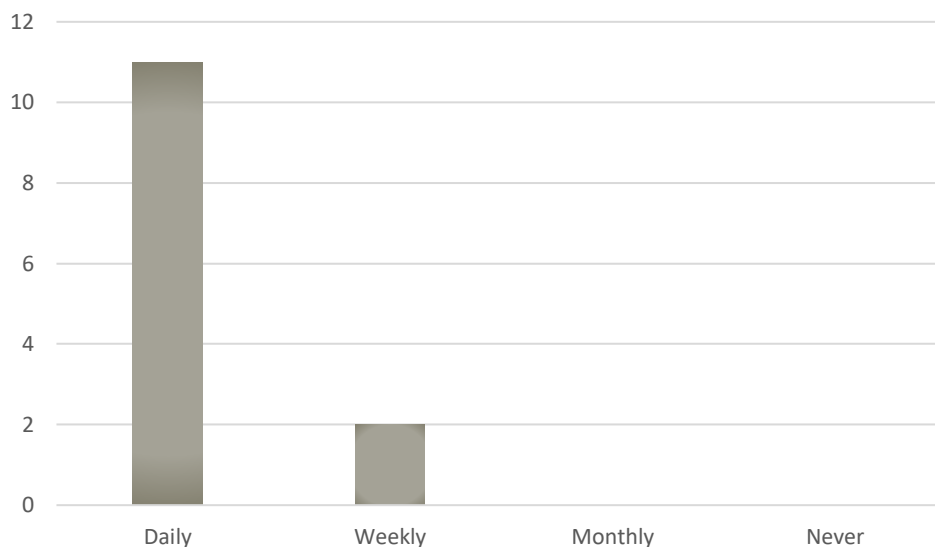


Figure 7: How often the respondents stated that they know the current FDI.

**Q23: Do you regularly forward the fire risk information you receive to someone else? (Multiple answers available)**

About a quarter of the respondents answered that they do not communicate the information further, however, most respondents responded that they do. A majority (62%) communicate it to workers/colleagues, 31% responded that they communicate it to family members, and 15% to tourists, see Figure 8. The one respondent who responded ‘other’ wrote: “No because our area leader sends it daily to all relevant persons in our area”.

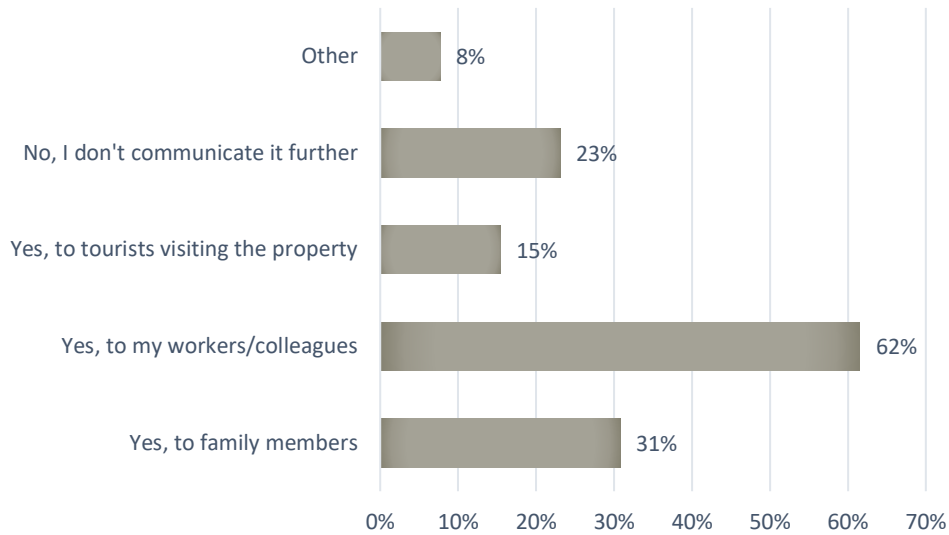


Figure 8: To Whom the respondents answered that they forwarded the fire risk information further.

**Q24: If yes, how often do you forward the fire risk information you receive? (Mark the most applicable answer)**

Out of the 10 respondents that stated that they forward the risk information, most responded that they forward it every or most times they receive it. The one respondent that answered ‘other’ wrote that they only forward it on days when the FDI is orange or red. The total result is shown in Figure 9.

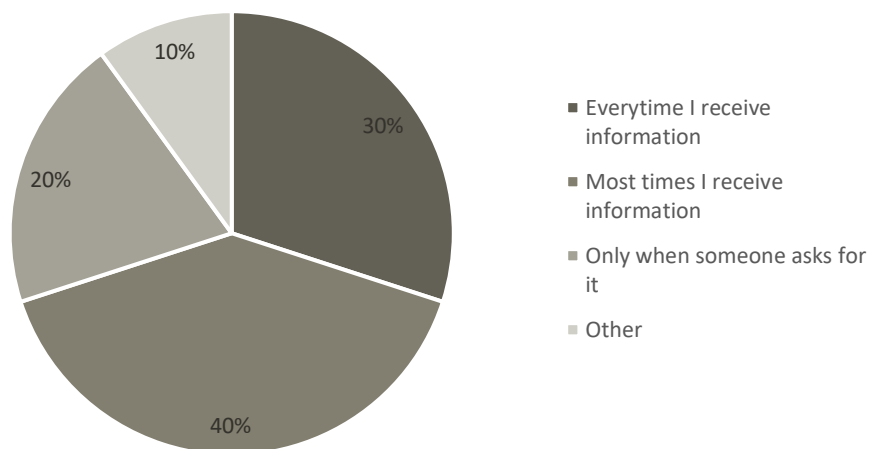


Figure 9: How often the respondents answered that they forward the fire information they receive to others.



**Q25: What precautions do you take before you use fire? (Multiple answers possible)**

A large part of the respondents (77%) answered that they never use fire alone and have water accessible, as seen in Figure 10. The majority also stated that they have support available. 46% claimed they inform their neighbors, 31% inform the FPA, and 23% have firebreaks on their property.

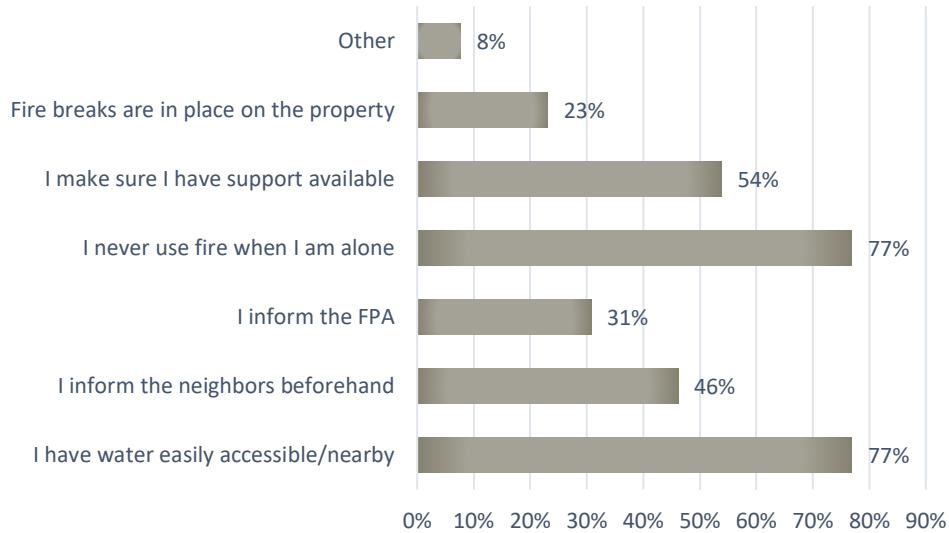


Figure 10: The precaution measures the respondents answered that they take before they use fire.

**Q28: Do you feel that you would like to have more knowledge and understanding about what you can do to use fire safely and prevent veldfires? (Choose the most applicable answer)**

The majority of the respondents felt that they have much knowledge but still felt that it could be helpful to learn even more. Three persons felt that they know enough as it is, while three respondents felt that it would be necessary for them to learn more, see Figure 11.

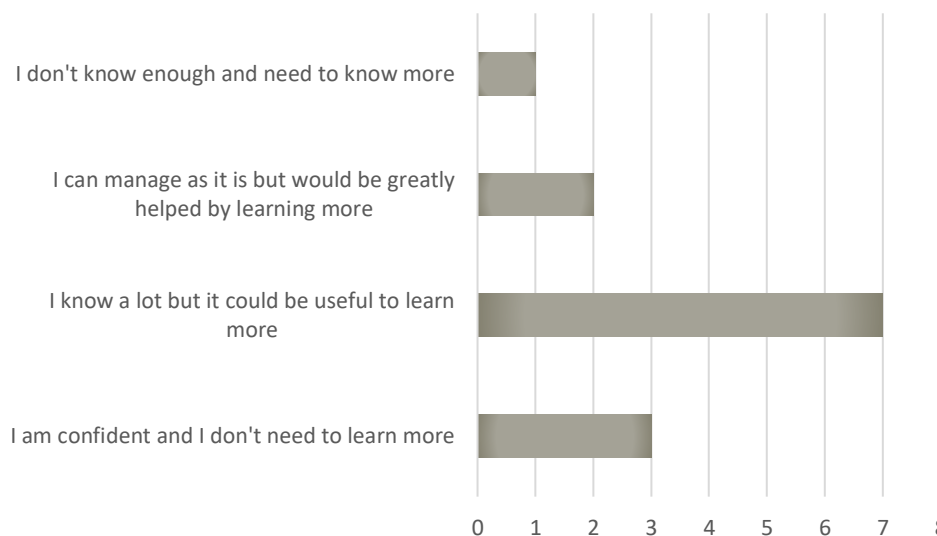


Figure 11: How the respondents feel about gaining more knowledge and understanding about safe fire use and veldfire prevention.

**Q29: How would you have liked to receive that information? (Multiple answers possible)**

Brochures seem to be the most popular way to receive more information, 46 % of the respondents would like to get it in that format. This is followed by course (38%) and video (31%), see Figure 12. The two respondents that chose “other” suggested educational literature and WhatsApp respectively.

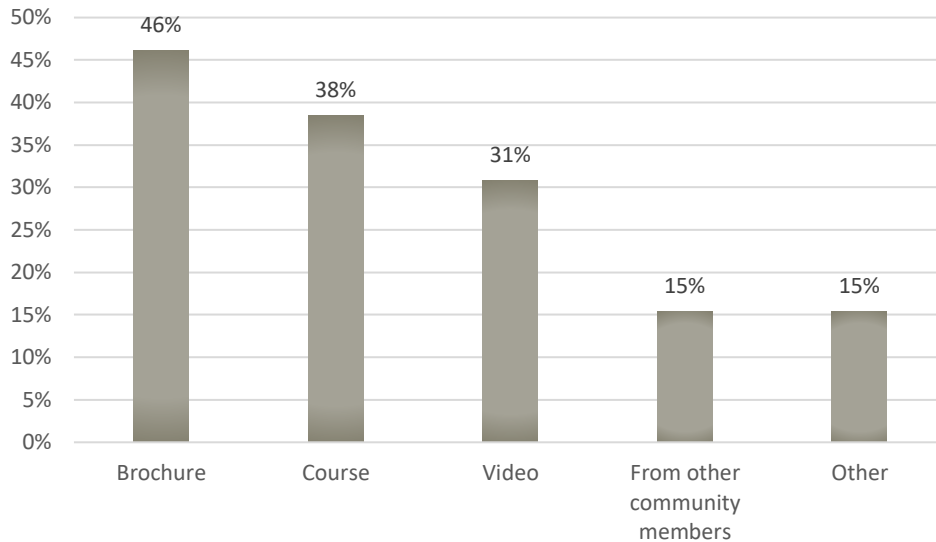


Figure 12: How the respondents would like to receive further information about how to use fire safely and prevent wildfires.

**Q30: Is there anything else you would like to share with us regarding fire use and fire safety?**

Most respondents did not have anything to add. However, two respondents brought up that they felt a need for visitors of the Dome to get informed about the risk of fire and to use fire responsibly. Both respondents put the responsibility to spread that information on the landowners. Apart from this, a problem with ignorant neighbors was mentioned. One of them also mentioned the need for more roadside warning signs, see the quote below.

*“Some fires have been started by visitors to the area due to open fires at picnic sites, dropping cigarette buds, etc. They somehow need to be made aware of the potential risks by local product owners on arrival. There are also no roadside fire warning signs. We are surrounded by mountains, and it is extremely difficult to control fires once they move into these.” – Survey respondent number 11*

## Appendix E – Form of Consent

*All interviewees had to sign a form of consent before participating. The form is presented in this appendix.*

### FORM OF CONSENT

By signing this form I understand that:

- I may withdraw from the interview at any time or refuse to answer any question without consequence.
- I will not receive any payment for participation.
- My interview will be recorded and transcribed.
- For confidentiality, identifying details will be kept separate from interview transcriptions.
- Access to my own interview recording or transcript will be provided at any time, if requested.
- Only the primary researchers, their supervisor, and academic colleagues with whom they may collaborate will have access to interview transcripts.
- Extracts from this interview may be quoted in the planned thesis and potential future publications.
- I am free to contact any of the people involved in the research at any time to seek clarification or further information.
- I consent to take part in the research project.

Please tick:

- I would like to be identified with any quotation
- I would like to be anonymous with any quotation

Please tick:

- I may be contacted again for further questions.

My contact information is (telephone number): \_\_\_\_\_

- I do not want to be contacted again.

Name of participant (texted): \_\_\_\_\_

Signature: \_\_\_\_\_

Date: \_\_\_\_\_

## Appendix F – Material from WoF


This appendix provides a picture of example material that WoF distributes to children during their workshops in schools where they raise awareness and spread knowledge about fire safety and hazards.

### Do's and Don'ts

Educate Children About the Dangers of Fire

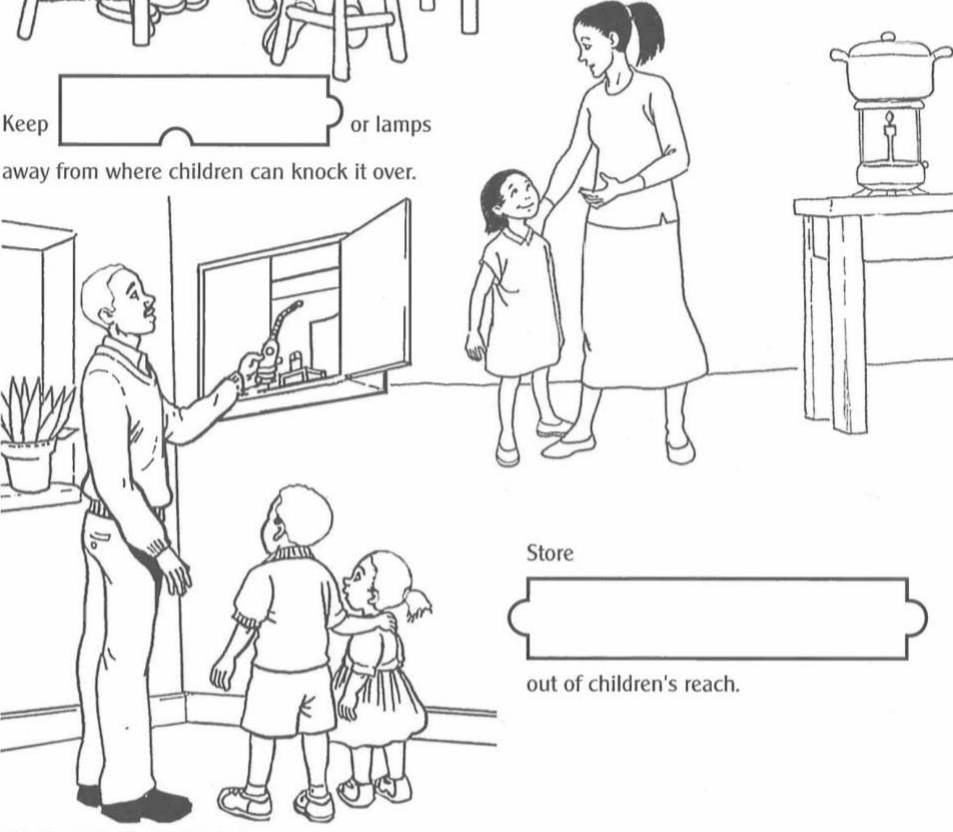
Identify the potential risks in these 3 images below

Stoves                      Candles                      Firelighters



Keep young children away from  
  
and always have adult supervision  
in the cooking area.

Keep  or lamps  
away from where children can knock it over.



Store  
  
out of children's reach.

© Copyright Protected 2018  
\* I identify potential risks or hazards in these images

Figure 13: Example of material for children provided by WoF.